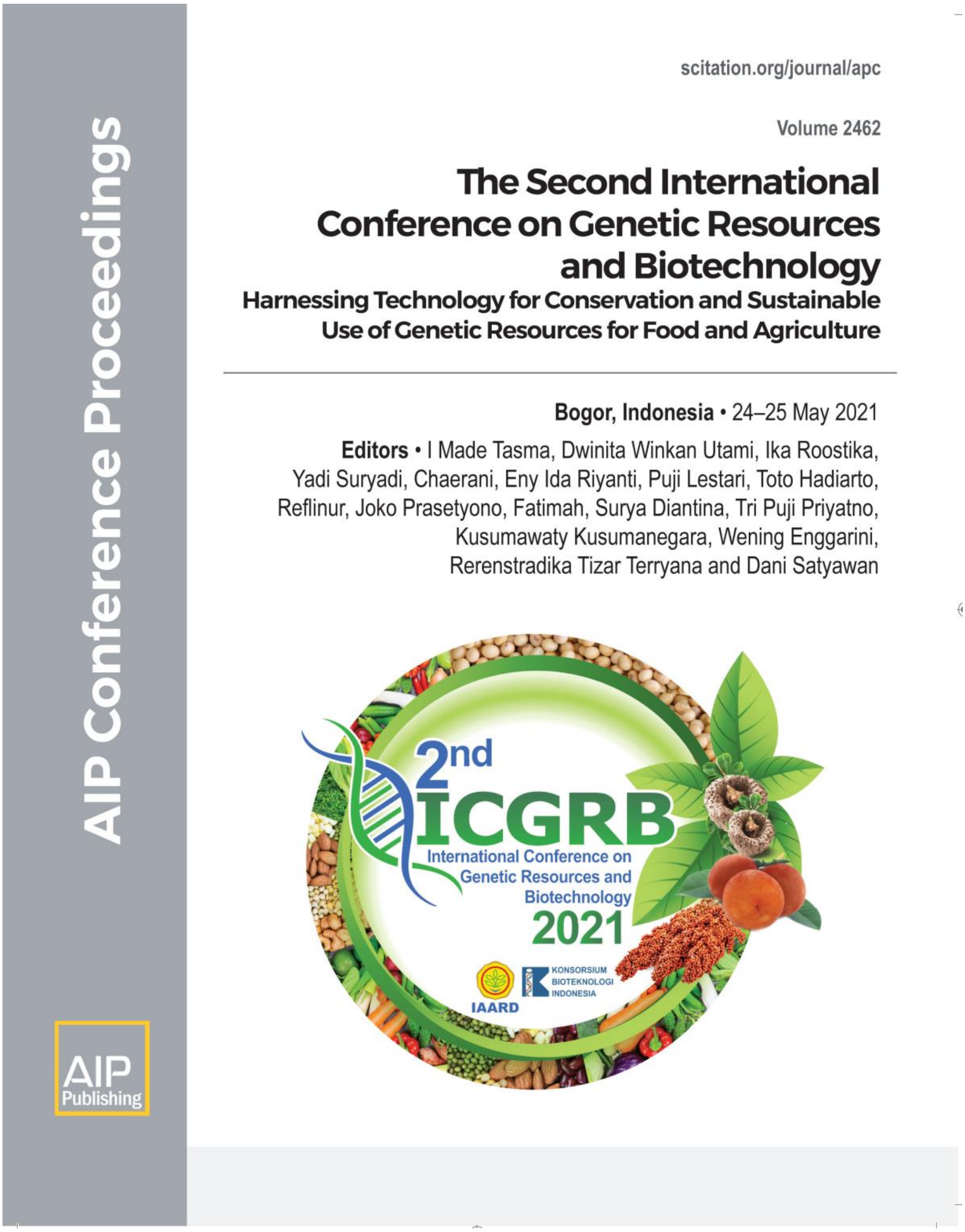



January 2022

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

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

Cite as: AIP Conference Proceedings **2462**, 060010 (2022); https://doi.org/10.1063/5.0075506
Published Online: 19 January 2022

