2017 International Award for Young Agricultural Researchers (Japan Award)

Plant-pathogen system biology and biotechnological approaches for plant disease management

Dr. Chandra Siddaiah NAYAKA
Principal Scientist
University of Mysore

Reason for the Award

This research has been evaluated to be of high quality as it yielded excellent results in a wide range of related fields, including basic research to determine the genome sequence of the causal fungus of downy mildew in gramineous plants, development of biological agrochemicals to control downy mildew infection in pearl millet, and development of a detection technology for identifying *Fusarium* spp. and its fungal poisons. It is expected that this project will contribute to developing a new variety of pearl millet resistant to downy mildew and disseminating the detection technology to society.

Outline of Research Achievements

Dr. Nayaka has worked as Seed Health Scientist in the prestigious Asian Seed Health Centre at the University of Mysore in India. He successfully developed novel molecular probes for the rapid and accurate detection of seed-borne pathogens (SBPs) (patent filed). More than 1000 partial genome sequences for SBPs from Asian region have been deposited in NCBI, DDBJ, and EMBL, and the phylogenetic diversity have been studied. Monoclonal antibody and lateral flow based assays were developed for rapid detection of mycotoxins from agricultural/food & feed samples (patent filed).

He currently works as Principal Scientist and Principal Investigator at the Department of Studies in Biotechnology, University of Mysore under the Indian Council of Agricultural Research (ICAR), and he is responsible for the research work titled **"Genome-wide analysis of *Sclerospora graminicola* and *Magnoporthe grisea*, the causal agent of downy mildew and blast disease of pearl millet, respectively, and characterization of effector candidates." Furthermore, his research group has, for the first time, sequenced the full length genome of a highly virulent strain of biotrophic *S. graminicola*.** This will help toward elucidating the evolutionary pattern and the *in-silico* prediction and annotation of the gene space and promoters of *S. graminicola*, with the aim of studying pathogenicity-related genes, secondary metabolism, hormone production, and evolution of RxLR–dEER crinklers and RxLR-like effectors and their canonical motif. This in turn will help in understanding the host-pathogen interaction and defense system in host plants, and be used in assisting breeding efforts for durable host resistance.

Main Publications:

(1) **Chandra Nayaka S**, H. Shekar Shetty, C. Tara Satyavathi, Rattan S. Yadav, P. B. Kavi Kishor, M. Nagaraju, T. A. Anoop, M. Milner Kumar, Boney Kuriakose, Navajeet Chakravartty, A.V.S.K. Mohan Katta, V.B. Reddy Lachagari, Om Vir Singh, Pranav Pankaj Sahu, Swati Puranik, Pankaj Kaushal, Rakesh K. Srivastava. 2017. Draft genome sequence of *Sclerospora graminicola*, the pearl millet downy mildew pathogen. Biotechnology Reports http://dx.doi.org/10.1016/j.btre.2017.07.006

(2) **Chandra Nayaka S**, Niranjan Raj S, Venkataramana M, Vijai Kumar G, Gurunathan S, Shobith R, Shekar Shetty H and Rakesh Kumar S. 2017. Elicitation of resistance and associated defense responses in *Trichoderma hamatum* induced protection against pearl millet downy mildew pathogen. Scientific Reports| 7:43991 | DOI: 10.1038/srep43991

(3) **Chandra Nayaka, S,** A.C. Udaya Shankar, Niranjana SR, Reddy MS, Prakash, HS. and CN. Mortensen. 2008. Control of *Fusarium verticilliodies* causing ear rot of maize by *Pseudomonas fluorescens*. Pest Management Science 65; 769-775

2017 International Award for Young Agricultural Researchers (Japan Award)

Dairy researches on production performances and health of dairy cows, livelihoods of local farmers and environmental concerns

Dr. Min AUNG
Assistant Lecturer
University of Veterinary Science (Myanmar)

Reason for the Award

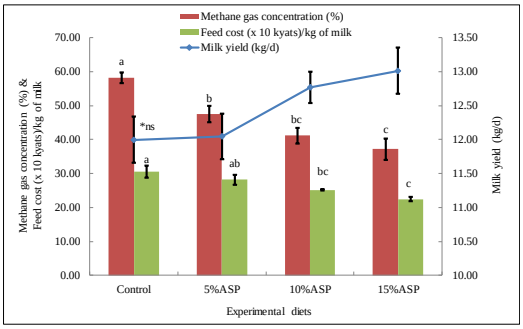
This research was evaluated to be of high quality owing to its practical merit, i.e., it aims to reduce the cost of livestock feed and improve the productivity of dairy cows through utilizing a local resource, *Albizia saman* pods, as basal feed and yeast cell wall as supplementary feed. The research was also highly appreciated for its environmental consideration because the use of *Albizia saman* could reduce methane emission from enteric fermentation.

Outline of Research Achievements

Albizia saman pods (ASP), abundantly available in Myanmar, were used as a replacement for commercial concentrate (up to 15%), and its effect on methane production, feed intake, milk yield and feed cost effectiveness of lactating dairy cows were studied. As a result, decreased methane production from feed fermentation and increased feed intake and milk yield were achieved. Moreover, feed cost was also reduced by 81 kyats (¥8) per kg of milk.

According to the result of a survey concerning dairy production systems and local feed resources in central Myanmar, 18 months of calving interval, 11.5 kg of milk/cow/day, less artificial insemination practice (23%), and abortion cases (7%) were observed. The agricultural by-products and crop residues, which have notable nutritive and feeding values, were commonly used as basal feeds for dairy cows. Thus, the returns from dairy farming could be maximized with the proper combination of factors in the agriculture sector; however, improving the current practice of artificial insemination is required to maximize the production of dairy cows in central Myanmar.

