2014 International Award for Young Agricultural Researchers

Enhancing Resilience to Agricultural Flood-Risks and Adaptation for Smallholder Farmers in Asia and Africa

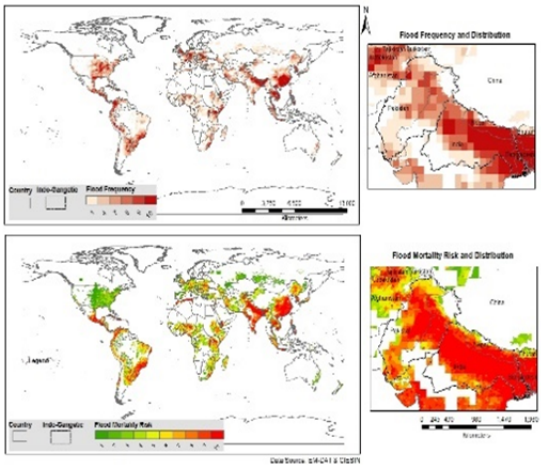
Dr. Giriraj AMARNATH
Researcher
International Water Management Institute（IWMI）

Reason for the Award

Flood risk management is highly important for sustainable agricultural and rural development, local food security, and poverty reduction. Dr. Giriraj AMARNATH's active efforts toward this research and development, together with the resulting world-class research findings aimed at solving real problems faced by those in the field, are highly commendable. Further research is expected that promotes concrete application of the research results to society to mitigate regional risks such as flood and drought, as well as the impacts of climate change.

Outline of Research Achievements

Dr. Amarnath's main research harnesses the potential use of satellite data to spatially and temporally characterize inundation patterns in order to formulate risk reduction and adaptation measures. For rapid emergency response, the Flood Mapping and Analysis Tool was developed to rapidly detect flood extent, and the tools were made freely-available to users. A global flood risk "hotspot" analysis was carried out to identify where the risks of natural disasters are particularly high to inform priorities for reducing disaster risk and making decisions on development investment. As a co-PI, he was involved in an innovative project that supports smallholders in Africa by providing climate, weather, and operational flood information to empower farmers to make informed decisions and better manage their land and water resources. The first of its kind in the region, the Smart-ICT system was implemented to allow sharing of operational flood information to farmers in advancing climate-smart agriculture. He is currently undertaking two major initiatives on the South Asia Drought Monitoring System in a holistic approach to address the implications of drought on agricultural production and advance the development of index-based flood insurance to support households that are severely affected by flooding in South Asia.



Main Publications:

(1) **Amarnath G.** (2014). An algorithm for rapid flood inundation mapping from optical data using a reflectance differencing technique. J Flood Risk Manag. 7:239-250
(2) **Amarnath G.** (2014) Monitoring of Floods and Droughts using Earth Observation Data. Geospatial Today (June) 15-19.
(3) **Giriraj Amarnath**; Ameer M; Aggarwal P., Smakhtin V (2012). Detecting spatio-temporal changes in the extent of seasonal and annual flooding in South Asia using multi-resolution satellite data. International Society for Optics and Photonics (SPIE). 11p.

2014 International Award for Young Agricultural Researchers

Allelopathy and Allelochemicals in Vietnam Local Cucumber Variety and Vietnamese Rice Cultivars

Dr. HO Le Thi
Vice Head of Farming System Division
Cuu Long Delta Rice Research Institute
Vietnam Academy of Agricultural Sciences (Vietnam)

Reason for the Award

Dr. HO Le Thi's identification of effective repellents with strong weed-suppression capability by focusing on ordinary and widely available cucumber and rice plants in Vietnam is highly commendable. The research is expected to make huge contributions to sustainable and stable food production in the region through increased application of the results in the paddy field.