**Laksmita P. Santi, Haryo T. Prakoso and Donny N. Kalbuadi**

# 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[a)], Haryo T. Prakoso and Donny N. Kalbuadi

*Indonesian Research Institute for Biotechnology and Bioindustry, PT Riset Perkebunan Nusantara, Jln. Taman Kencana No. 1, Bogor 16128, West Java, Indonesia*

[a)]Corresponding author: laksmita.santi@gmail.com

**Abstract.** Zeolites are aluminosilicates widely used as ameliorant in oil palm plantation especially on peatland. The zeolite mineral is known to have an excellent molecular sieve property which enables it to hold organic carbon compounds, $CO_2$, and water leading to its potential use for carbon sequestration. Moreover, bioactivated zeolite with bacterium producing exopolysaccharides could promote the formation of peat molecular structure and their configurations that related to water and nutrient supply for plant. The objective of this study is to characterize natural zeolite clinoptilolite type from Bayah, Banten as exopolysaccharide bacterial carrier for peat ameliorant and reduction of carbon emission. The physical-chemical characteristics of 60–80, 80–100, and 100–150 particles mesh of zeolite were determined using standard analytical procedures. Furthermore, separation capability of a zeolites sample for carbon dioxide ($CO_2$), $NH_3$, and $N_2$ was measured by temperature programmed desorption (TPD). The Brunauer-Emmett-Teller (BET) technique was used in order to estimate the specific surface area of zeolite while the relative crystallinity of the samples was estimated by comparing their X-ray diffraction (XRD) pattern. The morphology of the samples was investigated by field emission scanning electron microscopy. Total exopolysaccharide bacteria in the matrix of zeolite were counted using total plate count in ATCC 14 media. The results indicated that 100–150 particle mesh of natural clinoptilolite Bayah zeolite has excellent properties of porous structure which contribute to carbon and $N_2$ adsorption, water retention, and bacterial carrier.

## INTRODUCTION

Peatlands cover an estimate of 400 million hectares or equivalent to 3% of Earth's land surface. Tropical peatland is in the range of 30–45 million ha, which is 10–12% of the global peatland resource. Most of them are used for cultivation, especially for oil palm plantation in Indonesia, although the yield potential of oil palm planted on these areas has always been a controversial subject [1]. The long-term cultivation use of peatlands has an impact on peatlands environment such as decrease of groundwater level, changes of aerobic conditions, changes in rhizosphere communities, and root exudates of cultivated plants as well as degradation and mineralization of peat [2]. Furthermore, the natural structure and organic molecule configuration of peats are closely related to their water retention capacity [3]. The dominance of organic materials in peats tends to be water saturated makes it impossible to form complex organic bonding. Meanwhile, on a dry peat, water and nutrient retention capacity are considerably low. To obtain maximum productivity, an effort has been conducted to stabilize a relatively unstable peat material by implementing soil amelioration approach [4].

Peat physical properties will changed due to addition of zeolites in the large-scale test, which led to increase in the soil water retention capacity and also decrease the percolation [5]. Zeolite not only increases the water holding capacity but also increase the effect of mineral fertilizers [6]. Zeolites use in acid soil has beneficial effect on improving the nitrogen, phosphorous, and potassium uptake [7]. Unlike other soil amendment such as lime, the zeolite does not break down over time but it stays in the soil for improving nutrient retention. The natural zeolites have porous structure which helps to keep the soil aerated and moist as well as active for long period of time. Zeolite

*The Second International Conference on Genetic Resources and Biotechnology*
AIP Conf. Proc. 2462, 060010-1–060010-7; https://doi.org/10.1063/5.0075506
Published by AIP Publishing. 978-0-7354-4172-9/$30.00

is not acidic in nature. In fact, it is marginally alkaline and if amended with fertilizers can help buffer soil pH levels and may reduce the use of lime.

