Australia-Indonesia Agriculture and Food Security Workshop

Shine Dome
Canberra
8-9 June 2010

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Welcome message from the President of the Australian Academy of Science

Dear Colleagues,

On behalf of the Australian Academy of Science I would like to welcome the Indonesian delegation from The Ministry of Research and Technology (RISTEK), participating in the **Australia-Indonesia Agriculture and Food Security Workshop.** We are delighted that this delegation is being led by Dr Listyani Wijayanti, The Advisor to the Minister of Research and Technology in the field of Food and Health Technology.

Agriculture and food security are some of the biggest challenges that we face today. Indonesia has identified agriculture and food as one of the seven priority areas of research according to their national strategic plan on science and technology. For Australia, food security and agriculture are critical issues given that Australia is one of the driest continents on the planet. This workshop will provide a forum to share ideas and information between Indonesian and Australian scientists on rice, maize, soybean, sugar, beef cattle and sorghum and will explore the potential for research collaborations between the two countries.

I would like to express my gratitude to Dr Jim Fox and Dr Listyani Wijayanti for agreeing to be the Australian and Indonesian convenors of the workshop. I thank participants from both countries for generously giving their time to ensure the success of this meeting.

The Academy also acknowledges the financial support of the Australian Government Department of Innovation, Industry, Science and Research for this event.

Professor Suzanne Cory
President
Australian Academy of Science

Contents

Workshop program

Monday, 7 June

7:00pm **Welcome Reception**
Scarth Room, University House

Tuesday, 8 June

7:00-8:00 **Breakfast**

8:30 **Arrival and registration of participants**

9:00 **Welcome address by Professor Graham Farquhar FAA**
Vice President
Australian Academy of Science

9:10 **Welcome address by Dr Listyani Wijayanti**
The Advisor to the Minister of Research and Technology for Food and Health Technology
The Ministry of Research and Technology (RISTEK)

9:20 **Plenary presentation by Dr Jim Fox**
Resource Management in Asia-Pacific Program (RMAP)
Australian National University
TBA

10:00 **Morning tea break**

10:30 **S01: Dr Listyani Wijayanti**
The Ministry of Research and Technology (RISTEK)
Indonesian science and technology policy on food and agriculture

11:00 **S02: Dr Anthony Whitbread**
Sustainable Ecosystems
Australian Commonwealth Scientific and Research Organisation (CSIRO)
Improving food security using farming systems research and systems simulation in resource-poor smallholder farming systems

11:30 **S03: Dr Wahono Sumaryono**
The Agency for the Assessment and Application of Technology (BPPT)
Developing integrated farming through synergy of Academician, Business community and Government

12:00 **Lunch**

1:00 **S04: Dr Nigel Preston**
Food Futures National Research Flagship
Australian Commonwealth Scientific and Research Organisation (CSIRO)
Testis cell transfer: An alternative to artificial insemination in cattle to permit mass production of hybrid breeds

1:30 **S05: Dr Kusuma Diwyanto**
Ministry of Agriculture
Increasing the production of beef cattle through an integrated crop livestock system in Indonesia

2:00 **S06: Dr Heather Burrow**
Cooperative Research Centre for Beef Genetic Technologies (Beef CRC)
Potential use of DNA markers in Australian and Indonesian cattle herds

2:30 **Afternoon tea break**

3:00 **S07: Dr Soeranto Hoeman**
The National Atomic Energy Agency (BATAN)
Efforts on the development of sorghum for food, feed and fuel

3:30 **S08: Dr David Jordan**
Queensland Department of Primary Industries and Fisheries
Integrating new technologies to improve genetic advance in sorghum

4:00 **Plenary presentation by Dr Peter Horne**
Livestock Production Systems
Australian Centre for International Agricultural Research (ACIAR)
TBA

4:30 **Day 1 wrap up session**

7:00 **Official Dinner**
The Lobby Restaurant

Workshop program

Wednesday, 9 June

7:00-9:30 **Breakfast**

10:00 **S09: Dr Nicole Robinson**
University of Queensland
Physiology and biotechnology: Through understanding how sugarcane acquires and uses nitrogen, development of varieties that need less nitrogen fertiliser to make the same amount of sugar and biomass

10:30 **S10: Dr Soeranto Hoeman**
The National Atomic Energy Agency (BATAN)
Sugarcane Agroindustry in Indonesia

11:00 **S11: Dr Peter Bundock**
Southern Cross University
Single nucleotide polymorphisms, genome sequencing and sucrose synthesis in sugarcane

11:30 **Morning tea break**

12:00 **S12: Dr Bambang Prasetya**
Indonesia Institute of Science (LIPI)
Current status of main food crop production and the roll of biotechnology for sustainable production in connection with global climate change and decreasing environment quality

12:45 **S13: Mr Geoff Beecher**
Industry and Investment New South Wales
Strategies and tactics to improve the water productivity of rice based systems in SE Australia – managing spatial variability of rice growth and yield

1.15 **Lunch**

2:30 **S14: Professor Bob Lawn**
James Cook University
Soybean improvement in the tropics & subtropics

3:00 **S15: Dr Arief Indrasumunar**
ARC Centre of Excellence for Integrative Legume Research
Molecular genetics and functional genomics of soybean (Glycine max L.) nodulation and nitrogen fixation

3:30	**Discussion on future bilateral collaborations**
4.30	**End of Day 2**
4.45	**Australian delegates depart for airport by bus** **Indonesian delegates depart for Sydney by bus**

Thursday, 10 June
(For RISTEK delegation only)

7:00-8:45	**Breakfast**
9:30	**Depart for site visits**
10:00	**Site visits to the University of Sydney Plant Breeding Institute**
3:00	**Sydney Harbour sightseeing**
6:00	**Dinner at Zaaffran Restairant**

Friday, 11June
(For RISTEK delegation only)

9:15	**Indonesians depart for Jakarta**

Workshop convenors

Dr Jim Fox

Professor
Resource Management in Asia-Pacific Program (RMAP)
Australian National University
Email: james.fox@anu.edu.au

Biography

Professor James J. Fox was educated at Harvard (AB '62) and Oxford (B Litt. '65, DPhil. '68) where he was a Rhodes Scholar. He has taught at various American Universities: Harvard, Cornell, Duke and Chicago and at various European Universities: Leiden, Bielefeld and the École des Hautes Études en Sciences Sociales. He is a Foreign Fellow of the Royal Dutch Academy of Sciences and a Fellow of the Academy of the Social Sciences in Australia.

