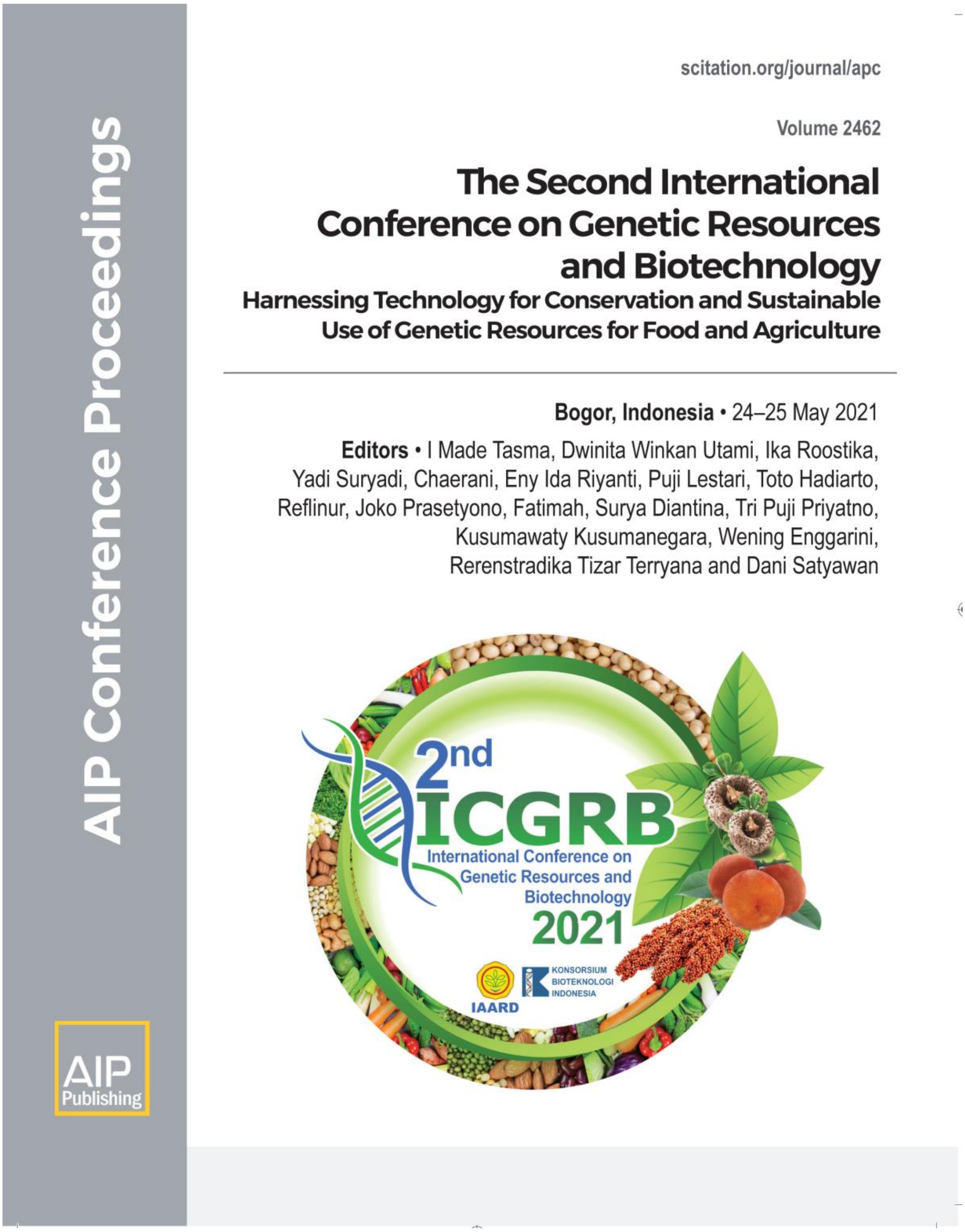
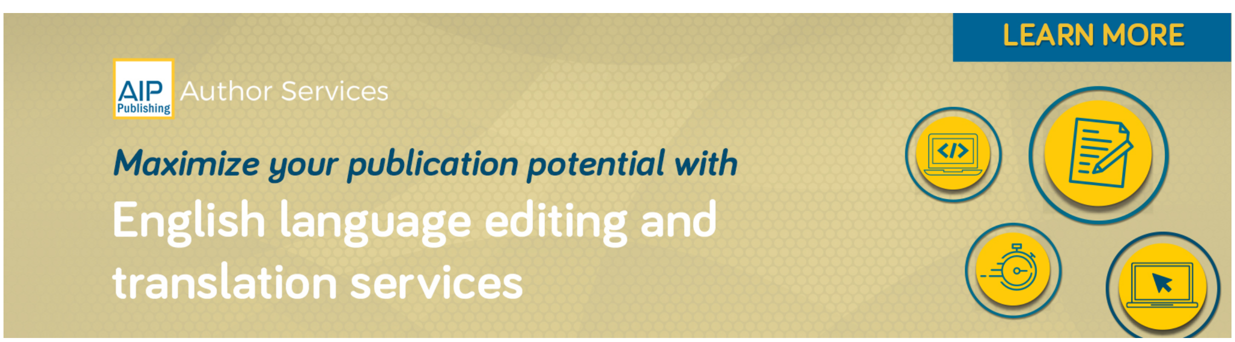


January 2022

THE SECOND INTERNATIONAL CONFERENCE ON GENETIC RESOURCES AND BIOTECHNOLOGY: Harnessing Technology for Conservation and Sustainable Use of Genetic Resources for Food and Agriculture

Committees: The Second International Conference on Genetic Resources and Biotechnology

Cite as: AIP Conference Proceedings **2462**, 010002 (2022); https://doi.org/10.1063/12.0008934
Published Online: 19 January 2022



Steering, Scientific and Organizing Committees

Steering Committee

Chair:

Dr. Ir. Fadjry Djufry, M.Si , *Director General of Indonesian Agency for Agricultural Research and Development (IAARD), Ministry of Agriculture, Indonesia*

Vice Chair:

Ir. Mastur Ph.D, *Director of Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

Dr. Siswa Setyahadi, *Head of Indonesian Biotechnology Consortium, Indonesia*

Secretary:

Dr. Sustiprijatno, *Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

Scientific Committee

Prof. Dr. M. Sabran, *Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

Prof. Dr. Bahagiawati A., *Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

Prof. Endang Gati Lestari, *Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

Associate Prof. Endang Septiningsih, *Texas A & M University, USA*

Dr. Prakit Somta, *Kasetsart University, Thailand*

Dr. Laosatit Kularb, *Kasetsart University, Thailand*

Dr. Back Ki Kim, *Seoul National University, South Korea*

Dr. Iswari Saraswati Dewi, *Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

Dr. Puji Lestari, *Indonesian Center for Rice Research, IAARD, Ministry of Agriculture, Indonesia*

Dr. Dani Satyawan, *Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

Dr. Alina Akhdiya, *Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

Ir. Tri Puji Priyatno, PhD, *Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

Dr. Ir. Ragapadmi Purnamaningsih, *Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

Dr. Nurul Hidayatun, *Indonesian Center for Agricultural Biotechnology and Genetic Resources Research and Development, IAARD, Ministry of Agriculture, Indonesia*

The Second International Conference on Genetic Resources and Biotechnology
AIP Conf. Proc. 2462, 010002-1–010002-3; https://doi.org/10.1063/12.0008934
Published by AIP Publishing. 978-0-7354-4172-9/$30.00

Organizing Committee

Chair	:	Dr. Toto Hadiarto
Vice Chair	:	Dr. Dani Satyawan
Secretary	:	Dr. Wening Enggarini
		Rerenstradika Tizar Terryana, M.Si
Treasurer	:	Dra. Sih Parmiyatni
		Ma'sumah, S.Si
Publication and documentation:		
		Dr. Hakim Kurniawan
		Endo Kristiyono, M.T.I.
		Andika Bakti, S.I.Kom
		Ansori
Logistic	:	Wawan, M.Si.
		M. Hasni Zulfikar

Preface: The Second International Conference on Genetic Resources and Biotechnology

Cite as: AIP Conference Proceedings **2462**, 010001 (2022); https://doi.org/10.1063/12.0006897
Published Online: 19 January 2022

Preface: The Second International Conference on Genetic Resources and Biotechnology

The Second International Conference on Genetic Resources and Biotechnology, which is the continuation of the first event held in 2018, focuses on topics related to advances in biotechnology to create more opportunities for effective conservation and sustainable utilization of genetic resources for food and agriculture. This year conference's theme is Harnessing Technology for Conservation and Sustainable Use of Genetic Resources for Food and Agriculture. The conference was organized by Indonesian Agency for Agricultural Research and Development (IAARD), Ministry of Agriculture, Indonesia, in collaboration with Indonesian Biotechnology Consortium and held on 24^{th}-25^{th} of May 2021virtually due to the pandemic of COVID-19.

The conference aims to share and exchange current scientific information and technological developments on biotechnology and their applications for conservation and sustainable use of genetic, to encourage and promote quality, efficiency, and modernization of management and utilization of genetic resources, and to facilitate national and international collaboration among participants. There are five scopes discussed in this conference. They are effective management of conservation and sustainable use of genetic resources for food and agriculture, application of genomics and molecular markers for genetic resource conservation and crop adaptation to climate change, application of innovative crop improvement techniques for conservation and sustainable use of plant genetic resources for food and agriculture, plant cell and tissue culture for conservation and effective utilization of genetic resources, and the use of microbial genetic resources as biological control agents of agricultural pests and diseases, and for soil bioremediation.