Data regarding mechanism of microbial interaction in relation to the formation of complex organic bonding and nutrient availability for plantation crops planted on peatland are somewhat limited. Interaction of microbes with host has very important role to the crop plant to be able to adapt to environmental changes [8]. There are some mechanisms of microbial interaction that promote plant growth, i.e. increase nutrient availability; improve soil structure; induce crop tolerance against pathogen via producing antibiotic, antifungal compounds, or enzyme; fix biological $N_2$; produce phytohormone (auxin, cytokinin, and gibberellin) [9]. Some researchers also reported that a bacterium of *Burkholderia* genera, particularly *B. cenocepacia* has high potential to inhibit the growth of *Ganoderma boninense* [10, 11]. Interaction between exopolysaccharide-producing microbe with host plant especially oil palm seedlings has been studied by [12, 13]. Consistency of positive impacts due to polysaccharide-producing endophytic microbe application on plant growth has been reported by [14, 15]. This research was carried out to study the characteristic physico-chemical of zeolite originating from Bayah and its potential use as $CO_2$, $NH_3$, and $N_2$ sorption and carrier material for exopolysaccharide bacteria.

## MATERIALS AND METHODS

### Physico-Chemical Analyses of Zeolite

A 60–80, 80–100, and 100–150 mesh of particle zeolite originating from Bayah, Banten was used in this experiment and subjected to physico-chemical analyses. Physical analyses such as pore structure measurements, specific surface area, pore-volume, and average pore diameter based on $N_2$-sorption method were done [16]. Chemical analyses were performed, including pH, cation exchange capacity (CEC), silica, aluminum, calcium, sodium, potassium elemental analyses, and water retention capacity. Both physical and chemical analyses were performed using standard laboratory analyses outlined by Indonesian national standardization [17] and as mentioned by Klute [18], respectively.

### Mineralogical Characteristics

Mineralogical composition of zeolite powder was determined by using X-ray diffraction (XRD) analysis by running it at 0–30° 2-theta with Cu Kα at the Indonesian Institute of Sciences (Lembaga Ilmu Pengetahuan Indonesia/LIPI), Serpong. Identification of the mineral present was carried out by using major intensive peak that characterize the mineral [19].

### Electron Microscopy

The surface morphology of the zeolites was observed by scanning electron microscope (SEM) (Jeol JSM-5310LV). The electron beam is accelerated through a high voltage 20 kV and pass through a system of apertures and electromagnetic lenses to produce a thin beam of electrons [20]. In the early stages a material sample leveled with a special tool. After sputter coating the cast with 35 nm of gold-palladium (Au-Pd), electron micrographs were recorded.

### Adsorption Capacity

Adsorption capacity of the Bayah zeolite were performed using $CO_2$, $N_2$, and $NH_3$ adsorption analyses at Chemical Engineering Department, LIPI. The $CO_2$ temperature-programmed desorption (TPD) performance of the N-FGO was evaluated in a modified setup of TG/DTA 6300 at atmospheric pressure. A certain amount of an adsorbent was placed in a small aluminum pan and was loaded inside the TGA. Initially, it was heated at 120°C for 30 min to remove moisture content, then a continuous flow of $N_2$ gas was set until the system was stable. Afterwards, the $N_2$ gas was stopped and pure $CO_2$ gas was flowed into the system for 180 min to achieve complete saturation. The weight increase after the adsorption process indicated as the adsorption capacity of the adsorbent.

The specific surface area of each sample was determined using the Brunauer-Emmett-Teller (BET) method [21], which was denoted as SBET. The total pore volume (Vt) of the adsorbent from the adsorption amount of nitrogen gas at P/Po ~0.99 was obtained. The micropore volume (<2 nm, Vmi), ultra-micropore volume (<0.7 nm, Vultra), and mesopore volume (2~50 nm, Vme) were calculated from the density functional theory (DFT) method.