Professor Fox's area of primary interest is Indonesia, with special focus on Java and eastern Indonesia. He has carried out considerable research in Timor, most recently in East Timor. More generally, his interests are in comparative issues affecting the whole of the Asia Pacific region.

Professor Fox’s research interests include: history and anthropology of Indonesia and East Timor; rural development and resource management; study of social organisation and symbolic systems; linguistic anthropology; and comparative Austronesian ethnology.

Dr Listyani Wijayanti

The Advisor to the Minister of Research and Technology in the field of Food and Health Technology
The Ministry of Research and Technology (RISTEK)
Email: liesw@ristek.go.id

Abstract

Indonesian science and technology policy on food and agriculture

Food supply and affordability are the main priority in the national strategic policy on science and technology. Indonesian Food Law No.7, 1996 regulates that all parties should provide enough food both in quantity and quality in any place and at any time. Food related problems in Indonesia include food availability (food production that is less than consumption), accessibility, affordability, quality as well as safety. Therefore, The Ministry of Science and Technology has determined food technology development is one of the seven priorities of research and development in the Mid-term Development Plan 2010-2014 and National Strategic Policy on Science and Technology 2010-2014.

The goals of agriculture and food S&T development are to increase productivity, quality and efficiency of farm production, to increase diversification of raw materials of food, to increase post harvest technology and food processing to improve added value of food products and to push conducive research collaboration between research institution, private and public sector.

To support food research and development, the Ministry for Research and Technology has provided incentive programs consisting of basic research, applied research, dissemination of research results and research on science and technology capacity building of production systems and National Strategic Competitive Research (RUSNAS) as well. However, the implementation of food research and development programs by the Ministry for Research and Technology should be in line with National Strategic Policies for Indonesian Science and Technology Development (JAKSTRANAS). The strategy was focused on efforts in developing national science and technology capabilities. Within 2005-2009 efforts taken were focused in the four main programs namely: (1) Research and development; (2) Diffusion and utilization of S&T; (3) Strengthening the capacity of institutions; and (4) Increasing the capacity of S&T for industries. Achievements obtained through these four programs are perceived to be the basis for the national innovation system.

According to Science and Technology Law No.18, 2002, Indonesian National Innovation System (NIS) should be built based on the three main pillars: institutions, resources and

network. There are four Presidential Decrees (Peraturan Presiden/Perpres) as detailed guidelines for the implementation of Law No. 18/2002 such as Presidential Decree No. 20/2005 on technology transfer of property right and outputs of research and development (R&D), No. 41/2006 on permission for international researchers, bodies and institutions to conduct research activities in Indonesia, No. 35/2007 on budget needed to be allocated by the enterprises for the purpose of increasing its capacity in R&D, innovation and technology diffusion and No. 48/2009 on permission for high risk research activities. Hopefully, through the policies and programs, food problems could be solved and food self sufficiency as well as food security in Indonesia could be achieved.

Curriculum Vitae

Education:

- Ph.D. in Biological Sciences (Flowering Physiology) Saitama University – Japan (1996)

Work Experience:

- Research Scientist at The Agency for the Assessment and Application of Technology (BPPT) (1982-1999)
- Director of Centre for Pharmaceutical and Medical Technology, BPPT (2000-2005)
- Staff for Marketing Technology, BPPT Engineering-BPPT (2006-2007)
- Advisor (Senior Staff) to The Minister of Research and Technology for Food and Health Technology (2008-present)

Training Courses and Others:

- Training on Biotechnology (Microbial Ecology), 1985-1986, The Institute of Physical and Chemical Research, Saitama- Japan
- Training on Plant Biotechnology, 1991, Muenster University- Germany
- International Training on Biotechnology Management, 1997, Yogyakarta- Indonesia
- R&D Management, 2001, Seoul-Korea
- Training on Leadership Level II, 2004, Jakarta-Indonesia
- Training on Leadership Level I, 2008, Jakarta-Indonesia
- Resource Person and Presenter at Seminars and Workshops on Food and Health Technology (1987-present)
- Indonesia Delegations for:
    - WHO Regional Meeting on The Use of Herbal Medicines in Primary Health Care, March 2009, Yangoon-Myanmar
    - Working Group Meeting on The Join Task Force Republic of Korea-Republic of Indonesia, March 2010, Seoul-Korea

Dr Anthony Whitbread

CSIRO

Sustainable Ecosystems

Email: anthony.whitbread@csiro.au

Abstract

Improving food security using farming systems research and systems simulation in resource-poor smallholder farming systems

As governments attempt to help resource poor smallholder farmers become food secure, the method by which research is undertaken and the participants engaged (farmers, extension staff and scientists), become critical for success. Farming systems research (FSR) is a methodology that aims to develop more 'farmer adoptable' technologies and intervention strategies by undertaking research with farmers as participants and building an understanding of the system. Using this methodology, CSIRO and its in-country partners have undertaken many RD&E projects across the developing world where the focus has been to improve the productivity of smallholder farmers. A key feature of this work, in addition to the usual FSR strategies, has been the use of systems simulation to develop an understanding of the system and test new technologies. The soil-plant-climate model, the Agricultural Production Systems sIMulator (APSIM) used in combination with other economic and animal production models, field experimentation and stakeholder engagement and has proved useful in extrapolating short term field research to the broader region and climate.

Biography

Dr Anthony Whitbread is a Farming Systems Scientist with CSIRO Sustainable Ecosystems based in Adelaide, South Australia. With a background in soil science and agronomy, he applies farming systems research methodologies and simulation models to improving farmer livelihoods across Australia and Africa. Since joining CSIRO over 10 years ago Anthony has worked in the mixed crop-livestock systems of northern and southern Australia to devise practical ways of managing cropping system resilience. Internationally, he has worked throughout South-East Asia and southern Africa on the use of tropical legumes for improving productivity and to devise strategies to manage risk and fertility in smallholder maize and rice cropping systems. Anthony was awarded a PhD by the University of New England in 1997 and has authored more than 25 journal articles, book chapters and >80 conference and industry publications.