Five speakers from the United States of America, Japan, India and Indonesia were invited to discuss about their expertise and knowledge on relevant subjects in the plenary sessions. This conference was attended by more than 100 participants including 75 presenters and 44 listeners worldwide. They came from diverse governmental, private, or academic institutions and also scientific communities. The presented materials have undergone peer review processes and only qualified papers were selected. Furthermore, all papers were subjected to double blind peer-review and expected to meet the scientific criteria of significance and academic excellence to be published in a conference proceedings indexed in a well-known, reputable service.

We would like to express our sincere gratitude to our speakers, presenters and all participants for their contributions in this conference. We would also like to express our appreciation for the generosity of our sponsors that support this conference: PT CropLife, PT ITS Science Indonesia, PT Fajar Mas Murni and PT Prima Instrument Analitika. Lastly, special thanks to all committee members for their exceptional work and contributions in the conference and publication.

Chair of Organizing Committee

Dr. Toto Hadiarto

The Second International Conference on Genetic Resources and Biotechnology
AIP Conf. Proc. 2462, 010001-1–010001-1; https://doi.org/10.1063/12.0006897
Published by AIP Publishing. 978-0-7354-4172-9/$30.00

Table of Contents

THE SECOND INTERNATIONAL CONFERENCE ON GENETIC RESOURCES AND BIOTECHNOLOGY: Harnessing Technology for Conservation and Sustainable Use of Genetic Resources for Food and Agriculture

_PREV

Conference date: 24–25 May 2021
Location: Bogor, Indonesia
ISBN: 978-0-7354-4172-9
Editors:
I Made Tasma, Dwinita Winkan Utami, Ika Roostika, Yadi Suryadi, Chaerani, Eny Ida Riyanti, Puji Lestari, Toto Hadiarto, Reflinur, Joko Prasetyono, Fatimah, Surya Diantina, Tru Puji Priyanto, Kusumawaty Kusumanegara, Wening Enggarini, Rerenstradika Tizar Terryana and Dani Satyawan
Volume number: 2462
Published: Jan 19, 2022

DISPLAY :

- 20
- 50
- 100
- all

PRELIMINARY

FreeJanuary 2022

Preface: The Second International Conference on Genetic Resources and Biotechnology

AIP Conference Proceedings **2462**, 010001 (2022); https://doi.org/10.1063/12.0006897

-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Committees: The Second International Conference on Genetic Resources and Biotechnology

AIP Conference Proceedings **2462**, 010002 (2022); https://doi.org/10.1063/12.0008934

-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

EFFECTIVE MANAGEMENT OF CONSERVATION AND SUSTAINABLE USE OF GENETIC RESOURCES FOR FOOD AND AGRICULTURE

FreeJanuary 2022

Harnessing plant genetic resources through biotechnology for food security in Indonesia

Mastur, Reflinur, Nurul Hidayatun, Sustiprijatno, Fatimah, Tri Puji Priyatno and Puji Lestari
AIP Conference Proceedings **2462**, 020001 (2022); https://doi.org/10.1063/5.0075671

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

DNA barcoding of *Vatica bantamensis*, a critically endangered tree endemic to Banten, Indonesia

Muhammad Rifqi Hariri, Iyan Robiansyah, Dipta Sumeru Rinandio, Dodo, Desi Siti Sundari, Cecep H. Sukmawan and Bayuntoro Ardi
AIP Conference Proceedings **2462**, 020002 (2022); https://doi.org/10.1063/5.0075529

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Genetic parameters of agronomic traits in soybean (*Glycine max* [L.] Merrill) genotypes tolerant to drought

Made J. Mejaya, Suhartina, Purwantoro, Novita Nugrahaeni and Titik Sundari
AIP Conference Proceedings **2462**, 020003 (2022); https://doi.org/10.1063/5.0075159

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Yield stability performance of soybean (*Glycine max* [L.] Merrill) lines tolerant to drought

Suhartina, Purwantoro, Novita Nugrahaeni, Abdullah Taufiq and Made Jana Mejaya
AIP Conference Proceedings **2462**, 020004 (2022); https://doi.org/10.1063/5.0075158

- SHOW ABSTRACT
-
  - PDF
  - E-READER

- ADD TO FAVORITES
- SHARE
- EXPORT CITATION

FreeJanuary 2022

Polymorphisms and associations of the *RACK1* genes with antibody response to Newcastle disease in KUB chickens

Ifa Manzila, Puji Lestari, Tike Sartika, Tri Puji Priyatno, Risa Indriani, Kristianto Nugroho and Rerenstradika Tizar Terryana
AIP Conference Proceedings **2462**, 020005 (2022); https://doi.org/10.1063/5.0075622

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Rice grain quality evaluation of promising lines of rice under irrigation and for salinity tolerance

Dody D. Handoko, Nafisah, Aris Hairmansis, Trias Sitaresmi, Heni Safitri, Satoto, Ali Imamuddin, Cucu Gunarsih and Untung Susanto
AIP Conference Proceedings **2462**, 020006 (2022); https://doi.org/10.1063/5.0075956

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Existing diversity profile for kernel characteristics of maize germplasm in IAARD-ICABIOGRAD gene bank

Andari Risliawati, Sobir, Trikoesoemaningtyas, Willy B. Suwarno and Puji Lestari
AIP Conference Proceedings **2462**, 020007 (2022); https://doi.org/10.1063/5.0075178

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Characterization of Japansche citroen rootstock somaclones and *in vitro* selection for aluminium tolerance

Deden Sukmadjaja, Mia Kosmiatin and Tiwi Wati
AIP Conference Proceedings **2462**, 020008 (2022); https://doi.org/10.1063/5.0077888

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Resistance to brown planthoppers (*Nilaparvata lugens* Stål) in rice accessions originated from Sumatra Island, Indonesia

Dodin Koswanudin, Nurul Hidayatun and Muhamad Ace Suhendar
AIP Conference Proceedings **2462**, 020009 (2022); https://doi.org/10.1063/5.0075680

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Morphological identification of underutilized local fruits in Kutai Barat Regency to support their conservation and sustainable use

Fitri Handayani, Nurbani and Asep Pebriandi
AIP Conference Proceedings **2462**, 020010 (2022); https://doi.org/10.1063/5.0075594

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Genetic resources of adlay (*Coix lacryma-jobi* L.) in East Kalimantan as source of functional food

Fitri Handayani, Muhammad Amin and Muhammad Taufiq Ratule
AIP Conference Proceedings **2462**, 020011 (2022); https://doi.org/10.1063/5.0075593

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Screening of soybean genotypes resistance to rust disease (*Phakopsora pachyrhizi*)

Sumartini and Kurnia Paramita Sari
AIP Conference Proceedings **2462**, 020012 (2022); https://doi.org/10.1063/5.0075674

- SHOW ABSTRACT

-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Identification of soybean promising lines resistant to pod-sucking bug, *Riptortus linearis* (Fabricius)

M. Muchlish Adie, Titik Sundari, Kurnia Paramita Sari and Ayda Krisnawati
AIP Conference Proceedings **2462**, 020013 (2022); https://doi.org/10.1063/5.0075343

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Variation in pod shattering resistance among black soybean genotypes associated with agronomic traits

Ayda Krisnawati, Titik Sundari and M. Muchlish Adie
AIP Conference Proceedings **2462**, 020014 (2022); https://doi.org/10.1063/5.0075338

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Preliminary characterization and identification of genetic integrity of velvet bean germplasm in IAARD-ICABIOGRAD gene bank

Nurwita Dewi, Andari Risliawati and Nurul Hidayatun
AIP Conference Proceedings **2462**, 020015 (2022); https://doi.org/10.1063/5.0076355

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Plant parasitic nematodes infesting three minor legumes (velvet bean, lablab bean, and jack bean)

Chaerani, Try Zulchi P. Hariyadi and Nurwita Dewi
AIP Conference Proceedings **2462**, 020016 (2022); https://doi.org/10.1063/5.0075204

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Proactive management approach of seed PGRFA conservation during the pandemic of coronavirus disease (COVID-19) in Indonesia

Nurul Hidayatun, Andari Risliawati, Nurwita Dewi, Lina Herlina and Dodin Koswanudin
AIP Conference Proceedings **2462**, 020017 (2022); https://doi.org/10.1063/5.0075531

- SHOW ABSTRACT

-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Evaluation of mung bean accessions in saline soil based on quantitative morphological characters

Trustinah, Ratri Tri Hapsari, Rudi Iswanto and Rudy Soehendi
AIP Conference Proceedings **2462**, 020018 (2022); https://doi.org/10.1063/5.0075324

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Screening and evaluation of 100 upland rice accessions for developing high-yielding upland rice varieties tolerant against acid soil

Lina Herlina and Yusi N. Andarini
AIP Conference Proceedings **2462**, 020019 (2022); https://doi.org/10.1063/5.0075550

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Morphological characters of sugarcane mutant (*Saccharum officinarum* L.) from *in vitro* selection for drought stress