## Exopolysaccharide Bacteria

The exopolysaccharide bacteria used as active ingredient of a molecule sieve material is *B. cenocepacia*. The bacteria produce exopolysaccharide in average of 5.03 mg/ml. Moreover, *B. cenocepacia* also has potential in fixing atmospheric $N_2$ non-symbiotically measured with acetylene reduction analysis (ARA) with the value of 0.73 µmol/g. Also, it can produce indole acetic acid (IAA) hormone of 78.9 ppm and can survive on pH 3–7 for 6–12 months [22]. Total population of exopolysaccharide bacteria in the zeolite matrix were estimated using total plate count method in ATCC 14 media.

## Formulation Zeolite and Exopolysaccharide Bacteria as Peat Ameliorant

A newly-constructed material sieve molecule ameliorant containing *B. cenocepacia* was prepared by the following steps: (i) inoculation of the bacteria into 500 ml shake flasks containing 150 ml pf ATTC No. 14 medium which incubated on orbital shaker at 150 rpm, 30°C for 7 days. Following incubation, the total cell count of exopolysaccharide bacteria was $10^8$ cell/ml. The American Type Culture Collection (ATCC) No. 14 medium consists of ($L^{-1}$): 0.2 g $KH_2PO_4$, 0.8 g $K_2HPO_4$, 0.2 g $MgSO_4.7H_2O$, 0.1 g $CaSO_4.2H_2O$, 2.0 mg $FeCl_3$, $Na_2MoO_4.2H_2O$ (*trace*), 0.5 g yeast extract, 20 g sucrose, 15 g bacto agar, and final pH 7.2; (ii) incorporation of the cultured microbe onto a pasteurized zeolite; (iii) packaging [8].

# RESULTS AND DISCUSSION

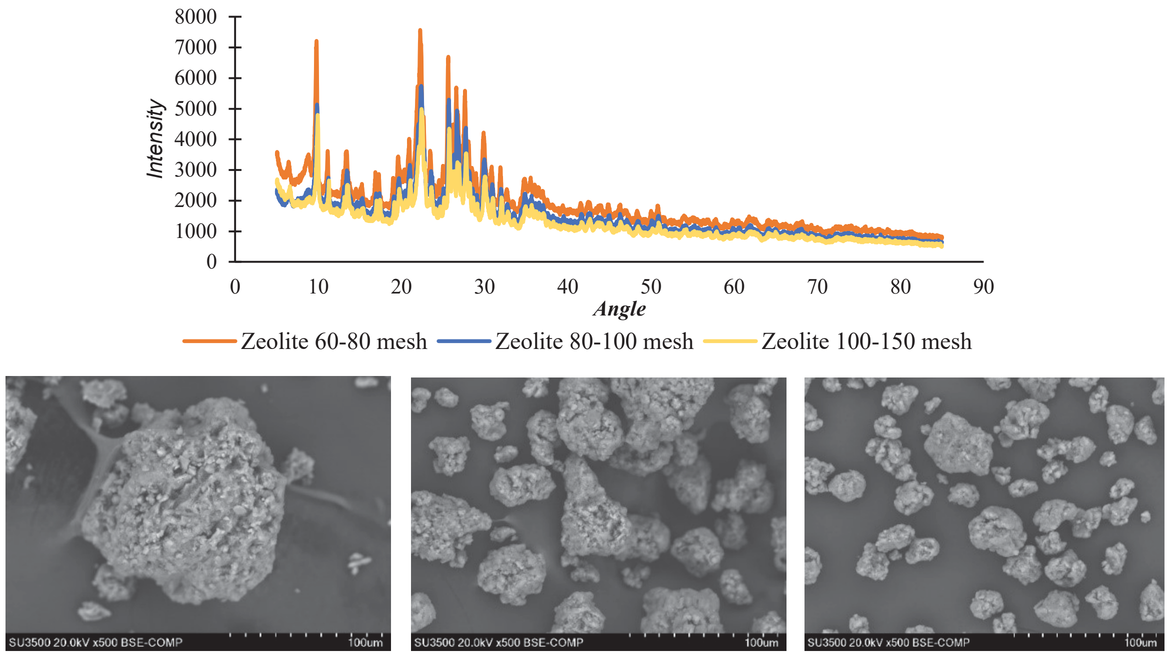
The analysis showed that the zeolites have alkaline pH (7.7). The CEC values that meet the SNI 13-7168-2006 standards are zeolites with a size of 100–150 mesh (≥100 $cmol_{(+)}$/kg). Moreover, in terms of the effects of microbiological analysis, the zeolite material has the minimum technical requirements standards of *E. coli* and *Salmonella* (pathogenic bacteria) with the value of below 3 MPN/gram, and heavy metal levels are overall below the permissible threshold (Table 1).