Dr Wahono Sumaryono

The Agency for the Assessment and Application of Technology (BPPT)

Email: wahono@bppt.go.id; wahono@ceo.bppt.go.id

Abstract

Developing integrated farming through synergy of Academician, Business Community and Government

Indonesia is a developing country with a population of around 235 million with the projected growth of 1.5% per year. Approximately 40% of the population is working in the agriculture sector. These factors will become the major consideration of the Government and the stakeholders for at least the next two decades to establish and develop the agro-industry sector for food security and the development of agro-based non-food industrial products through increasing the productivity and the added value.

The principles of Good Agricultural Practice would need to be applied for the development of the food crops agricultural sector, including rice, maize, soybeans, sorghum, and sugarcane to ensure the productivity. Besides the quality of seeds and the suitability of agro-climate, other variables in farming technology need to be considered in order to maximize results. Along with the increasing public awareness on the importance of environmental preservation, the development of integrated farming including ruminants such as cattle is often preferred. This is because through integrated farming two objectives will be achieved; the productivity of activities and preservation of the environment through reduced use of inorganic fertilizer, use of a balanced fertilizer (inorganic and organic), use of biopesticide and other relevant efforts. In order to convince the farmers and agribusiness entrepreneurs of the importance of integrated farming, pilot projects with high success rates need to be established. Therefore, the support of relevant science and technology accompanied with the implementation of effective management becomes an absolute necessity.

Although the support of science and technology is considered as determinant variables, the role of other stakeholders outside the science and technology community, namely business community, remains necessary to ensure the development of integrated farming on a large scale. The business community will apply the results of the pilot-scale study conducted by the academic communities into large-scale commercial production involving partnership with small farmers to ensure that economic feasibility and benefit-sharing can be achieved.

Besides the role of the two communities that have been mentioned above as determinant variable in integrated farming success, there is also a natural trend that occurs in almost all countries, which is the increasingly declining exchange value of agro products relative to manufactured products.
Therefore, it is the role of the Government as trade regulator, which includes promoting various productive activities that involve public interests, to contribute significantly, either in the form of incentives to encourage productivity or in the process of adding value to agricultural products for food and non-food .
From the description above, the synergy of A + B + G is the accelerator and also determinant factor in the success of integrated farming in the context of food security and diversification of innovative agro-based product development. When the synergy of its role and functions can be implemented significantly, then the Biobased Economy which is one of the economic characteristics of the First Quarter of the 21st Century will become a reality.
Keyword : integrated farming, synergy ABG

Curriculum Vitae

Education:

- Dr.rer.nat/Ph.D (Phytochemistry-Plant Biotechnology), 1990, by Technical University, Carolo Wilhelmina Braunschweig, Germany
- Management Course and Comparative Study on the Privatization of Governmental R&D Institutes in the Great Britain, by the Crown Agent-Worthing, September 2001
- Management Course on Cost Benefit Analysis, Forecasting Techniques, and System Analysis by The Management Inst. of the Faculty of Economy-University of Indonesia, Jakarta, 1984
- Training on the Application of Radiation & Radioisotopes for Biological and Medical Field; National-Inst for Radiological Sciences, Chiba-Tokyo and Kanazawa University-School of Medicine, Japan 1984

Work Experience:

- Deputy Chairman of the Agency for Assessment and Application of Technology (BPPT) for Agroindustry and Biotechnology, since Oct. 2000
- Member of the National Research Council of the Republic of Indonesia, 1999-2004, 2004-2007, 2007-2011
- Member of the National Team for Biofuel Development, 2006-2007 (Presidential Decree No. 10, 2006)
- Member of the Steering Committee for Agrotechno-Park Development-Ministry of Research and Technology, 2006-2010
- Professor in Natural Product Chemistry at Pancasila University-Jakarta, since June, 2007.

Participants

- Co-Promotor of Ph.D Candidates in the field of Biotechnology, Phytochemistry, in the Bogor Agriculture University (IPB) and Indonesia University (UI) Jakarta

Dr Nigel Preston

Australian Commonwealth Scientific and Research Organisation (CSIRO)
Food Futures National Research Flagship
Email: nigel.preston@csiro.au

Abstract

Testis cell transfer an alternative to artificial insemination in cattle to permit mass production of hybrid breeds

The ability to use testis cell transfer to deliver sperm cells from a donor male via a recipient surrogate male has the potential to create new ways to deliver elite genetics and accelerate the rate of genetic gain in livestock. Brahman or Zebu breeds of cattle represent about 60% of Australia's total beef cattle population and are able to survive and reproduce in harsh tropical conditions, but they produce beef of relatively poor quality. Crossbreeds of Brahman and European breeds, such as Angus are able to perform well in the tropics and produce beef of superior quality. Pure European cattle breeds are not suitable as sires in these harsh environments, and artificial insemination (AI) is too costly to implement. Our research aims to generate Brahman bulls that have received a transplant of male germ line stem cells from Angus, or another high-value beef breed. The recipient males will then be able to pass on the donor genetics to their offspring via natural mating. Our research team has recently demonstrated the feasibility of this approach in sheep. Testis cells from one breed of sheep were transferred into a recipient of a different breed. Live offspring, fathered by the donor, were obtained after natural mating. Following the success with sheep the focus of the project is now on cattle. Spermatogonial stem cells from the testis of the donor breed (Angus) have been implanted into the testis of young recipent Brahman bulls. Matings from these bulls are anticipated in 2012.

Biography

Dr Preston leads the Breed Engineering Theme of the CSIRO Food Futures Flagship. The Theme deploys the skills of a team of 50 scientists to develop and apply novel genetic, nutrition and production technologies to achieve a quantum increase in the value of livestock and aquaculture industries. Dr Preston has more than 25 years research experience and has published 80 science papers on a broad range of topics including invertebrate embryology, reproductive biology, genetics, ecology, nutrition, production technology and

environmental management. He is an acknowledged world authority in aquaculture and has contrinuted to the sustainable growth of aquaculture in Australia, Vietnam, Indonesia, Mexico and Brazil.