Rr. Sri Hartati, Sri Suhesti and Nurya Yuniyati
AIP Conference Proceedings **2462**, 020020 (2022); https://doi.org/10.1063/5.0075656

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Identifying potential seedless citrus accessions through floral structure and pollen performance

Baiq Dina Mariana, Anis Andrini and Sri Andayani
AIP Conference Proceedings **2462**, 020021 (2022); https://doi.org/10.1063/5.0076922

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Secondary characters based selection of Indonesian kenaf (*Hibiscus cannabinus* L.) germplasm for developing superior varieties

Taufiq Hidayat R. S., Marjani, Nurindah, Muhammad Rasyidur Ridho, Cynthia Lestari Hertianti and Widya Fatriasari
AIP Conference Proceedings **2462**, 020022 (2022); https://doi.org/10.1063/5.0075716

- SHOW ABSTRACT

-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Genetic relationship of pigmented rice (*Oryza sativa* L.) collected from Eastern Indonesia based on morpho-agronomical traits and SSR markers

Yusi Nurmalita Andarini, Willy Bayuardi Suwarno, Hajrial Aswidinnoor and Hakim Kurniawan
AIP Conference Proceedings **2462**, 020023 (2022); https://doi.org/10.1063/5.0075706

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Rejuvenation and morphological characterization of local rice from the province of Yogyakarta

Setyorini Widyayanti, Sutarno, Endang Wisnu Wiranti and Kristamtini
AIP Conference Proceedings **2462**, 020024 (2022); https://doi.org/10.1063/5.0075721

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Characterization of plant architecture and yield trait of castor (*Ricinus communis* L.) germplasm suitable for mechanical harvesting

Tantri Dyah Ayu Anggraeni and Rully Dyah Purwati
AIP Conference Proceedings **2462**, 020025 (2022); https://doi.org/10.1063/5.0075155

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Characterization and interrelationships of the number of vessel bundles with yield components in various genotypes of soybean (*Glycine max* [L.] Merrill)

Anna S. Karyawati and Dyah P. Fitrawantio
AIP Conference Proceedings **2462**, 020026 (2022); https://doi.org/10.1063/5.0075693

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Tuber starch content of edible canna (*Canna indica* L.) from different geographical origins

Surya Diantina, Randy Sanjaya, Kristina Dwi Atmini, Ace Suhendar and Dodin Koswanudin
AIP Conference Proceedings **2462**, 020027 (2022); https://doi.org/10.1063/5.0075922

- SHOW ABSTRACT

-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

The diversity of morpho-agronomic characters and identification of early maturity cassava (*Manihot esculenta* Crantz.) germplasm

Tinuk Sri Wahyuni, Kartika Noerwijati and Made J. Mejaya
AIP Conference Proceedings **2462**, 020028 (2022); https://doi.org/10.1063/5.0075658

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Radiosensitivity and phenotypic characterization of gamma ray-induced mutant population of four *Capsicum annuum* L. cultivars grown in screen house

Andri Fadillah Martin, Dyah Retno Wulandari, Tri Muji Ermayanti, Betalini Widhi Hapsari, Erwin Al Hafiizh and Laela Sari
AIP Conference Proceedings **2462**, 020029 (2022); https://doi.org/10.1063/5.0075173

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Morphological performances of mutant butterfly pea (*Clitoria ternatea* L.)

Try Zulchi, Ali Husni, Dwinita Wikan Utami, Reflinur, Mia Kosmiatin, Tarkus Suganda and Agung Karuniawan
AIP Conference Proceedings **2462**, 020030 (2022); https://doi.org/10.1063/5.0075592

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Screening of beta carotene and its correlation with tuber flesh color in sweet potato

Kristina Dwi Atmini, Surya Diantina, Muhamad Sabda and Dodin Koswanudin
AIP Conference Proceedings **2462**, 020031 (2022); https://doi.org/10.1063/5.0075618

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Evaluation of morpho-agronomical characters and grain quality of red rice lines

Heni Safitri and Puji Lestari
AIP Conference Proceedings **2462**, 020032 (2022); https://doi.org/10.1063/5.0078807

- SHOW ABSTRACT
-
  - PDF
  - E-READER

- ADD TO FAVORITES
- SHARE
- EXPORT CITATION

FreeJanuary 2022

Growth variation and relationship of clove progenies of high-yielding mother trees collected from various regions in Indonesia

Mariana Susilowati, Sri Wahyuni, Adi Setiadi and Nurliani Bermawie
AIP Conference Proceedings **2462**, 020033 (2022); https://doi.org/10.1063/5.0075824

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Screening on bast fiber plants resistant to spiral stem borer, *Agrilus acutus* (Coleoptera: Buprestidae)

Sujak, Nurindah, Dwi Adi Sunarto, Marjani and Nurul Hidayah
AIP Conference Proceedings **2462**, 020034 (2022); https://doi.org/10.1063/5.0075691

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Characteristic of indigenous *Leuconostoc mesenteroides* EN 17-11 protease and its stability during storage at cold and freezing temperatures

Tatik Khusniati, Ika, Harry Noviardi and Sulistiani
AIP Conference Proceedings **2462**, 020035 (2022); https://doi.org/10.1063/5.0076004

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Performance of introduced lines based on morphological markers for diversity enrichment of Indonesian chili pepper (*Capsicum annuum* L.) varieties

Rinda Kirana, Catur Hermanto, Reflinur and Derek W. Barchenger
AIP Conference Proceedings **2462**, 020036 (2022); https://doi.org/10.1063/5.0075186

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

The growth of garlic internal sprout on different storage condition

Chotimatul Azmi, Imas Rita Saadah, Nazly Aswani and Asih Kartasih Karjadi
AIP Conference Proceedings **2462**, 020037 (2022); https://doi.org/10.1063/5.0075180

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Genetic diversity analysis of *Castanopsis argentea* using random amplified polymorphic DNA markers

Muhammad Imam Surya, Lily Ismaini, Decky Indrawan Junaedi, Aisyah Handayani, Taufikurrahman Nasution, Muhammad Efendi, Andes Hamuraby Rozak, Zaenal Mutaqien, Musyarofah Zuhri, Imawan Wahyu Hidayat, Fitri Kurniawati, Vandra Kurniawan, Dwinda Mariska Putri and Risha Amilia Pratiwi
AIP Conference Proceedings **2462**, 020038 (2022); https://doi.org/10.1063/5.0077390

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

APPLICATION OF GENOMICS AND MOLECULAR MARKERS FOR GENETIC RESOURCE CONSERVATION AND CROP ADAPTATION TO CLIMATE CHANGE

FreeJanuary 2022

Current status of tidal swamp rice varieties and its improvement for Fe toxicity tolerance and biofortification

Muhamad Sabran, Dwinita Wikan Utami and Susilawati
AIP Conference Proceedings **2462**, 030001 (2022); https://doi.org/10.1063/5.0075202

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Agroforensic, a new emerging study using molecular marker technique

Edy Listanto, Ahmad Warsun, Ahmad Dadang, Eny Ida Riyanti, Saptowo Jumali Pardal, Sustiprijatno and Mastur
AIP Conference Proceedings **2462**, 030002 (2022); https://doi.org/10.1063/5.0075164

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Molecular diversity comparison in local rice accessions originated from Kalimantan and other islands of Indonesia

Puji Lestari, Rerenstradika Tizar Terryana, Kristianto Nugroho, Andari Risliawati, Nurul Hidayatun, Priatna Sasmita, Yudhi Sastro, I. Gusti Komang Dana Arsana and Ikhwani
AIP Conference Proceedings **2462**, 030003 (2022); https://doi.org/10.1063/5.0075665

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Genetic variation of Adan, a Krayan local rice mutant, using microsatellite markers

Joko Prasetiyono, Tio Fadel Rafsanjani, Tri Aminingsih, Tasliah and Sugiono Moeljopawiro
AIP Conference Proceedings **2462**, 030004 (2022); https://doi.org/10.1063/5.0075660

- SHOW ABSTRACT

-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

The genome sequence of Ciherang, an Indonesian rice mega variety, revealed the footprints of modern rice breeding

Ida Rosdianti, Dani Satyawan, Muhamad Yunus and Dwinita Wikan Utami
AIP Conference Proceedings **2462**, 030005 (2022); https://doi.org/10.1063/5.0075676

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Field adaptation and molecular characterization of Code-*qTSN4* and Code-*qDTH8* rice lines at two different locations

Tasliah, Kurniawan Rudi Trijatmiko and Joko Prasetiyono
AIP Conference Proceedings **2462**, 030006 (2022); https://doi.org/10.1063/5.0075661

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Hybrid purity assessment in F_1 hybrids segregating for phytophthora root rot resistance genes of chili pepper (*Capsicum annuum* L.)