**TABLE 1**. Physicochemical characteristics of the Bayah zeolite.

| Type of analysis | Zeolite 60–80 mesh | Zeolite 80–100 mesh | Zeolite 100–150 mesh | Kepmentan 261/KPTS/SR.310/M/4/2019 | Unit | Method |
|---|---|---|---|---|---|---|
| pH | 7.8 | 7.2 | 8.2 | 7–12 | - | pH meter |
| Organic carbon | 0.2 | 0.1 | 0.7 | - | % | Spectrophotometer |
| N | 0.013 | 0.012 | 0.013 | - | % | Kjedahl |
| $P_2O_5$ | 27.9 | 36.1 | 89.92 | - | ppm | Spectrophotometer |
| $K_2O$ | 1.54 | 1.58 | 1.75 | - | % | ICP-AES |
| CEC | 70.35 | 86.97 | 126.45 | Min. 60 | $cmol_{(+)}$/kg | Titration |
| *Escherichia coli* | <3 | <3 | <3 | <3 | MPN/g | TPC |
| *Salmonella* | <3 | <3 | <3 | <3 | MPN/g | TPC |
| As | nd | nd | nd | 10 | ppm | ICP |
| Hg | nd | nd | nd | 1 | ppm | ICP |
| Cd | nd | nd | nd | 2 | ppm | ICP |
| Pb | 3.48 | 3.34 | 3.38 | 50 | ppm | ICP |
| Fe | 88.45 | 93.24 | 105.34 | Min. 7 | mg/100 g | ICP |
| Mn | 8.96 | 10.52 | 30.38 | - | ppm | ICP |
| Zn | 1.34 | 1.5 | 2.06 | - | mg/100 g | ICP |
| Ni | nd | nd | nd | Max. 50 | ppm | ICP |
| Cr | 0.20 | 0.29 | 0.32 | Max. 180 | ppm | ICP |
| WHC | 43.59 | 49.22 | 60.50 | - | % | |

CEC = cation-exchange capacity, ICP-AES = inductively coupled plasma-atomic emission spectroscopy, TPC = total plate count, WHC = water-holding capacity, nd = not detected.

Based on these characteristics, the new molecule sieve material formulated from zeolite, both at laboratory and scale-up production processes, conform to quality standard requirements enforced by the local authority for commercial uses. Furthermore, according on XRD analysis, the Bayah zeolite consists of clinoptilolite-Na formula ($[NaKCa]_5Al_6Si_{30}O_{72}\cdot 18H_2O$) with other minerals such as mordenite and quarts present as accessory minerals (Fig. 1). Most application of this mineral in Indonesia was reported focused on agricultural sector especially in soil amendment and fertilizer industries. Based on these characteristics, this mineral has a great potential as an adsorbent [24] of greenhouse gas sequestration at peat land area [25] especially for oil palm cultivation.




(a) (b) (c)

**FIGURE 1**. X-ray diffractogram (top) and scanning electron microscopes (bottom) of Bayah zeolite indicating the particle size of zeolite of 60–80 mesh (a), 80–100 mesh (b), and 100–150 mesh (c). The smaller of zeolite particle size would increase water-holding capacity and enhance the efficiency of water use.