Dr Kusuma Diwyanto

Ministry of Agriculture

Email: kd_267@yahoo.com

Abstract

Increasing the production of beef cattle through an integrated crop livestock system in Indonesia

In the era of the 1960's to 1970's Indonesia was a beef cattle exporter. However, in the last two decades, Indonesia became an importer of beef and feeder cattle. The meat import has reached 110 thousand tons, and imported feeder cattle is about 620 thousand. In the early 2000s some researchers predicted a dramatic increase in the demand for beef; it could reach around 2-3 times what it is currently by the year 2020. This situation would have an impact on the high dependency on imported beef and feeder cattle. Therefore, an effort to increase beef cattle population as well as its productivity is needed. One of the most important factors in increasing beef and cattle production is providing a sufficient amount of feed throughout the year. In order to overcome those problems, it is necessary to develop an integrated crop livestock system in the plantation region in Sumatra and Kalimantan. Various research results have been published, but the development process requires more rapid acceleration in the provision of breeding stock. Australia can assist this program by providing breeding stock, while Indonesia can participate by preparing the region and providing human resources.

Key words: Beef, CLS, palm oil

Biography

Prof. Dr. Kusuma Diwyanto was born in 1951 in Surakarta, Indonesia and is married with two children. He holds a BS degree from UGM, Indonesia in 1976, a MS degree from IPB, Indonesia in 1982, and a DR degree from University of Missouri Columbia (UMC), USA in 1989.

As a senior reseacher at the Indonesian Agency for Agriculture Research and Development, Dr. Diwyanto has written many publications on animal production research especially about animal breeding and genetics in ruminant. He is the former Director of the Indonesian

Participants

Research Institute for Animal Production, Bogor (1993-1997); Director of Indonesian Center for Animal Research and Development, Bogor (1997-2005), and Director of Breeding, Directorat General Livestock Services, Jakarta (2005-2006).
Other activities:

- President, Indonesian Society of Animal Science, ISPI (1994-1998;1998-2002)
- President, Breeding Science Society of Indonesia, PERIPI (2005-2009; 2009-2013)
- Head, National Committee on Genetic Resources, KNPN (1999-2005)
- Member, National Committee on Bioethics, KBN (2004-2008; 2008-2012)
- Advisor, R & D of Indonesian Beef and Buffalo Association, PPSKI (2009-2014)

Dr Heather Burrow

Cooperative Research Centre for Beef Genetic Technologies (Beef CRC)

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Abstract

Potential use of DNA markers in Australian and Indonesian cattle herds

Beef CRC's genomics research aims to improve the profitability of Australian beef businesses by performing genome-wide association studies using SNP (Single Nucleotide Polymorphism) panels and phenotypic measures of production and adaptation to discover, validate and commercialise DNA markers associated with economically important traits. Independently-validated DNA tests provide cost-effective information that is simple to use, stable over an animal's life (but available at birth) and enables decision-making to best manage animals for breeding or marketing for greatest profit. Although the discovery and validation of DNA markers has proved to be more difficult than originally anticipated, strong progress is now being made. This presentation outlines progress to date and identifies new opportunities whereby DNA technologies could potentially be used in Indonesia to practically and cost-effectively increase productivity and profitability of small-holder cattle herds.

Biography

Dr Heather Burrow is Chief Executive Officer of the Cooperative Research Centre for Beef Genetic Technologies, Australia's largest integrated beef research program that aims to increase competitiveness of Australia's beef industry by discovering and commercialising DNA markers associated with economically important traits. Before taking up her current position in Armidale NSW in 2005, Heather was Beef CRC's Deputy CEO and leader of the CRC's largest research project involving multi-disciplinary collaboration amongst scientists from research institutions in Australia and South Africa. At that time, she was a scientist with CSIRO in Rockhampton, Qld, where she had been involved in collaborative cattle breeding research since 1978. A quantitative geneticist by training, she is recognised as having specialist expertise in the genetic improvement of tropically adapted beef cattle.

Dr Soeranto Hoeman

The National Atomic Energy Agency (BATAN)

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Abstract (Sorghum)

Efforts on the development of sorghum for food, feed and fuel

Indonesia needs to explore and utilize potential crops that can ensure food and energy security in future agriculture development. The crops should be suitable for dryland farming systems and require less water than that of the traditionally wetland of paddy fields. This is important in anticipating the effects of global climate change issues which cause some arable lands to become prone to drought. Water scarcity is still a major problem for agricultural development in some areas such as in Central and East Java, West and East Nusa Tenggara, Sulawesi, Maluku and Irian. For those arid areas, development of dryland farming systems may be focused on crops that require less water, have a high yield potential and with good economic values such as sorghum.

Sorghum (Sorghum bicolor L.) is one of the suitable crops grown in arable lands conditioned by hot and dry climates. Sorghum can be used as a food, feed, and raw materials for industries like bioethanol. Sorghum is known to have wide adaptability ranging from lowland, medium up to highland altitude. In the areas where sorghum is commonly grown, yields of 3-4 ton/ha are obtained under normal condition. The main sorghum production areas are East and Central Java, South Sulawesi, and East and West Nusa Tenggara. In Indonesia sorghum is grown in the areas with agroclimatic zones C2-C3 (5-6 consecutive wet months and 2-4 to 5-6 consecutive dry months) or D2-D3 (3-4 consecutive wet months and 2-4 to 5-6 consecutive dry months). As a minor crop, sorghum receives less attention than the other food crops such as rice, maize, and soybean. The total sorghum harvested area was reported to be only about 18,600 ha with total production of 26,500 tons.

Efforts on sorghum development have been reached through a plant breeding program. Available sorghum genotypes consist of local germplasm collections and breeding materials introduced from the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) in India and from China. The objectives of sorghum breeding are to search and develop genotypes tolerant to adverse conditions such as drought and soil acidity with

simultaneously improved yield and quality for food, feed and fuel (bioethanol). Sorghum breeding with a combination of conventional, mutational and biotechnological approaches has been conducted at the Center for the Application of Isotope and Radiation Technology, National Nuclear Energy Agency. A number of promising sorghum lines have been obtained and registered as highly drought and acid soil tolerant.

White grain sorghum will hopefully play a significant role in the food diversification program and ensure food resilience in future Indonesia. Grain and forage sorghum will also be important for livestock industries including poultry and ruminants (beef cattle). The potential use of sweet sorghum for fuel (bioethanol) industry will promote a cleaner environment and to some extent it is relevant to anticipating the global warming and climate change issues. Integration of sorghum cultivation with livestock and bioethanol business has been disseminated as an ideal farm model for farmers in certain areas, especially during dry seasons. Moreover, sorghum cultivation will also promote land conservation and is useful for supporting sustainable agriculture development in the drought prone or marginal areas in Indonesia.