Fatimah, Reflinur, Joko Prasetiyono, Wartono, Kristianto Nugroho, Rinda Kirana, Dani Satyawan, Rerenstradika Tizar Terryana, Aqwin Polosoro, Puji Lestari and I. Made Tasma
AIP Conference Proceedings **2462**, 030007 (2022); https://doi.org/10.1063/5.0075160

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Characterization of genomic variation on three Indonesian oil palm genotypes analyzed using next-generation sequencing HiSeq

I. Made Tasma, Habib Rijzaani, Dani Satyawan, Ida Rosdianti, Edy Supriyanto and Razak Purba
AIP Conference Proceedings **2462**, 030008 (2022); https://doi.org/10.1063/5.0075392

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Cytological and molecular identifications of seedless tangerine derived from endosperm culture

Chaireni Martasari, Mia Kosmiatin, Ali Husni, Kurniawan Budiarto and Innez Candri Gilang Purnama
AIP Conference Proceedings **2462**, 030009 (2022); https://doi.org/10.1063/5.0076395

- SHOW ABSTRACT

-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Improvement of sex determination of salak plant using sequence characterized amplified regions

Reflinur, Ma'sumah, Namira Nur Arfa, Budi Setiadi Daryono and Azis Natawijaya
AIP Conference Proceedings **2462**, 030010 (2022); https://doi.org/10.1063/5.0075698

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

Table of Contents

THE SECOND INTERNATIONAL CONFERENCE ON GENETIC RESOURCES AND BIOTECHNOLOGY: Harnessing Technology for Conservation and Sustainable Use of Genetic Resources for Food and Agriculture

_PREV

Conference date: 24–25 May 2021
Location: Bogor, Indonesia
ISBN: 978-0-7354-4172-9
Editors:

I Made Tasma, Dwinita Winkan Utami, Ika Roostika, Yadi Suryadi, Chaerani, Eny Ida Riyanti, Puji Lestari, Toto Hadiarto, Reflinur, Joko Prasetyono, Fatimah, Surya Diantina, Tru Puji Priyanto, Kusumawaty Kusumanegara, Wening Enggarini, Rerenstradika Tizar Terryana and Dani Satyawan
Volume number: 2462
Published: Jan 19, 2022
DISPLAY :

- 20
- 50
- 100
- all

APPLICATION OF INNOVATIVE CROP IMPROVEMENT TECHNIQUES FOR CONSERVATION AND SUSTAINABLE USE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

FreeJanuary 2022

Design and *in vitro* test of sgRNA for the CRISPR/Cas9 plasmid construct of the *SQS* gene of *Artemisia annua* L.

Sri Koerniati
AIP Conference Proceedings **2462**, 040001 (2022); https://doi.org/10.1063/5.0075695

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

The efficacy of genetically modified (GM) corn Bt11 against *Ostrinia furnacalis* (Guenee) and *Helicoverpa armigera* (Hubner)

Bahagiawati and Diani Damayanti
AIP Conference Proceedings **2462**, 040002 (2022); https://doi.org/10.1063/5.0075312

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Construction and introduction of OsAER1::LeAlaAT cassette to improve the nitrogen use efficiency in rice cv. Mekongga

Atmitri Sisharmini, Aniversari Apriana, Intan Kamila, Aqwin Polosoro, Wening Enggarini, Tri Joko Santoso, Toto Hadiarto, Bahagiawati A. Husin and Kurniawan Rudi Trijatmiko
AIP Conference Proceedings **2462**, 040003 (2022); https://doi.org/10.1063/5.0075458

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Environmental safety assessment of genetically engineered potato resistant to late blight caused by *Phytophthora infestans*

Alberta Dinar Ambarwati, Eny Ida Riyanti, Edy Listanto, Tri Joko Santoso, Toto Hadiarto and Kusmana
AIP Conference Proceedings **2462**, 040004 (2022); https://doi.org/10.1063/5.0075612

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES

- SHARE
- EXPORT CITATION

FreeJanuary 2022

Backcrossing of soybean lines containing aluminium tolerance gene into superior soybean variety, Biosoy

Saptowo J. Pardal, Amalia Prihaningsih, Suharsono, Ratna Utari and Riri Sundasari
AIP Conference Proceedings **2462**, 040005 (2022); https://doi.org/10.1063/5.0075187

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Phenotypic and genetic stability evaluation of the targeted *GA20ox-2* gene mutation in CRISPR/Cas9 mutant rice derived from Mentong cultivar

Aniversari Apriana, Tri Joko Santoso, Atmitri Sisharmini, Reflinur, A. Dinar Ambarwati, Toto Hadiarto, Sustiprijatno and Nuryati
AIP Conference Proceedings **2462**, 040006 (2022); https://doi.org/10.1063/5.0075603

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Transformation of *csp* gene into tobacco plant mediated by *Agrobacterium tumefaciens*

Sustiprijatno, Seagames Waluyo and Suharsono
AIP Conference Proceedings **2462**, 040007 (2022); https://doi.org/10.1063/5.0075571

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

PLANT CELL AND TISSUE CULTURE FOR CONSERVATION AND EFFECTIVE UTILIZATION OF GENETIC RESOURCES

FreeJanuary 2022

The application of gamma ray irradiation to increase triterpenoid compounds in embryogenic calli of *Centella asiatica* L. Urban

Ika Roostika, Suci Rahayu and Nurliani Bermawie
AIP Conference Proceedings **2462**, 050001 (2022); https://doi.org/10.1063/5.0076402

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

The effect of $FeSO_4$ concentration on the callus growth of two chili (*Capsicum annuum* L.) varieties

Rossa Yunita, Endang Gati Lestari, Iswari S. Dewi, Mastur and Bambang Sapta Purwoko
AIP Conference Proceedings **2462**, 050002 (2022); https://doi.org/10.1063/5.0075223

- SHOW ABSTRACT
-
  - PDF

- E-READER
- ADD TO FAVORITES
- SHARE
- EXPORT CITATION

FreeJanuary 2022

Evaluation of ratooning ability in several sweet sorghum (*Sorghum bicolor* [L.] Moench) mutant lines

Endang Gati Lestari, Iswari Saraswati Dewi, Rossa Yunita and Amin Nur
AIP Conference Proceedings **2462**, 050003 (2022); https://doi.org/10.1063/5.0075542

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Response of gamma ray irradiation derived-cultures of three sugarcane varieties to drought stress induced by polyethylene glycol

Ragapadmi Purnamaningsih and Suci Rahayu
AIP Conference Proceedings **2462**, 050004 (2022); https://doi.org/10.1063/5.0075185

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Sucrose and putrescine increased callus induction in tomato anther culture

Iswari Saraswati Dewi, Imam Nur Kholis, Bambang Sapta Purwoko and Ratna Ningsih
AIP Conference Proceedings **2462**, 050005 (2022); https://doi.org/10.1063/5.0075666

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Field evaluation of elephant grass mutant lines (*Pennisetum purpureum* Schumach.) in highlands

Ali Husni, Muhammad Rifay, Mia Kosmiatin and Vyta W. Hanifah
AIP Conference Proceedings **2462**, 050006 (2022); https://doi.org/10.1063/5.0076418

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Increasing drought tolerance of sugarcane through gamma ray irradiation and *in vitro* selection

Sri Suhesti, Syafaruddin, I. Ketut Ardana, Endang Hadipoentyanti and Rr. Sri Hartati
AIP Conference Proceedings **2462**, 050007 (2022); https://doi.org/10.1063/5.0076155

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Cells density affects cell production of *Citrus limonia* in flask and air-lift bioreactor cultures and limonin farming

Dita Agisimanto, Farida Yulianti and Hidayatul Arisah
AIP Conference Proceedings **2462**, 050008 (2022); https://doi.org/10.1063/5.0075651

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

THE USE OF MICROBIAL GENETIC RESOURCES AS BIOLOGICAL CONTROL AGENTS OF AGRICULTURAL PESTS AND DISEASES, AND FOR SOIL BIOREMEDIATION

FreeJanuary 2022

In Silico functional prediction of CAS2, a protein specifically expressed in appressorium and required for pathogenicity of *Colletotrichum gloeosporioides*

Tri Puji Priyatno, Farah Diba Abu Bakar, Rohaiza Ahmad Redzuan, Abdul Munir Abdul Murad and Ifa Manzila
AIP Conference Proceedings **2462**, 060001 (2022); https://doi.org/10.1063/5.0075625

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Biofertilizer increases nutrient use efficiency (NUE) of nitrogen, phosphorus, and potassium at leaves level of *Artemisia annua* L.