SEM analysis showed that zeolite is a crystalline alumina-silicate mineral. It has high porosity and a large surface area suited for microbial carrier, especially exopolysaccharide bacteria on peat application. The exopolysaccharide-producing bacteria could help form structure and peat molecule configuration related to water and nutrient supply to the plants. Exopolysaccharide bacteria analysis in this study confirmed that the population was high, averaged in $10^7$–$10^8$ CFU/gram of the product until 12 months observation under ambient temperature and about 60% of relative humidity. Furthermore, zeolite absorbs and releases water without changing its crystal structure according to the molecular sieve material to minimize fires in peatlands. The zeolite-clinoptilolite material from Bayah also has water absorption characteristics that can increase the water-holding capacity of the peat. Zeolites with 100–150 mesh of particle size have a higher water-holding capacity (60.50%) than 60–80 mesh (43.59%) and 80–100 mesh (49.22%) (Table 1).

Improving energy production and consumption in plantation can increase the number of reactive $N_2$. This accumulation of $N_2$ can alter the natural ecosystem and composition of various species, biodiversity, and ecosystem functions and affect nutritional imbalances. It is estimated that 60% of global $NH_3$-N emissions are produced from anthropogenic activity [26]. It needs to get special attention because it can cause problems in the future, such as damage to the plant leaves, increase sensitivity to drought checks, decrease biodiversity, increase environmental risk, eutrophication, and health. Reduce ammonia accumulation in an ecosystem environment is required.

The analysis of the adsorption-desorption potential of the molecular sieve material against $NH_3$ used the Temperature Programmed Desorption (TPD) method. The smaller the size of zeolite particles (100–150 mesh), the higher the $CO_2$ and $NH_3$ adsorption capacity. A high specific surface area combined with high pore volume appears as a determining factor for achieving high adsorption capacity (Table 2).

**TABLE 2**. The $CO_2$ volume adsorbed by zeolite.

| Particle size distribution of zeolite (mesh) | mol $CO_2$ (mmol) | Basicity (mmol/g) $CO_2$ | mol $NH_3$ (mmol) | Acidity (mmol/g) $NH_3$ |
|---|---|---|---|---|
| 60–80 | 0.03355735 6 | 1.0586 | 0.02572543 6 | 0.8380 |
| 80–100 | 0.05392426 6 | 1.7856 | 0.02932856 6 | 0.8729 |
| 100–150 | 0.07211457 4 | 2.4038 | 0.03261893 7 | 1.0290 |

A very significant source of greenhouse gas emissions comes from the manufacture of synthetic nitrogen (N) fertilizers, which are widely used in agricultural and plantation crop fertilization activities. It is commonly reported that the application of this N fertilizer dramatically contributes to the cause of $N_2O$ emissions from the soil. In modern agricultural and plantation cultivation technology, various efforts have been made to reduce greenhouse gas emissions, including reducing the dosage of fertilizers and utilizing soil microorganisms to increase fertility and land productivity. Based on research of Kusin *et al*. [27] stated that for each release of $N_2O$ between 19.11–22.17 kg $N_2O$-N/ha, an equivalent emission would be 1052.26–1209.51 kg $CO_2$-eq/ha. According to the Intergovernmental Panel on Climate Change [28], one percent of $N_2O$-N emission is generated from the total N given during the application of fertilization. Based on the above research, a further study is needed on the impact of using N fertilizers and practical efforts to reduce the rate of $N_2O$ emissions.

The potential use of zeolite for molecular sieve material to adsorb $N_2$ gas has been studied in this research. Zeolites with 100–150 mesh of particle sizes have a higher adsorption capacity (75.6 $cm^3$/g STP) of $N_2$ at relative pressure (0.989 P/Po) and absolute pressure (752.2 mmHg) compared to 80–100 mesh (71.7 $cm^3$/g STP) and 60–80 mesh (67.7 $cm^3$/g STP) (Fig. 2).