Research on sorghum technology related to food, feed and fuel industries has been conducted in collaboration with some counterparts including Ministry of Agriculture, universities and private companies. International support has been received from the International Atomic Energy Agency (IAEA) through INS/5/030 and RAS/5/045 projects and the Forum for Nuclear Co-operation in Asia (FNCA). Following the Indonesia-Australia Joint Working Group in Science and Innovation, Research and Technology, sorghum is proposed to be a part of the agriculture and food topic. Scientists from the two countries are expected to increase research collaboration and scientific discussion on the specific topic. For mutual interests on sorghum, this idea may be implemented through scientist exchanges or fellowships, training, scientific meetings or other collaborative activities related to the development of sorghum technologies for food, feed and fuel in both countries. Finally, we hope that this collaborative work will further strengthen our friendship and scientific collaboration between Indonesia and Australia.

Abstract (Sugar)

Sugarcane Agroindustry in Indonesia

Indonesia's sugar industry dates back to the seventeenth century. It reached its zenith in the early-thirties when 179 factories produced nearly 3 million tons of sugar annually. Following a slump in the thirties, when low sugar prices prevailed, the industry declined to 35 factories producing about 500,000 tons of sugar. A decade later the industry had recovered somewhat, and by the beginning of World War II there were 93 factories producing about 1.5

million tons. But a second reduction occurred, so that by the end of World War II only 30 factories remained producing less that 300,000 tons. During the fifties some recovery occurred and Indonesia again became a net exporter. However, since 1967, Indonesia has reverted to a net importer position. In 1957, the industry was nationalized and to-date remains highly regulated. The national sugar policy seeks to encourage the intensification of production, the rehabilitation of factories in Java, and the establishment of new factories outside Java to meet growing domestic market requirements arising from steady population growth, rising incomes and the growth of the food and beverage industries. Since the mid-eighties imports have continued to rise and reached record levels in 1997/98. Rising land and labor costs and rapidly growing consumption make Indonesian sugar self-sufficiency a difficult target to achieve, at least in the short run.

Indonesia harvests about 400,000 ha of cane for centrifugal sugar, of which almost three-quarters is on Java. Most of the remainder comes from Sumatra, Kalimantan and Sulawesi. While a decade ago more than half of Java's cane was irrigated, this area has declined reflecting a shift to the cultivation of more profitable crops. Nevertheless, sugarcane cultivation in the major producing islands remains a highly significant economic activity, and covers more than one-third of the total land area.

About 70 percent of the sugarcane areas is cultivated by farmers, mostly on small to medium sized holdings. The remainder is cultivated on sugar factory plantations, both in Java as well as on other islands where the dominant form of sugarcane cultivation is plantation-style. Farmers are organized into groups responsible for at least 20 ha of land in order to coordinate the supply of cane to the mills. Sugarcane areas have increased sharply since the mid-seventies at an average annual rate of 7.5 percent from 116,000 ha in 1976 to a peak of 496,000 ha in 1995. However, areas have since declined to 395,000 ha in 2007. Through the revitalization program the sugarcane areas have increased again in 2009 to become 415,000 ha.

Sugarcane yields have shown little growth, fluctuating during the nineties in the range of 73 to 79 tons per ha, compared to an average level of 73 tons during the eighties and 83 tons during the late-seventies. Between the late-seventies and the nineties, average sugar extraction rates declined from about 10 percent to 7 percent. Production of sugarcane rose from about 28 million tons in the early-nineties to a peak of 33 million tons in 1994, but subsequently receded to 30 million tons in 1995 and 1996. Sugar production showed comparable changes, rising from 2.1 million tons in 1990 to nearly 2.5 million tons in 1993 and declining to 2.1 million tons in 1996. The lowest sugar production was recorded in 1998-2003 i.e. 1.8-1.9 million tons, but then it started to increase again in 2005 (2.2 million tons) and in 2009 it reached 2.8 million tons.

Sugarcane has had to compete with other crops, especially rice. Relatively less attractive returns as compared to other crops have continued to discourage some farmers from growing cane, leaving certain factories without sufficient raw materials to operate at capacity. In addition, since the 1995/96 season, there has been a weakening in the ratio of producer prices for sugarcane to those for rice. Over the years, many Government schemes have been implemented to encourage sugarcane production, including the 1975 Smallholder Sugarcane Intensification Program and the 1981 Induced Increasing Sugar Production Program. At present, the Government provides financial assistance to growers in various forms, for example to support production, harvesting and hauling costs through the Koperasi Unit Desa, or rural cooperative unit. Some funds also flow through the factories to assist with fertilizers and chemicals.

Competition for land, particularly irrigated areas, not only from other crops and livestock production, but also increasingly from urbanization in the densely populated areas of Java, has resulted in a shift in the cultivation of sugarcane to non-irrigated areas and to poorer lands. Improved productivity through sugarcane breeding program is particularly important especially in searching for superior genotypes for adverse condition of land. Some new recommended sugarcane varieties have been released by the Indonesian Sugar Research Institute (P3GI). These high yielding varieties include PS 851, PSBM 901, Bululawang, PSCO 902, Kentung and Kidang Kencana.

In the processing sector, there is also scope for enhancing mill efficiency, thereby contributing to better returns to both industry and agriculture. However, certain structural rigidities make the rationalization of the industry, particularly in the older mills of Java difficult to achieve, including the need to find alternative employment and income opportunities for mill workers.

Curriculum Vitae

Education:

- Graduated from Bogor Agricultural University (IPB) in Bogor (1981)
- Master of Science from the Agricultural University of Norway (1988)
- Doctoral Degree from the Agricultural University of Norway (1992)

Work Experience:

- National Nuclear Energy Agency (1983-present) – as a plant breeder at the Agricultural Division

Research:

Participants

- Wheat (Tritcum aestivum) breeding for rust disease (Puccinia striiformis) resistance and lowland adaptation
- Sorghum breeding for improved yield and quality for food, feed and fuel.