Wiguna Rahman, Arthur A. Lelono, Erwin Al Hafiizh and Tri Muji Ermayanti
AIP Conference Proceedings **2462**, 060002 (2022); https://doi.org/10.1063/5.0075503

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Effect of nitrogen fixation and phosphate solubilizing bacteria on growth and yield of lowland rice in different soil type

Ikhwani, Higa Afza, Siti Yuriyah and Waluyo
AIP Conference Proceedings **2462**, 060003 (2022); https://doi.org/10.1063/5.0077914

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Morphological, physiological, and molecular identification and characterization of yeast isolated from Indonesian fruits and woods

Rerenstradika Tizar Terryana, Nazhirotul Ilmiyah, Inda Setyawati, Titin Haryati, Karden Mulya, Eny Ida Riyanti, Yudi Sastro and Puji Lestari
AIP Conference Proceedings **2462**, 060004 (2022); https://doi.org/10.1063/5.0075170

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

The effect of coating application using chitosan enzymatic depolymerization on anthracnose disease suppression in mango (*Mangifera indica* L.) cv. 'Arumanis'

Yadi Suryadi, Dwi Ningsih Susilowati, I. Made Samudra, Alina Akhdiya and Karsinah
AIP Conference Proceedings **2462**, 060005 (2022); https://doi.org/10.1063/5.0075183

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Understanding yeast tolerance as cell factory for bioethanol production from lignocellulosic biomass

Eny Ida Riyanti and Edy Listanto
AIP Conference Proceedings **2462**, 060006 (2022); https://doi.org/10.1063/5.0075157

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Isolation and pathogenicity test of fusarium basal rot and purple blotch fungal pathogens from shallot and *Allium* spp

Chaerani, Ragapadmi Purnamaningsih and Suci Rahayu
AIP Conference Proceedings **2462**, 060007 (2022); https://doi.org/10.1063/5.0075209

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Morphological characters and efficacy of thirteen entomopathogenic fungi of *Aschersonia aleyrodis* Webber isolates on whitefly (*Bemisia tabaci* Gennadius)

Yusmani Prayogo, Marida Santi Yudha Ika Bayu, Sri Wahyuni Indiati and Made Jana Mejaya
AIP Conference Proceedings **2462**, 060008 (2022); https://doi.org/10.1063/5.0076067

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Physicochemical characteristics of yoghurt from various beans and cereals

Heny Herawati, Diana Nur Afifah, Eni Kusumaningtyas, Sri Usmiati, Agus S. Soemantri, Miskiyah, Elmi Kamsiati and Muchamad Bachtiar
AIP Conference Proceedings **2462**, 060009 (2022); https://doi.org/10.1063/5.0075712

- SHOW ABSTRACT

-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

The potential use of zeolite and exopolysaccharide bacteria for reduction of degradation and carbon emission on oil palm plantation in tropical peatland

Laksmita P. Santi, Haryo T. Prakoso and Donny N. Kalbuadi
AIP Conference Proceedings **2462**, 060010 (2022); https://doi.org/10.1063/5.0075506

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

FreeJanuary 2022

Application of phosphate solubilizing microbes to promote the effectiveness of rock phosphate on cacao seedling growth in acid soil

Kurnia Dewi Sasmita, Iswandi Anas, Syaiful Anwar, Sudirman Yahya and Gunawan Djajakirana
AIP Conference Proceedings **2462**, 060011 (2022); https://doi.org/10.1063/5.0075843

- SHOW ABSTRACT
-
  - PDF
  - E-READER
  - ADD TO FAVORITES
  - SHARE
  - EXPORT CITATION

Rice grain quality evaluation of promising lines of rice under irrigation and for salinity tolerance

Cite as: AIP Conference Proceedings **2462**, 020006 (2022); https://doi.org/10.1063/5.0075956
Published Online: 19 January 2022

Dody D. Handoko, Nafisah, Aris Hairmansis, et al.

Rice Grain Quality Evaluation of Promising Lines of Rice under Irrigation and for Salinity Tolerance

Dody D. Handoko[a)], Nafisah, Aris Hairmansis, Trias Sitaresmi, Heni Safitri, Satoto, Ali Imamuddin, Cucu Gunarsih and Untung Susanto

Indonesian Center for Rice Research, IAARD, Jln. Raya 9, Sukamandi, Subang 41256, West Java, Indonesia

[a)]Corresponding author: dodyhandoko@gmail.com

Abstract. Improved rice (*Oryza sativa* L.) variety is one of the main components of technology for increasing rice productivity and quality. The research aimed to determine the grain quality of some promising lines from the advanced breeding generation of irrigated and saline tolerant rice. A total of 37 promising lines from the multilocation test of irrigated rice (19 lines and 4 check varieties) and saline tolerant rice (12 lines and 2 check varieties) harvested in 2018 were used in this study. The rough rice of total lines was analyzed for the physical, milled rice physical, and physicochemical quality. The results showed that, in general, the rice grain quality of promising lines for salinity tolerance was similar to those under irrigation. The range of head rice, unpolished rice, polished rice yield, protein, and amylose content were 53.08–97.43%, 73.68–80.84%, 67.59–71.61%, 7.80–10.25%, 14.01–26.66%, respectively. Among the irrigated rice, B15886M-12D-SKI-5-2-1 and BP14352E-2-2-OKR had the highest head rice, unpolished and polished rice yield, whereas, among the salinity tolerance, BP14080-5B-6-5-TRT-27-4-SKI-5-B, BP14082-2B-2-3-TRT-23-1-SKI-1-B, BP14082-2B-2-5-TRT-36-2-SKI-3, and BP14082-2B-2-5-TRT-35-2-SKI-2 had the highest head rice, unpolished and polished rice yield. Based on the grain quality, they can be considered for released as new improved rice varieties suitable for irrigation or salinity tolerance.

INTRODUCTION

Lowland rice (*Oryza sativa* L.) areas along the coast contribute significantly to Indonesia's rice production. The rise in soil salinity resulting from seawater flooding poses a threat to rice production in specific locations. The problem is made worse by the rising sea level due to global climate change [1]. Salinization is the mechanism of unnecessary soluble salt deposition in fields, which has a detrimental effect on environmental quality, grain production, and farmer profitability. Salt stress affects rice metabolism and physiology, lowering agronomic yield [2].

The key to improving salinity tolerance is the availability of genetic diversity in rice germplasm for this trait. Furthermore, the selection of breeding methods to take advantage of existing genetic diversity and salinity tolerance screening methods are the main determinants of improving salinity tolerant varieties. Biotechnology gives excellent hope in accelerating and increasing precision in breeding salinity-tolerant rice [4]. The Indonesian Agency for Agricultural Research and Development (IAARD) has released over 300 improved rice varieties across agroecosystems, namely lowland (irrigated), upland, and swampland. Ciherang, Mekongga, Inpari 30, Inpari 32, Inpari 37, Inpari 47, Inpari 48, and Inpari Gemah are examples of irrigated rice varieties [3]. Some lowland varieties, namely Dendang, Lambur, Inpari 34, Inpari 35, and Inpari Unsoed 70 Agritan, tolerate saline areas [1, 3]. In addition, some rice varieties, such as Mekongga, were not saline tolerant, but are popular, widely adaptable, and grown on saline-affected land.

The key breeding tool used to enhance rice is pedigree, but hybridization and population improvement have been added to the breeder's portfolio. Most national breeding programs focus on increasing grain yield capacity, blast disease resistance, grain quality, and drought tolerance [5]. However, the yield is not the only factor to consider

The Second International Conference on Genetic Resources and Biotechnology
AIP Conf. Proc. 2462, 020006-1–020006-8; https://doi.org/10.1063/5.0075956
Published by AIP Publishing. 978-0-7354-4172-9/$30.00

when developing new rice varieties since quality traits have a significant effect on the acceptance of any new variety [6].

Due to good rice grain quality and pest resistance, Ciherang, Mekongga, Ciliwung, Cigeulis, IR 64, and Situ Bagendit varieties dominated 54% of 13 to 14 billion hectares transplanted paddy field annually [7]. In 2018, in decreasing order, Ciherang, Mekongga, IR 64, Inpari 30, Situ Bagendit, Inpari 32, Ciliwung, and Cigeulis dominated the distribution of rice varieties planted by Indonesian farmers [8].

Appearance, milling, cooking, sensory, palatability, and nutritional properties arrange rice quality and critical factors in determining consumer price [9]. Rice physical quality includes grain dimensions, head rice yield, chalky and broken grain, grain break, color, and appearance [6]. Some general routine rice grain quality tests are amylose content, cooking time, grain expansion, gelatinization temperature, pasting properties, gel consistency, texture profiling, sensory evaluation, aroma profiling, protein content, lipid content, and micronutrients [10]. The research aimed to determine the grain quality of some promising rice lines from the advanced breeding generation under irrigation and salinity tolerance.

MATERIALS AND METHODS

A total of 37 promising lines from the multilocation test of irrigated rice (19 lines and 4 check varieties) and saline tolerant rice (12 lines and 2 check varieties) harvested in 2018 was used in this study. Check varieties were popular rice varieties among Indonesian farmers used as a control for irrigated rice or saline tolerant rice experiments. Check varieties for irrigated rice were Ciherang, Inpari 32, Inpari 31, and Inpari 43, whereas check varieties for saline tolerant rice were Inpari 35 and Mekongga. All rough rice was analyzed for their physical quality, milled rice physical quality, and physicochemical quality. The grain samples of these lines were produced at the Sukamandi Experimental Station (no replication), whereas the rice grain analysis was performed at the Laboratory of Rice Grain Quality, the Indonesian Center for Rice Research (ICRR), Indonesian Agency for Agricultural Research and Development (IAARD).

The physical quality of rough rice, such as moisture content and empty grain, was measured following the national standard for paddy [11]. Furthermore, the unpolished rice yield and polished rice yield were also measured. After observing its physical quality, the rough rice was dehulled into unpolished (brown) rice using a rice husker (Satake THU 35A). Then, the unpolished rice was polished using a rice polisher (Satake TM 050).

The degree of polishing (milling), moisture content, head rice yield, broken grains, groats, red grains, damaged + yellow grains, and chalky + immature grains [12] were conducted to measure the rice physical properties. Besides, the amylose content (spectrophotometry method), gel consistency, and protein content (micro Kjeldahl method) tests were conducted to measure the rice physicochemical qualities.