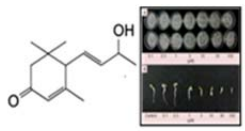
Outline of Research Achievements

Allelochemicals produced by certain crop and rice cultivars have potential to biologically control barnyardgrass (*Echinochloa crus-galli* L.), a major rice yield-limiting factor. Three growth inhibitory compounds were isolated and identified from a Vietnam local cucumber variety (*Cucumis sativus* L. cv. Phung Tuong). 3-Oxo-α-ionol (3-OI) was first found as an allelochemical in cucumber plants, (S)-2-benzoyloxy-3-phenyl-1-propanol (SBPP) was first reported to have growth-inhibiting activity, and (6S,7E,9S)-6,9,10-trihydroxy-4,7-megastigmadien-3-one (TMO) was first identified to be an important potential allelochemical. The average ED50 (concentration required for 50% inhibition) of 3-OI, SBPP and TMO on test plant species (including barnyard grass) root and hypocotyl elongation were 99.3 and 38.4 µM, respectively. The endogenous contents of 3-oxo-α-ionol, (S)-2-benzoyloxy-3-phenyl-1-propanol, and (6S,7E,9S)-6,9,10-trihydroxy-4,7-megastigmadien-3-one in 1.0 kg fresh cucumber plants were 0.35, 2.5 and 5.1 mg, respectively. N-trans-cinnamoyltyramine (NTCT) was identified for the first time as an allelochemical produced by Oryza sativa L.cv. OM 5930 rice plants. The ED50 of NTCT on barnyard grass root and hypocotyl elongation were 1.35 and 1.85 µM, respectively. The endogenous content of NTCT in 1.0 kg fresh rice plants was 42 mg, this production of NTCT in intact rice plants can be considered high.

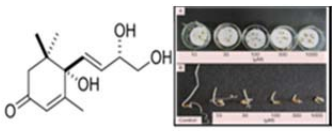
These findings suggest that developing plants of cucumber variety Phung Tuong and rice cultivar OM 5930 release such allelochemicals and may be utilized to biologically control weeds in rice fields.

Cumcumber (*Cucumis sativus* L. cv. Phung Tuong)

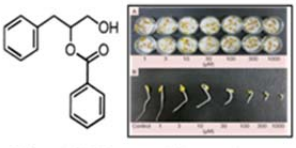
Rice (*Oryza sativa* L.cv. OM 5930)



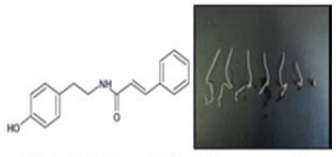
Effect of 3-OI on *Lactuca sativa*



Effect of TMO on *Echinochloa crus-galli*



Effect od SBPP on *Lepidium sativum*



Effect of NTCT on *Echinochloa crus-galli*

Main Publications:

(1) **Ho Le Thi**, Chung-Ho Lin, Nathan D. Leigh, Wei G. Wycoff, Reid J. Smeda and Felix B. Fritschi. 2014. Isolation and Identification of a Novel Allelochemical in Rice. Phytochemistry. (In press). DOI: 10.1016/j.phytochem.2014.08.019.

(2) Hisashi Kato-Noguchi, **Ho Le Thi**, Hiroaki Sasaki and Suenaga Kiyotake (2012). A potent allelopathic substance in cucumber plants and allelopathy of cucumber. Acta Physiologiae Plantarum.

(3) **Ho Le Thi**, Teruya Toshiaki, Suenaga Kiyotake, Duong Van Chin and Hisashi Kato-Noguchi (2008). Allelopathy and the allelopathic activity of a phenylpropanol from cucumber plants. Plant Growth Regulation. 56 (1): 1-5.

2014 International Award for Young Agricultural Researchers

Analysis of Plant Growth Regulation under Abiotic Stress Conditions

Dr. Asad JAN
Associate Professor
Institute of Biotechnology and Genetic Engineering
The University of Agriculture, Peshawar (Pakistan)

Reason for the Award

Dr. Asad JAN's isolation and analysis of highly promising genes and promoters that can improve the tolerance of rice plants to abiotic stresses such as drought, together with research by the recipient using these findings to develop new cultivars, are highly commendable. Future application of the results to marginal land is expected to help eliminate poverty and enhance food security around the world.