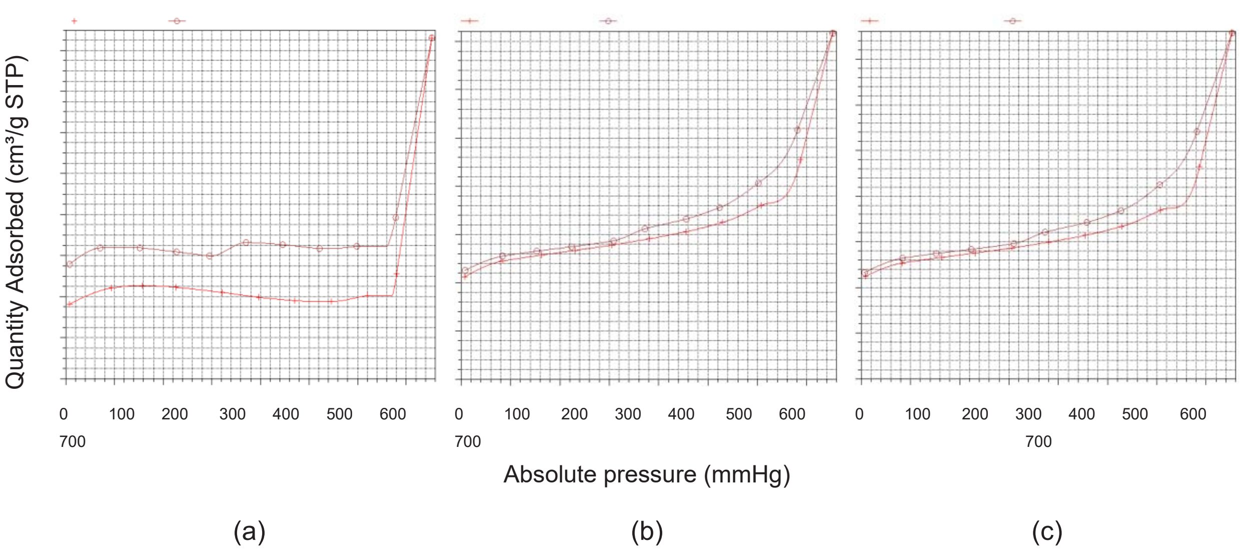



**FIGURE 2.** Graphics of the adsorption pattern (+) and desorption pattern (-0-) $N_2$ from zeolite 60–80 mesh (a), 80–100 mesh (b), and 100–150 mesh (c).

## CONCLUSIONS

Natural clinoptilolite zeolite of Bayah origin in 100–150 mesh particle offers a reliable solution to minimize degradation of peat soils via its cation exchange, $CO_2$, $N_2$, $NH_3$ adsorbent, and have high water holding capacity functions. The viability of exopolysaccharide bacteria in the zeolite was high until 12 months. Thus, zeolite was appropriate as an inoculation carrier, especially under field conditions.

## ACKNOWLEDGMENTS

The authors wish to thanks to the Indonesia Estate Crop Fund Management Agency for Palm Oil, Ministry of Finance, the Republic of Indonesia for valuable supports in funding this research (Contract No. PRJ-14/DPKS/2020).