RESULTS AND DISCUSSIONS

Rice grain quality covers physical, physicochemical, sensory, and nutritional properties [10]. This study evaluates the rough rice physical, milling, milled rice physical and physicochemical properties of promising lines under irrigation compared to salinity tolerance. The physical properties of rough rice were measured following the national standard for paddy [11]. The standard, for example for grade 1 requires paddy to have moisture content maximum 14.0%, empty grain maximum 1.0%, damaged + yellow grain maximum 2.0%, chalky + immature grain maximum 1.0%, red grain 1.0%, foreign matter 0%, and grain of other varieties maximum 2.0%. Milling properties are essential, particularly from the commercial standpoint. Milling quality covers milled rice and head rice yield. The quantity of total milled rice recovered from a unit of rough rice after removing the hulls, germ, and majority of the bran is known as milling yield or polished rice yield [9].

The average moisture content, empty grain, chalky + immature grain, damaged + yellow grain, red grain, unpolished rice yield, and polished rice yield of irrigated rice lines were 12.44%, 0.74%, 0.87%, 2.70%, 0.25%, 78.54%, and 70.13%, respectively (Table 1). The average moisture content, empty grain, chalky + immature grain, damaged + yellow grain, red grain, unpolished rice yield, and polished rice yield of saline tolerant rice lines were 12.22%, 0.48%, 1.10%, 2.58%, 0.04%, 79.15%, and 70.56%, respectively. The rice line B13824D-RS*1-2-MR-14-1-1 is red rice as it contained 100% red grains, and therefore, did not polished. The physical and milling properties of rough rice lines of irrigated rice, particularly the unpolished and polished rice yield, are similar to those of saline tolerant rice. This indicated that the saline condition did not impair the physical properties of saline tolerant rice.

TABLE 1. Physical and milling properties (%) of rough rice of promising lines under irrigation compared to salinity tolerance.

No.	Promising rice lines	Rough rice properties					Milling properties	
		Moisture	Empty grain	Chalky + immature grain	Damaged + yellow grain	Red grain	Unpolished rice yield	Polished rice yield
	Irrigated rice							
1	B12411E-MR-9-4-1	12.70	0.82	0.18	2.95	0.00	78.71	70.01
2	B12743-MR-18-2-3-4-PN-10-3-4-1	13.10	0.58	0.74	2.43	0.00	79.68	69.57
3	B15886M-12D-SKI-5-2-1	12.70	0.27	0.51	1.02	0.00	79.44	71.61
4	BP9444-1F-KN-1-3-KLT-2*B	12.20	0.45	1.35	1.84	0.49	78.88	69.47
5	BP5478-IF-KN-19-1-2-KLT-2*B-SKI-1*B	12.10	0.71	1.44	2.80	0.00	78.20	68.79
6	IR84636-13-12-2-6-3-3-2-2-B	12.10	0.64	1.33	6.07	0.00	79.78	66.13
7	B15277-MR-9	12.40	0.40	0.19	1.67	0.00	79.27	70.86
8	BP16732E-1	11.80	0.45	0.52	2.05	0.02	79.38	71.24
9	IR83381-B-B-6-1	13.30	0.40	0.30	1.97	0.00	78.72	69.41
10	CRS1291	12.30	0.77	2.07	1.50	0.00	79.32	71.47
11	CRS850	11.60	0.87	0.89	6.29	0.00	73.52	68.62
12	BP17762E-7-1-3-2 (43)	12.50	1.08	0.23	3.61	0.13	80.84	68.64
13	BP20713D-SKI-24-7-3 (156)	12.30	1.91	0.43	2.36	4.64	79.12	70.73
14	B13824D-RS*1-2-MR-14-1-1	11.70	1.54	0.56	0.46	100	79.35	0.00
15	B14667E-MR-57-3	13.40	0.85	0.67	6.97	0.38	76.93	67.59
16	BP14352E-2-2-OKR	13.60	1.30	0.35	4.62	0.05	78.42	70.51
17	BP10108F-7-KN-1 (70)	12.80	0.73	1.16	2.07	0.00	78.99	69.86
18	BP5168F-KN-16-3-WBC-3	11.30	0.45	1.25	1.93	0.02	78.14	69.54
19	BP5480-3F-KN-4-1-KLT-2*B-SKI-1*B(72)	11.80	0.47	0.63	1.57	0.02	73.68	68.70
20	Ciherang	11.80	0.37	1.49	1.35	0.00	79.27	70.52
21	Inpari 32	12.50	0.63	1.86	2.35	0.00	79.16	69.49
22	Inpari 31	12.20	0.65	0.61	1.78	0.00	78.52	69.58
23	Inpari 43	14.00	0.68	1.17	2.55	0.00	79.00	71.55
	Mean	12.44	0.74	0.87	2.70	0.25	78.54	70.13
	Saline tolerant rice							
24	BP14092-2B-2-1-TRT-17-3-SKI-1-B	11.70	0.37	0.30	1.67	0.11	78.67	70.63
25	BP14080-5B-6-5-TRT-27-4-SKI-5-B	11.60	0.55	0.54	3.47	0.00	79.51	71.29
26	BP14082-2B-2-3-TRT-23-1-SKI-1-B	13.10	0.62	1.19	2.23	0.00	79.59	71.15
27	IR11T184	11.80	0.62	1.00	4.87	0.00	77.71	69.90
28	BP14082-2B-2-5-TRT-36-2-SKI-3	12.90	0.29	0.48	2.16	0.46	79.66	70.68
29	HHZ14-SAL19-Y1	12.90	0.34	0.33	2.78	0.02	78.47	70.75
30	BP14082-2B-2-5-TRT-35-2-SKI-2	12.80	0.42	0.41	1.61	0.00	79.67	71.06
31	BP14092-2B-1-1-TRT-14-1-4-B	12.60	0.39	0.43	1.86	0.00	79.68	70.97
32	IR86385-35-1-1-B	12.40	0.47	3.63	2.99	0.00	79.50	70.95
33	HHZ5-SAL9-Y3-Y1	11.40	0.45	1.15	2.93	0.00	78.80	70.84
34	HHZ5-SAL10-DT2-DT1	11.50	0.67	0.62	2.25	0.00	78.77	70.57
35	BP14092-2B-2-1-TRT-17-2-SKI-1-B	12.30	0.33	1.12	1.42	0.00	79.83	70.84
36	Inpari 35	12.20	0.73	1.45	4.48	0.00	78.52	67.23
37	Mekongga	11.90	0.52	2.79	1.46	0.00	79.65	70.92
	Mean	12.22	0.48	1.10	2.58	0.04	79.15	70.56

Among the irrigated check varieties, Ciherang had the highest unpolished rice yield, whereas Inpari 43 had the highest polished rice yield. Among the irrigated rice lines, B15886M-12D-SKI-5-2-1 had slightly higher milling qualities than those of check varieties, whereas lines B15277-MR-9, BP16732E-1, CRS1291, and BP14352E-2-2-OKR had milling qualities similar to check varieties.

TABLE 2. Physical properties (%) of milled rice of promising lines for under irrigation compared to salinity tolerance.