International Linkages:

- Main counterpart of the IAEA TC Project INS/5/030 “Sustainable Agriculture Development in Yogyakarta” (2000-2006)
- National project coordinator of IAEA/RCA Project RAS/5/040 “Enhancement of Genetic Diversity in Food, Pulses, and Oil Crops and Establishment of Mutant Germplasm Network” (2002-2007)
- National project coordinator of IAEA/RCA Project RAS/5/045 “Improvement of Crop Quality and Stress Tolerance for Sustainable Crop Production Using Mutation Techniques and Biotechnology” (2008-2011)
- National counterpart of Forum for Nuclear Co-operantion in Asia (FNCA) Project “Drought tolerance in sorghum and soybean” (2001-2006)
- Joint research with the University of Tokyo under sponsor of Japan Society for the Promotion of Science (JSPS) on Toward Harmoniation between Development and Environmental Conservation in Biological Production (1999-2008)

Award

- Radioisotope Research Promotion Award from the Japan Radioisotope Association (Tokyo, 2001)

Dr David Jordan

Queensland Department of Primary Industries and Fisheries

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Abstract

Integrating new technologies to improve genetic advance in sorghum

Sorghum is a C4 cereal crop with high yield potential and broad adaptation to a range of climatic conditions particularly hot dry environments. In the developing world it is important as reliable dry-land food crop in large areas of Africa and Asia where drought is common. In the developed world it is grown as a feed grain in conditions where water is often limiting. Agric-science QLD conducts a sorghum improvement program which focuses on improving grain yield, drought and insect pest resistance and grain quality. The program has recently begun to make use of developments in technologies such as whole genome marker scans, sequencing of the sorghum genome and crop simulation modelling to improving the rate of genetic gain in its sorghum breeding program. In this presentation I will present an overview of our sorghum improvement activities.

Biography

Dr David Jordan is a principal sorghum breeder and sorghum team leader with Agric-Science Queensland. He has 18 years of experience working as a sorghum plant breeder and molecular geneticist. David has strong collaborative links with international sorghum researchers particularly at Texas A&M University and Pioneer Hi-Bred and is a member of the international sorghum genome executive committee. David also works closely with researchers at University of Queensland where he holds an adjunct associate professorship. His main research activities are in the areas of sorghum germplasm enhancement, integration of new technologies into applied plant breeding programs and gene discovery.

Participants

Dr Peter Horne

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Biography

Dr Peter Horne is Research Program Manager for Livestock Production Systems (LPS). LPS aims to build a better understanding of the biological, social and economic aspects of smallholder livestock systems (small and large ruminants, pigs and poultry).

Dr Horne is also the Principal Regional Coordinator for Indonesia, East Timor and the Philippines. This position involves identifying strategic directions and providing high-level oversight for ACIAR's program in this region, together with managing stakeholder relations both in Australia and in Indonesia, East Timor and the Philippines.

Peter has spent most of his career based in Asia involved in agricultural research-for-development, with a particular focus on forages and livestock systems. Prior to joining the team in Canberra he was Manager of a research program funded by AusAID and implemented by ACIAR in Eastern Indonesia called "Support for Market-driven Adaptive Research (SMAR)". As one component of the ongoing Smallholder Agribusiness Development Initiative, SMAR focused on building adaptive research capacity in eastern Indonesia to contribute to better linkages between smallholder farmers and markets. Peter has also worked as a researcher for CIAT, CSIRO, North Carolina State University and University of New England. He has a PhD in Tropical Agronomy from University of New England.

Dr Nicole Robinson

University of Queensland

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Abstract

Physiology and biotechnology: through understanding how sugarcane acquires and uses nitrogen, development of varieties that need less nitrogen fertiliser to make the same amount of sugar and biomass

Up to 50% of the nitrogenous fertiliser applied to sugarcane farming systems can be lost to the environment and while considerable effort has been invested in optimising agronomic nitrogen management there has been little focus on plant improvement. Successful breeding of nitrogen use efficient sugarcane cultivars requires identification of the key processes of the plant nitrogen economy associated with both plant nitrogen acquisition and utilisation. An understanding of plant traits affecting nitrogen use efficiency in sugarcane farming systems has been sought by investigation of (i) the differential use of nitrogen forms, (ii) the genetic variation in Australian sugarcane germplasm for nitrogen use efficiency (iii) the potential of nitrogen-linked molecular markers; and (iv) the contribution of morpho-physiological traits to nitrogen use efficiency under varied nitrogen supply. This integrated approach, which ranges from developing molecular breeding tools to increasing understanding of agro-ecosystem N dynamics, will provide knowledge for targeted N supply and low N loss while maintaining yields in sugarcane farming systems.

Biography

My research interests are focussed on the development of sustainable cropping systems. For the past six years I have worked as part of a collaborative group involving researchers and industry on nitrogen use efficiency of sugarcane within the CRC for Sugar Industry Innovation through Biotechnology based at the University of Queensland. The work on nitrogen use efficiency will continue with a focus on field based screening for the next four years with funding from the SRDC. Prior to my current role I was a research scientist with the Department of Conservation and Land Management in Western Australia investigating

the role of trees in salinity control. My PhD on the regulation of nitrate assimilation of species from an ecological perspective was awarded from the University of Queensland in 2003.

Dr Peter Bundock

Southern Cross University

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Abstract

Single nucleotide polymorphisms, genome sequencing and sucrose synthesis in sugarcane

Due to polyploidy, interspecific hybridisation and other factors, the sugarcane genome is highly complex. Genetic linkage maps can however be constructed for sugarcane using DNA markers. Single nucleotide polymorphisms (SNPs) are the marker system of choice for species with sufficient DNA sequence information (eg. humans). We have utilised 454 sequencing to discover a large number of SNPs in about 300 sugarcane genes with 400 SNPs being converted into SNP assays with 100 single dose SNP markers have been placed on the genome map of sugarcane variety Q165. We are now utilising Illumina Genome Analyser sequencing to obtain genome sequence to contribute to international efforts to sequence the sugarcane genome. In a separate project we have been characterising the sucrose phosphate synthase (SPS) gene family which is central to sucrose synthesis. The expression of SPS-V has been found to be dominant in high sucrose internodes and is highly correlated with sucrose content. Expression levels of soluble acid invertase (SAI) may also be explanatory for sucrose content.