Outline of Research Achievements

Plants are constantly challenged by a variety of biotic (pathogens, insect attacks, etc.) and abiotic (high and low temperature, drought and salinity) stresses. Progress has been made in understanding the molecular basis of the adaptive responses and identification of key pathways involved in different abiotic stresses. This has led to the utilization of more effective ways to improve plant abiotic stress tolerance/hardiness.

Dr. Jan actively pursued research on the mechanism and tailoring of abiotic stress tolerance in plants. His research was on the characterization of CCCH-Zinc Finger Protein genes and isolation of stress inducible promoters in rice. He characterized a gene designated as OsTZF1 which is involved in conferring multiple stress tolerance in rice (Jan et al., 2013). The transgenic plants over-expressing OsTZF1 gene exhibited delayed senescence and tolerance to multiple stresses, for example salt stress in Figure 1. The protein of OsTZF1 gene could bind the 3' untranslated regions of target RNAs (Figure 2). It was suggested that OsTZF1 gene confers abiotic stress tolerance in plants by regulating the turnover of the mRNA of target genes involved in abiotic stress. The expression of OsTZF1 with suitable stress inducible promoter will enhance its usefulness for abiotic stress tolerance to multiple stresses with minimal effects on plant growth (Nakashima et al., 2014). Dr. Jan also isolated and characterized another gene which confers abiotic stress tolerance and minimizes the penalty of abiotic stress on plants. Currently, the transgenic plants for unmentioned gene which is involved in an increase in panicle and seed number under drought conditions are under extensive investigation in the fields.

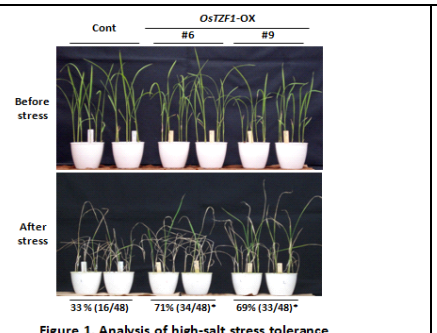


Figure 1. Analysis of high-salt stress tolerance in control, *OsTZF1*-OX plants.

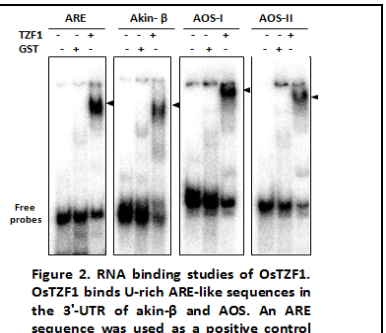


Figure 2. RNA binding studies of OsTZF1. OsTZF1 binds U-rich ARE-like sequences in the 3'-UTR of akin-β and AOS. An ARE sequence was used as a positive control (left).

Main Publications:

(1) Kazuo Nakashima, **Asad Jan**, Daisuke Todaka, Kyonoshin Maruyama, Shingo Goto, Kazuo Shinozaki, Kazuko Yamaguchi-Shinozaki (2014). Comparative functional analysis of six drought-responsive promoters in transgenic rice. Planta, 239:47-60. (KN, DT, KM, SG, KYS, JIRCAS, Japan)

(2) **Asad Jan**, Kyonoshin Maruyama, Daisuke Todaka, Satoshi Kidokoro, Mitsuru Abo, Etsuro Yoshimura, Kazuo Shinozaki, Kazuo Nakashima and Kazuko Yamaguchi-Shinozaki (2013). OsTZF1, a CCCH-tandem zinc finger protein gene, confers delayed senescence and stress tolerance in rice by regulating stress-related genes. Plant Physiology, 161: 1203-1206. (KM, DT, SK, KN, KYS, JIRCAS, Japan)

(3) **Asad Jan**, Guangxiao Yang, Hidemitsu Nakamura, Hiroaki Ichikawa, Hidemi Kitano, Makoto Matsuoka, Hiroshi Matsumoto and Setsuko Komatsu (2004). Characterization of a xyloglucan endotransglucosylase gene that is up regulated by gibberellin in rice. Plant Physiology, 136: 3670-3681. (GY, HN, HI, SK, NIAS, Japan)