No.	Promising rice lines	Moisture	Polishing degree	Head rice	Broken grains	Brewers	Red grains	Chalky grains	Yellow/ damaged grain
	Irrigated rice								
1	B12411E-MR-9-4-1	11.00	100	94.23	5.21	0.56	0.00	0.66	2.16
2	B12743-MR-18-2-3-4-PN-10-3-4-1	10.70	100	83.30	14.82	1.88	0.00	1.29	0.74
3	B15886M-12D-SKI-5-2-1	10.90	90	97.43	2.33	0.24	0.00	0.39	1.11
4	BP9444-1F-KN-1-3-KLT-2*B	10.60	100	77.32	19.43	3.25	0.49	0.90	0.79
5	BP5478-IF-KN-19-1-2-KLT-2*B-SKI-1*B	11.50	90	88.13	10.85	1.02	0.00	1.76	2.16
6	IR84636-13-12-2-6-3-3-2-2-B	10.80	100	53.08	41.32	5.60	0.00	1.71	0.61
7	B15277-MR-9	10.80	90	91.93	7.47	0.60	0.00	0.48	0.88
8	BP16732E-1	10.40	90	88.11	10.11	1.78	0.02	0.29	1.42
9	IR83381-B-B-6-1	11.60	100	90.02	9.16	0.82	0.00	0.72	1.46
10	CRS1291	11.00	100	92.65	6.28	1.07	0.00	1.35	1.05
11	CRS850	11.60	90	91.47	7.46	1.07	0.00	0.84	3.22
12	BP17762E-7-1-3-2 (43)	10.70	100	74.56	22.98	2.46	0.13	0.86	0.62
13	BP20713D-SKI-24-7-3 (156)	10.80	90	79.07	17.62	3.31	4.64	0.16	1.27
14	B13824D-RS*1-2-MR-14-1-1	12.40	0	96.74	3.12	0.14	0.00	0.37	0.24
15	B14667E-MR-57-3	11.70	90	94.60	4.80	0.60	0.38	0.42	3.67
16	BP14352E-2-2-OKR	11.80	90	96.96	2.53	0.51	0.05	0.11	3.11
17	BP10108F-7-KN-1 (70)	10.80	100	91.17	7.59	1.24	0.00	0.55	0.87
18	BP5168F-KN-16-3-WBC-3	10.90	95	93.34	5.61	1.05	0.02	0.70	0.86
19	BP5480-3F-KN-4-1-KLT-2*B-SKI-1*B(72)	10.60	100	85.82	10.72	3.46	0.02	0.66	0.51
20	Ciherang	11.30	100	92.95	5.82	1.23	0.00	0.78	0.75
21	Inpari 32	11.60	100	86.35	11.20	2.45	0.00	2.71	1.24
22	Inpari 31	11.30	90	85.05	12.36	2.59	0.00	1.67	1.36
23	Inpari 43	12.30	90	97.51	1.84	0.65	0.00	0.07	1.39
	Mean	11.18	91.09	87.90	10.46	1.63	0.25	0.85	1.37
	Saline tolerant rice								
24	BP14092-2B-2-1-TRT-17-3-SKI-1-B	10.30	95	86.32	11.57	2.11	0.11	0.10	0.63
25	BP14080-5B-6-5-TRT-27-4-SKI-5-B	12.00	95	93.24	5.42	1.34	0.00	1.30	2.96
26	BP14082-2B-2-3-TRT-23-1-SKI-1-B	11.90	100	94.25	4.78	0.97	0.00	0.69	1.19
27	IR11T184	11.20	100	74.26	21.53	4.21	0.00	0.67	7.27
28	BP14082-2B-2-5-TRT-36-2-SKI-3	11.40	95	93.45	5.50	1.05	0.46	0.54	0.63
29	HHZ14-SAL19-Y1	12.60	80	95.57	3.97	0.46	0.02	0.19	2.65
30	BP14082-2B-2-5-TRT-35-2-SKI-2	11.60	90	93.42	5.99	0.59	0.00	1.07	1.12
31	BP14092-2B-1-1-TRT-14-1-4-B	11.40	100	90.35	8.45	1.20	0.00	1.08	1.22
32	IR86385-35-1-1-B	12.10	90	92.41	6.65	0.94	0.00	1.48	2.03
33	HHZ5-SAL9-Y3-Y1	10.80	90	88.91	10.22	0.87	0.00	0.62	1.10
34	HHZ5-SAL10-DT2-DT1	10.90	90	87.72	11.10	1.18	0.00	0.60	1.42
35	BP14092-2B-2-1-TRT-17-2-SKI-1-B	11.20	100	91.10	8.08	0.82	0.00	1.00	1.45
36	Inpari 35	10.50	90	62.38	31.55	6.07	0.00	2.76	0.67
37	Mekongga	11.70	100	92.81	5.96	1.23	0.00	1.41	0.54
	Mean	11.40	93.93	88.30	10.06	1.65	0.04	0.97	1.78

Between the saline tolerant check varieties, Mekongga had slightly higher milling qualities than those of Inpari 35. Among the saline tolerant rice lines, BP14080-5B-6-5-TRT-27-4-SKI-5-B, BP14082-2B-2-3-TRT-23-1-SKI-1-B, BP14082-2B-2-5-TRT-35-2-SKI-2, BP14092-2B-1-1-TRT-14-1-4-B, and IR86385-35-1-1-B had milling qualities similar to Mekongga.

The average moisture, degree of polishing, head rice yield, broken rice, brewers, red rice, chalky grains, and yellow/damaged grains of irrigated rice lines was 11.18%, 91.09%, 87.90%, 10.46%, 1.63%, 0.25%, 0.85%, and 1.37%, respectively (Table 2). The average moisture, degree of polishing, head rice yield, broken grains, groats, red grains, chalky grains, and yellow/damaged grains of saline tolerant rice lines was 11.40%, 93.93%, 88.30%, 10.06%, 1.65%, 0.04%, 0.97%, and 1.78%, respectively. The physical properties of milled rice lines of irrigated rice, particularly the head rice yield, are comparable to those of saline tolerant rice. This result also indicated that the saline condition did not impair the physical properties of saline tolerant rice. Among the irrigated check varieties, Inpari 43 had the highest physical properties of milled rice, particularly the head rice yield. Among the irrigated rice lines, B15886M-12D-SKI-5-2-1 and BP14352E-2-2-OKR had physical properties of milled rice similar to Inpari 43.

Between the saline tolerant check varieties, Mekongga had higher physical properties of milled rice than those of Inpari 35. Among the saline tolerant rice lines, BP14080-5B-6-5-TRT-27-4-SKI-5-B, BP14082-2B-2-3-TRT-23-1-SKI-1-B, BP14082-2B-2-5-TRT-36-2-SKI-3, HHZ14-SAL19-Y1, and BP14082-2B-2-5-TRT-35-2-SKI-2 had slightly higher physical properties of milled rice than those of Mekongga.

Fitzgerald [6] pointed out that rice's important physical traits are head rice yield, broken and chalky grain, color, and grain appearance. Fissuring occurs within the grain, causing grains to break. These fissures are weak points, and during the milling process, the grain is subjected to mechanical forces that cause fractures along existing cracks. The fracture decreases the head rice yield and increases the broken and brewers.

There are terms head rice, broken grains, and brewers in the national standard for milled rice [12]. Head rice is a grain with a size greater than or equal to 0.8 parts of whole grain, whereas brewers are grains with a size smaller than 0.2 parts of whole grains. Broken grains are grains with a size in between head rice and brewers.

The rates of milled rice fissuring were greatest at low (10%) and high (90%) relative humidity (RH), while fissuring was minimal at 30–70% RH [13]. Due to changes in kernel structure and tensile strength, bending strength, and fracture energy, the fissured kernel was more susceptible to breakage and head rice yield reduction, resulting in lower commodity value and economic returns for producers and processors [14].

The gel consistency, protein, and amylose content of irrigated rice lines were 65.4 mm (soft), 8.8%, and 20,74%, respectively (Table 3). The gel consistency, protein and amylose content of saline tolerant rice lines were 54.5 mm (medium), 8.6%, and 20.8%, respectively. The main physicochemical tests for measuring rice cooking, eating, and nutritional quality include amylose content, gelatinization temperature, and gel consistency [10]. In addition, protein in rice affects its cooking quality [15]. The content of amylose and protein and gel consistency in improved Indonesian rice varied [16]. The amylose content value ranges from 16–31%, while the protein content ranges from 6–10%. The value of the gel consistency ranges from 5–100 mm (hard–soft). Physicochemical properties, such as gel consistency and amylose content, are consumer preferences that may differ among countries or regions [17], whereas protein is an essential nutrient needed by the human body.

Boiled rice is preferred if the soft texture lasts for an extended period of time or does not harden quickly. Amylopectin staling causes this easily hardened cooked rice texture, which is more common in rice with medium and high gelatinization temperatures than rice with low gelatinization temperatures [19]. Boiled rice texture is more closely related to the chemical properties than physical properties [20].

The preference for rice characteristics, such as grain size and shape, amylose content, and physicochemical properties, may differ among regions. East and Northeast Asian rice consumers have the same preference for short-grain rice, round, glossy, low amylose (≤20%), soft, and sticky cooked rice texture. Rice consumers in South Asia have the same preferences for small, long, and slender grains, with high amylose (≥26%). The preference of rice consumers in Southeast Asia is intermediate between both extremes [20]. Furthermore, in Southeast Asia, premium quality is defined by the nutritional benefits, softness, and aroma, while in South Asia, it is defined by the physical appearance of the grains (uniformity, whiteness, and slenderness), satiety, and aroma [21]. Damardjati and Oka [22] pointed out that Javanese consumers prefer smooth-textured rice (*pulen*) with intermediate amylose. Consumers in West and North Sumatra prefer high amylose rice with a firm texture that is easier to separate (*pera*). Furthermore, rice consumer preference in Java Island follows a similar pattern, except for the Special Region of Yogyakarta [23]. Rice with intermediate amylose content is preferred by consumers in West, East, and Central Java, as well as Special Capital Region of Jakarta, while rice with low amylose content is preferred by consumers in Special Region of Yogyakarta. Based on rice seed distribution planted by farmers [7,8] and the grain qualities [16], Ciherang, Mekongga, and IR 64, can be used as benchmark rice varieties preferred by both farmers and rice consumers.

TABLE 3. Physicochemical properties of promising lines for under irrigation compared to salinity tolerance.