## REFERENCES

1. R. Veloo, E. Ranst and P. Selliah, J. Life Sci. **72(73)**, 33–40 (2015).
2. L. W. Szajdak, T. Meysner, L. I. Inisheva, M. Szczepański, W. Gaca and K. Styła, *Peat-Physicochemical Properties* (Lambert Academic Publishing, Saarbrücken, 2017), pp. 63–79.
3. J. R. R. Campos, A. C. Silva, J. C. Fernandes, M. M. Ferreira, D. V. Silva and R. Bras, Ci. Solo. **35**, 1217–1227 (2011).
4. M. Könönen, J. Jauhiainen, R. Laiho, K. Kusin and H. Vasander, Mires and Peat **16**, 1–13 (2015).
5. N. Colombani, M. Mastrocicco and B. M. S. Giambastiani, Water Resour. Manag. **29(2)**, 603–618 (2015).
6. S. A. Shinde, S. M. Telang, S. S. Patil and M. M. V. Baig, Asian J. Soil Sci. **5(1)**, 68–69 (2010).
7. O. H. Ahmed, G. Sumalatha and A. M. N. Muhamad, Int. J. Physic. Sci. **5(15)**, 2393–2401 (2010).
8. L. P. Santi, J. Tanah Iklim **38(2)**, 101–108 (2014).
9. G. A. Akbari, S. Y. Arab, H. A. Alikhani, I. Allahdadi and M. H. Arzanesh, World J. Agric. Sci. **3(4)**, 523–529 (2010).
10. B. F. Azadeh, M. Sariah and M. Y. Wong, Afr. J. Biotechnol. **9(24)**, 3542–3548 (2010).
11. N. R. Ramli, M. S. Mohamed, I. A. Seman, M. A. Zairun and N. Mohamad, Malaysiana **45(3)**, 401–409 (2016).
12. L. P. Santi and D. H. Goenadi, "The use of exo-polysaccharide-producing endophytic microbe as bio-ameliorant in peat soils," in *Proceeding at International Oil Palm Conference*, edited by E. Nuryanto (Indonesian Oil Palm Research Institute, Medan, 2018), pp. 214–224.
13. U. K. Vandana, J. Rajkumari, L. P. Singha, L. Satish, H. Alavilli, P. D. V. N. Sudheer, S. Chauhan, R. Ratnala, V. Satturu, P. B. Mazumder and P. Pandey, Biology **10(101)**, 1–29 (2021).
14. D. H. Goenadi, A. B. Mustafa and L. P. Santi, IOP Conf. Ser. Earth Environ. Sci. **183,** 1–11 (2018).
15. S. L. Kandel, P. M. Joubert and S. L. Doty, Microorganisms **5(77)**, 1–26 (2017).
16. J. M. Zielinski and L. Kettle, *Physical Characterization: Surface Area and Porosity* (Intertek Pharmaceutical Services, Manchester, 2013), 7 p.
17. Standardisasi Nasional Indonesia, SNI-13-3494-1994 (1994).
18. A. Klute, "Water retention: laboratory methods," in *Methods of Soil Analysis*, edited by A. Klute (American Society of Agronomy, Madison, 1986), p. 635–662.
19. B. D. Cullity and S. R. Stock, *Elements of X-Ray Diffraction* (Prentice Hall, New York, 2001), pp. 174–177.
20. R. F. Zuo, G. X. Du, W. G. Yang, L. B. Liao and Z. Li, Open Geosci. **8**, 606–611 (2016).
21. J. Brame and C. Griggs, *https://hdl.handle.net/11681/38243* (2016).
22. L. P. Santi, Sudarsono, D. H. Goenadi, K. Murtilaksono and D. A. Santosa, Menara Perkebunan **78(1)**, 1–16 (2010).
23. D. H. Goenadi, Y. T. Adiwiganda and L. P. Santi, *Forum for Nuclear Cooperation in Asia, Biofertilizer Project Issue No. 6 November 2005* (Japan Atomic Industrial Forum, Inc., Tokyo, 2005), 16 p.
24. C. Sangeetha and P. Baskar, Agric. Rev. **37(2)**, 101–108 (2016).
25. A. Dariah and E. Susanti, J. Trop. Soils **20(2)**, 67–75 (2015).
26. H. Shibata, C. Branquinho, W. H. McDowell, M. J. Mitchell, D. T. Monteith, J. Tang, L. Arvola, C. Cruz, D. F. Cusack, L. Halada, J. Kopa´cˇek, C. Ma´guas, S. Sajidu, H. Schubert, N. Tokuchi and J. Za´hora, AMBIO **44**, 178–193 (2015).

27. F. M. Kusin, N. I. M. Akhir, F. M. Yusuff and Awang, Atmósfera **28(4)**, 243–250 (2015).
28. C. D. Klein, R. F. S. Novoa, S. Ogle, K. A. Smith, P. Rochette and T. C. Wirth, "$N_2O$ emissions from managed soils, and $CO_2$ emissions from lime and urea application," in *2006 IPCC Guidelines for National Greenhouse Gas Inventories (Agriculture, Forestry and Other Land Use, Volume 4)*, edited by S. Eggleston (Intergovernmental Panel on Climate Change, Geneva, 2006), p. 11.5–11.48.