Biography

Peter received his bachelor degree from the University of New England before working on Arabidopsis transformation at Monash University and IAA biosynthesis at the University of Western Sydney. He completed a PhD at the University of Tasmania on genome mapping and detection of quantitative trait loci (QTL) in Eucalyptus globulus. Peter is currently a Research Fellow at Southern Cross University where his main focus has been on the discovery and analysis of SNPs (single nucleotide polymorphisms) in barley and more recently sugarcane, with experience also in gene expression analysis (SAGE, microarrays, qRT-PCR). Peter has recently been involved with using next generation sequencing to

discover DNA polymorphisms and is working within a consortium on the sugarcane genome sequencing project.

Dr Bambang Prasetya

Indonesia Institute of Science (LIPI)

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Abstract

Current status of main food crop production and the roll of biotechnology for sustainable production in connection with global climate change and decreasing environment quality

Indonesia is part of the second largest mega biodiversity and tropical humid region which has a high productivity of photosynthesis. Great extensions of available land for agriculture and plantations secures the food supply for 250 million people from varying socio-economic backgrounds. However, Indonesia faces environmental problems which have been partly caused by conventional farming and by global climate change. Therefore to secure food supply, much effort has been made by Indonesia such as trade regulation, agribusiness schemes, developing suitable crops, improvement of farming methods, production and distribution of fertilizer, etc. To support these kinds of programs, biotechnology plays an important role especially in providing modified crops and improving the environmentally-friendly farming. This paper will give an overview of the current status of food crop production in Indonesia and related problems, especially in connection to declining environmental quality. The state of the art of research and development in the field of plant biotechnology will also be summarized.

Some research has been conducted on developing modified crops with new characteristics including tolerance to environmental stress (such as drought, salinity and high acidity), tolerance to emerging pests and diseases, improving the quality of crop content (nutrition, vitamin, protein). By adopting the properties desired, the plants produced by genetic engineering become more environmentally friendly, and are able to increase income for farmers. A short review about the regulation of genetically modified organisms in Indonesia will also be described and finally I will report on some being made to produce environmentally friendly crop farming by utilizing a potential microbe to repair damaged land, to replacethe synthetic fertilizer, to develop crop production in marginal land and to enhance the productivity of crop food.

Participants

Key words : food crop production, environmental damage, climate change, genetic modified crop, regulation, environmental friendly farming, potential microbe

Curriculum Vitae

Education:

- Graduated from Bogor Agriculture University, IPB Faculty of Agriculture Technology (1979-1983)
- MSc. (Aufbaustudium) Georg August University Gottingen (West Germany) (1986-1989)
- Dr. (Magna Cum Laude) from Georg August University Gottingen (Germany) (1989-1992)
- Cooperative Program at Kyoto University, Japan (40- 60 days 1994, 1996, 1998, 1999, 2000) (1994-2000)
- National Resilience Institute Course, KRA XXXIV (2001)
- Leadership training. Diklatpim II LAN (2007)

Scientific Biography:

- Research Scholarship, Forest Product Research Centre, Bogor (1982-1983)
- Research staff at Wood Research Centre, National Physics Institute, Bandung (1984-1986)
- Research Scholarship, Wood Research Institute (WKI), Fraunhofer Institute Braunschweig, Germany (1989-1991)
- Research Scholarship, Agricultural Research Institute (FAL) Braunschweig, Germany (1991-1992)
- Assistant Research Scientist, R & D Centre for Applied Physics (LIPI), PUSPIPTEK Serpong (1993)
- Associate Adjunct Research Scientist, R & D Centre for Applied Physics (LIPI), PUSPIPTEK Serpong (1994)
- Research Scientist, R & D Centre for Applied Physics (LIPI), PUSPIPTEK Serpong (1996)
- Associate Senior Research Scientist, R & D Centre for Applied Physics (LIPI), PUSPIPTEK Serpong (1997)
- Senior Research Scientist (APU) R & D Centre for Applied Physics (LIPI), PUSPIPTEK Serpong (1999)
- Senior Research Scientist (APU) on biopolymer and biomass conversion R & D Unit for Biomaterial (LIPI), Cibinong Science Center, Cibinong, Bogor (2001)

- Deputy Assistant for Assessment of Research, Science, Technology and Economic, The Ministry of Research and Technology – RI (2002-2005)
- Research Professor on bioprocess engineering (2005)
- Director of Research Center for Biotechnology Indonesian Institute of Science (LIPI) (2005-present)

Membership of Scientific Organisations

- Member of FAO Global Network on selective delignification Since 1993
- Member of Indonesian Polymer Society, Since 1995
- Member of Indonesian Chemistry Society, Since 1994
- Vice President of Indonesian Bamboo Researcher Society, Since 1995-1999
- Head of Technology Division, Indonesian Bamboo Society. 1996-2000
- Vice President of Indonesian Wood Research Society (IWoRS), 1997-2001
- Head of Selection Panels (Materials Science) of Integrated Competitive Research (RUT)-MORT Since 2001-2005
- Member of National Team for Restructuring Government Company, BUMN 2003-2004
- Member of National Selection Board, MoRT (2006-2008)
- Member of GCG under Commissaries Board of PT Dirgantara Indonesia
- Director of Assessment of Technology, Center of Strategic Studies for National Interest (Paskal8), Since 2001-2004
- Director of Center for Transfer of Technology and Information since 2004
- Director of Institute of S, T Research Services LaRIPTEK, Since 2005
- President of Indonesian Biotechnology Consortium (Konsorsium Bioteknologi Indonesia),Since 2006
- President of Indonesian Bioprocess Engineering Society, Since 2006
- Member of Steering Committee of Agro technopark-RISTEK 20056-2008
- Vice Division of Food Security, Indonesian Engineering Association, Since 2006
- Focal Point of Multilateral Cooperation on Biotechnology, ASEAN since 2007 (involving Asean European Union, ASEAN China, ASEAN India, ASEAN Canada, ASEAN Russia)
- Focal Point of Bilateral Cooperation Indonesia Germany on Biotechnology 2006-2008
- Focal point of Bilateral Cooperation Korea Indonesia on Bioprocess Engineering
- Focal point of Bilateral Cooperation Iran Indonesia on Biotechnology since 2007

Mr Geoff Beecher

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Abstract

Strategies and tactics to improve the water productivity of rice based systems in SE Australia – managing spatial variability of rice growth and yield.