No.	Promising rice lines	Gel consistency*		Protein content (%)	Amylose content (%)
		mm	Information		
	Irrigated rice				
1	B12411E-MR-9-4-1	78.0	Soft	9.58	14.82
2	B12743-MR-18-2-3-4-PN-10-3-4-1	81.0	Soft	9.39	14.01
3	B15886M-12D-SKI-5-2-1	79.5	Soft	8.74	15.39
4	BP9444-1F-KN-1-3-KLT-2*B	73.5	Soft	9.47	16.40
5	BP5478-IF-KN-19-1-2-KLT-2*B-SKI-1*B	56.0	Medium	8.27	20.82
6	IR84636-13-12-2-6-3-3-2-2-B	86.5	Soft	8.25	18.71
7	B15277-MR-9	80.0	Soft	8.62	17.74
8	BP16732E-1	83.5	Soft	8.76	17.09
9	IR83381-B-B-6-1	55.0	Medium	8.60	20.74
10	CRS1291	57.0	Medium	9.45	19.81
11	CRS850	79.5	Soft	8.21	17.41
12	BP17762E-7-1-3-2 (43)	58.0	Medium	9.26	22.00
13	BP20713D-SKI-24-7-3 (156)	55.0	Medium	9.61	23.21
14	B13824D-RS*1-2-MR-14-1-1	58.0	Medium	10.25	20.74
15	B14667E-MR-57-3	57.0	Medium	7.88	22.85
16	BP14352E-2-2-OKR	72.5	Soft	7.80	16.52
17	BP10108F-7-KN-1 (70)	57.0	Medium	8.44	20.70
18	BP5168F-KN-16-3-WBC-3	59.0	Medium	8.43	22.24
19	BP5480-3F-KN-4-1-KLT-2*B-SKI-1*B(72)	54.0	Medium	9.27	21.22
20	Ciherang	48.0	Medium	8.75	21.10
21	Inpari 32	49.0	Medium	7.89	22.64
22	Inpari 31	55.0	Medium	8.46	21.67
23	Inpari 43	73.0	Soft	8.96	16.28
	Mean	65.4	Soft	8.8	19.3
	Saline tolerant rice				
24	BP14092-2B-2-1-TRT-17-3-SKI-1-B	38.0	Hard	8.89	26.66
25	BP14080-5B-6-5-TRT-27-4-SKI-5-B	56.0	Medium	8.23	21.67
26	BP14082-2B-2-3-TRT-23-1-SKI-1-B	58.0	Medium	8.23	20.86
27	IR11T184	57.0	Medium	8.94	21.18
28	BP14082-2B-2-5-TRT-36-2-SKI-3	50.0	Medium	8.57	19.64
29	HHZ14-SAL19-Y1	75.5	Soft	8.05	14.41
30	BP14082-2B-2-5-TRT-35-2-SKI-2	50.5	Medium	8.64	19.24
31	BP14092-2B-1-1-TRT-14-1-4-B	54.0	Medium	8.42	19.12
32	IR86385-35-1-1-B	56.0	Medium	8.80	19.89
33	HHZ5-SAL9-Y3-Y1	59.0	Medium	9.49	21.39
34	HHZ5-SAL10-DT2-DT1	47.0	Medium	8.75	20.54
35	BP14092-2B-2-1-TRT-17-2-SKI-1-B	47.5	Medium	8.56	19.52
36	Inpari 35	56.0	Medium	8.25	24.91
37	Mekongga	59.0	Medium	8.49	21.87
	Mean	54.5	Medium	8.6	20.8

*Gel consistency: hard (<40 mm), medium (41–60 mm), soft (>60 mm) [18].

The rice grain quality, particularly the head rice yield, unpolished and polished yield, of saline tolerant rice was comparable to those irrigated rice lines. This indicated that the saline tolerant rice lines could cope with the soil salinity. Zayed *et al*. [24] concluded that micronutrient application, particularly through the foliage, is beneficial for rice growth and yield in saline soil conditions. In addition, Hairmansis [4] reported that three tolerance mechanisms that plants use to adapt to high external salt conditions, i.e. plants adapt to the effects of osmotic pressure (osmotic tolerance), plants adapt by removing salt ions from outside the cells or plant tissues (ion exclusion), and plants adapt to the adverse effects of salt by tolerating the toxic nature of sodium in tissues (tissue tolerance).

CONCLUSION

The grain quality, namely paddy physical, milled rice physical, and physicochemical quality, of saline tolerance lines were similar to those irrigated rice lines. Therefore, based on the grain quality, lines B15886M-12D-SKI-5-2-1 and BP14352E-2-2-OKR can be considered for release as new improved rice varieties for irrigation, whereas lines BP14080-5B-6-5-TRT-27-4-SKI-5-B, BP14082-2B-2-3-TRT-23-1-SKI-1-B, BP14082-2B-2-5-TRT-36-2-SKI-3, and BP14082-2B-2-5-TRT-35-2-SKI-2 can be considered for release as new improved rice varieties for salinity tolerance.

ACKNOWLEDGMENTS

The authors would like to thank the Indonesian Agency for Agricultural Research and Development (IAARD), Ministry of Agriculture for funding this research.

REFERENCES

1. A. Hairmansis, N. Nafisah and A. Jamil, KnE Life Sci. **2**, 72–79 (2017).
2. M. Hussain, S. Ahmad, S. Hussain, R. Lal, S. Ul-Allah and A. Nawaz, Adv. Agron. **148**, 231–287 (2018).
3. P. Sasmita, Suprihanto, Satoto, Y. Nugraha, I. Hasmi, Z. Susanti, B. Kusbiantoro, Rahmini, A. Hairmansis, T. Sitaresmi, Suharna, M. Norvyani and D. Arismiati, *Description of Improved Rice Varieties* (Indonesian Center for Rice Research, Subang, 2020), 136 p.
4. A. Hairmansis, J. Pangan **29**, 161–170 (2020).
5. E. P. Guimarães, "Rice breeding," in *Handbook Plant Breeding Vol. 3, Cereal*, edited by M. J. Carena (Springer-Verlag, New York, 2009), pp. 99–126.
6. M. A. Fitzgerald, "Rice: grain-quality characteristics and management of quality requirements," in *Cereal Grains: Assessing and Managing Quality*, edited by C. W. Wrigley, I. L. Batey and D. Miskelly (Woodhead Publishing, Ltd., Cambridge, 2010), pp. 291–316.
7. I. N. Widiarta, "Upaya percepatan adopsi varietas unggul baru padi," in *Dukungan Inovasi Teknologi Padi untuk Mewujudkan Indonesia sebagai Lumbung Pangan Dunia*, Prosiding Seminar 2017 Buku 2, edited by Rahmini, Suprihanto, B. Nuryanto, N. Usyati, N. A. Herawati, B. Kusbiantoro, D. D. Handoko, Shinta, A. Ruskandar and Widyantoro (Balai Besar Penelitian Tanaman Padi, Sukamandi, 2018), pp. 881–892.
8. Direktorat Perbenihan Tanaman Pangan, *Laporan Tahunan Direktorat Perbenihan Tanaman Pangan* (Kementerian Pertanian, Jakarta, 2018), 45 pp.
9. N. Sharma and R. Khanna, "Rice grain quality: current developments and future prospects," in *Recent Advances in Grain Crops Research*, edited by F. Shah, Z. Khan, A. Iqbal, M. Turan and M. Olgun (IntechOpen, London, 2020), pp. 137–144.
10. V. M. Butardo Jr., N. Sreenivasulu and B. O. Juliano, "Improving rice grain quality: state-of-the-art and future prospects," in *Rice Grain Quality, Methods and Protocols*, edited by N. Sreenivasulu (Humana Press, Totowa, 2019), pp. 19–55.
11. BSN, *Indonesian National Standard of Paddy* (Badan Standardisasi Nasional, Jakarta, 1987), 4 pp.
12. BSN, *Indonesian National Standard of Rice* (Badan Standardisasi Nasional, Jakarta, 2015), 10 pp.
13. T. J. Siebenmorgen, M. I. Saleh and R. C. Bautista, Trans. ASABE **52**, 893–900 (2009).
14. C. Tong, H. Gao, S. Luo, L. Liu and J. Bao, Compr. Rev. Food Sci. Food Saf. **18**, 626–640 (2019).
15. M. Martin and M. A. Fitzgerald, J. Cereal Sci. **36**, 285–294 (2002).
16. Suismono, A. Setyono, S. D. Indrasari, P. Wibowo and I. Las, *Evaluation of Rice Quality for Various Rice Varieties in Indonesia* (Balai Besar Penelitian Tanaman Padi, Subang, 2003), 41 pp.
17. K. R. Bhattacharya, *Rice Quality: A Guide to Rice Properties and Analysis* (Woodhead Publishing Limited, Cambridge, 2011), 577 pp.
18. IRRI, *Standard Evaluation System (SES) for Rice* (International Rice Research Institute, Manila, 2013), 55 pp.
19. C. M. Perez, C. P. Villareal, B. O. Juliano and C. G. Biliaderis, Cereal Chem. **70**, 567–571 (1993).
20. C. Mestres, F. Ribeyre, B. Pons, V. Fallet and F. Matencio, J. Cereal Sci. **53**, 81–89 (2011).
21. M. C. Custodio, R. P. Cuevas, J. Ynion, A. G. Laborte, M. L. Velasco and M. Demont, Trends Food Sci. Technol. **92**, 122– (2019).
22. D. S. Damardjati and M. Oka, "Evaluation of urban consumer preferences for rice quality characteristics in

Indonesia," in *Consumer Demand for Rice Grain Quality*, edited by L. J. Unnevehr, B. Duff and B. O. Juliano (International Rice Research Institute, Manila and International Development Research Centre, Ottawa, 1992), pp. 59–76.
23. Z. Mardiah, A. T. Rakhmi, S. D. Indrasari and B. Kusbiantoro, Penelit. Pertan. Tanam. Pangan **35**, 163–172 (2016).
24. B. A. Zayed, A. K. M. Salem and H. M. El Sharkawy, World J. Agric. Sci. **7**, 179–184 (2011).