Australian rice production is highly dependent on irrigation water.

Current extended drought conditions and the prospect of reduced water availability due to climate change emphasise the need to maximise crop production from available water.

Water productivity (grain mass per volume water (t/ML)) can be improved by:

• increasing rice yield –_by breeding more adapted high yielding varieties and improved fertiliser, water and weed management

• or decreasing water use – by improving rice land suitability assessment or water management – delayed permanent water, shorter duration varieties.

Modifying rice based cropping systems and crop sequences could improve water productivity on a system basis.

Current Australian rice research and approaches will be presented in relation to improving water productivity, and thus food security.

These include:

increasing yields through breeding for cold tolerance; precision agriculture; improved crop establishment; and reducing water requirements by moving from continuous permanent water to delayed permanent water or aerobic systems.

Biography

Geoff Beecher joined NSW Agriculture (now Industry & Investment NSW) as a research agronomist in 1987 after 9 years working with NSW Water Resources Commission in the area of soil and water research. He has 31 years experience in irrigated rice based cropping systems, salinity, groundwater and land management issues. He is considered a specialist in irrigated soils, salinity, rice-based cropping systems and has made a significant

contribution to extending best management practices and benchmarking of irrigated cropping systems in NSW.

His research on rice land assessment using EM technology has resulted in this technology being adopted commercially throughout the Australian rice industry. This has made a significant contribution to reducing groundwater accessions, thereby improving the sustainability and water productivity of rice production in the Riverina.

Geoff has been significantly involved in Land and Water Management Plans in irrigated regions of NSW and has undertaken several research projects addressing the use of raised-bed farming systems in irrigated farming..

Geoff has been invited to make presentations at international rice conferences and meetings in Guyana, Malaysia, Uruguay and the FAO Vienna, Austria and has participated in an ACIAR project in conjunction with Punjab Agricultural University Ludhianna, India.

He currently has projects exploring the management of in-field spatial variability of rice crop growth and yield in Australia, and leads an ACIAR project on rice establishment and productivity in Cambodia and Australia. His current research investigates the in-field spatially variability of rice growth and yield with potential to increase the water productivity of rice on an industry wide basis

Professor Bob Lawn

James Cook University

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Abstract

Soybean improvement in the tropics & subtropics

Soybean is a major source of vegetable oil for human consumption and industrial uses and of protein for humans and livestock. Soybean is also useful in cropping rotations because of its ability to fix nitrogen. In Australia, production and yields are variable due to weather and prices and we remain a net importer. Because most varieties are quantitative, short-day plants, with large differences in response to photoperiod and temperature, they often have narrow adaptation across regions and seasons. The long-juvenile (LJ) trait has allowed development of varieties with broader adaptation. The LJ trait has also helped 'convert' temperate semi-dwarf and culinary varieties to subtropical/tropical adaptation. Collaborative studies in Thailand and Vietnam show the LJ trait is also useful for raising yield potential in short duration varieties in intensive rotation systems. Generally, soybean is more drought-sensitive than the other tropical grain legumes. Limited progress has been made in breeding truly drought-tolerant varieties, apart from better matching of maturity to available water. Traits that enhance leaf area maintenance may improve recovery after stress and so may improve drought-resistance in rain-fed crops exposed to intermittent stress. In contrast to other grain legumes, soybeans are generally tolerant of saturated soil conditions, to the extent that rice-soybean intercrops are possible where the watertable can be reliably controlled.

Biography

Bob Lawn is Professor of Tropical Crop Science at James Cook University, and Honorary Fellow with CSIRO Plant Industry, in Townsville, north Queensland. He has 45 years experience in tropical crop improvement and sustainable tropical agriculture, and has published > 260 scientific articles on these topics. Prior to his current role, he was Director of the CRC for Sustainable Sugar Production 1994-2003 and before that, led the CSIRO

Tropical Crops Program. Bob's main research focus has been the physiological basis of genotype x environment interaction in crop plants and the implications for agronomy and breeding. His main crops of interest are the tropical grain legumes (soybeans, mungbeans, black gram, pigeonpea, cowpea) and sugarcane and his primary environmental focus has been climate (photoperiod, temperature, water, radiation). He has worked on many projects for various national and international agencies in south-east Asia, including Jawa, Sulawesi Selatan, Sumatera Selatan and Nusa Tenggara Timur in Indonesia.

Dr Arief Indrasumunar

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Abstract

Molecular genetics and functional genomics of soybean (Glycine max L.) nodulation and nitrogen fixation

Soybean (Glycine max L.) is a high value crop grown worldwide as food and animal feed. Through a symbiotic interaction with soil bacteria (Bradyrhizobium japonicum), it develops nitrogen fixing nodules, a process closely controlled by plant genetic systems. This symbiosis is of agronomic importance, environmental friendly, and reduces the need for nitrogen fertilizer. The establishment of the symbiosis involves a complex interplay between host plant and bacterial symbiont, resulting in the formation of a novel organ, the nodule, which the bacteria colonise as intracellular symbionts. Here we present recent discoveries relating to how this symbiosis is established and regulated. Several genes which act at early stages of nodulation process, and genes which control nodule number have been cloned, characterised and analysed in transgenic roots. The potential for increasing nodulation and nitrogen fixation of soybean in stressed environment by modifying the expression of these genes will also be discussed.

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Gresshoff, P.M., Ferguson, B.J., Indrasumunar, A. and Jiang, Q. (2009) Modern genetics and biotechnology of soybean nitrogen fixa¬tion and nodulation. Chinese Journal of Nature 31: 320-326.

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Biography

Arief Indrasumunar was born in Pacitan, Jawa Timur, Indonesia in 17th of January 1964. He got his Bachelor degree in 1990 from Agriculture Faculty, Gadjah Mada University, Yogyakarta, Indonesia. He works at Indonesian Centre for Agricultural Biotechnology and Genetic Resources Research and Development Bogor since 1990. He continued his study at the University of Queensland and got his Master of Agricultural Science in 1999. In 2003 he had another AusAID scholarship to continue his study at the same university and got his PhD in 2007. In 2009 he started his postdoctoral research fellow at ARC centre of Excellence for Integrative Legume Research, the University of Queensland, Australia. His current research topic is molecular genetics of symbiotic nitrogen fixation of soybean.