The dietary supplementation of yeast cell wall (YCW) increased milk and milk component yields and feed efficiency of early lactating dairy cows. The somatic cell count was reduced by 50%, thereby improving udder health. Moreover, it had a positive effect on energy metabolism and nutrient utilization. For the immune function of dairy cows, T cell receptors, cytotoxic T cells, and cytokines such as IL8, CCL2, CCL3 and CCR2 were increased. Thus, YCW supplementation activated the function of monocytes and macrophages, thereby enhancing phagocytosis activity.



Main Publications:

(1) **Min Aung**, Yin Yin Kyawt, Moe Thidar Htun, Khin San Mu and Aung Aung (2016) Effect of inclusion of *Albizia saman* pods in the diet on the performances of dairy cattle. American Journal of Animal and Veterinary Science 11 (1): 41-46.

(2) **Min Aung**, Myo Khaing, Tin Ngwe, Khin San Mu, Moe Thidar Htun, Lwin Naing Oo and Aung Aung (2015) Preliminary survey on the dairy cattle production system and conventional feed resources in the central dry zone of Myanmar. Global Journal of Animal Scientific Research 3(2): 383-387.

(3) **Min Aung**, Tin Ngwe, Aung Aung, Khin Hnin Swe, Moe Thidar Htun, Lwin Naing Oo and Mar Mar Kyi (2013) *In vitro* gas production and its prediction on dry matter and organic matter digestibility and methane production of *Albizia saman* pods partially replaced in commercial concentrates. Myanmar Veterinary Journal 15:69-77.

2017 International Award for Young Agricultural Researchers (Japan Award)

Development of innovative approaches to enable small-holder farmers of South Asia to achieve gains in productivity and profitability through use of cutting edge Information & Communication Technologies to guide application of site-specific nutrient and crop management options

Dr. Sheetal SHARMA
Scientist
International Rice Research Institute (IRRI)

Reason for the Award

The awardee's research aims to improve *Crop Manager*, the crop management software developed by the International Rice Research Institute (IRRI), in accordance with regional conditions in India, and conduct demonstration experiments based on the software and disseminate its results. The research was evaluated to be of high quality, particularly because it established collaborative partnerships with local research institutes and private organizations and greatly promoted the dissemination of research results to society. In addition, this crop management software was improved so it could be used by female farmers and hence aid in their decision-making process.

Outline of Research Achievements

In South Asia, traditional blanket recommendations for soil fertility management do not consider the huge variability among fields of smallholder farmers in terms of soil type, farm management, and other aspects. Future gains in productivity and input use efficiency will therefore require soil and crop management technologies that are more knowledge-intensive and tailored to the specific characteristics of individual farms and fields. Sheetal Sharma and her team worked to translate and transfer the science of site-specific nutrient management and tools developed at IRRI HQ to developing countries through innovative approaches to reap the benefits at a large scale. She played a central role in conceptualizing and designing the Crop Manager for India, an ICT tool that provides nutrient recommendations to farmers. She also collected the desired data through strategic and adapted research, and the tools were further developed and evaluated by establishing strategic partnerships.

These concentrated efforts resulted in the development of two versions of *Crop Manager for India*. Documented evidence demonstrates that *Crop Manager* for Odisha improved rice productivity by 0.5-0.8 t/ha and increased net added benefit by USD104-155/ha per season over farmers' practice. Likewise, *Crop Manager* for Bihar improved rice and wheat yield by 0.7 and 0.3 t/ha, respectively, and resulted to a net added benefit of USD 147/ha per season in rice and USD 63/ha per season in wheat over farmers' practice. *Crop Manager for India* is the result of a joint effort between IRRI and national partners under the National Mission for Sustainable Agriculture by the Department of Agriculture, Cooperation & Farmers Welfare, Ministry of Agriculture & Farmers Welfare. Forging partnerships and enhancing the capacity of various stakeholders have provided more than 30,000 farmers with *Crop Manager* recommendations. Furthermore, Sharma and her team aim to bring the benefits of *Crop Manager* to about 1 million small-scale farmers by the end of 2020.

Main Publications:

(1) Singh, S.P., Jain, A., Anantha, M.S., Tripathi, S., Sharma, S., Kumar, S., Prasad, A., Sharma, B. Karmakar, B., Bhattarai, R., Das, S. P., Singh, S. K., Shenoy, V., Babu, R. C., Robin, S., Swain, P., Dwivedi, J. L., Yadaw, R. B., Mandal, N. P., Ram, T., Mishra, K. K., Verulkar, S. B., Aditya, T., Prasad, K., Perraju, P., Mahato, R. K., **Sharma, S.**, Raman, K. A., Henry, A. (2017) Depth of soil compaction predominantly affects rice yield reduction by reproductive-stage drought at varietal screening sites in Bangladesh, India and Nepal. Plant Soil 417: 377-392.

(2) Ladha, J. K., Rao, A. N., Raman, A. K., Padre, A. T., Dobermann, A., Gathala, M., Kumar, V., Saharawat, Y., **Sharma, S.**, Piepho, H. P., Alam, M. M., Liak, R., Rajendran, R., Reddy, C. K., Parsad, R., Sharma, P. C., Singh, S. S., Saha, A. and Noor, S. (2016) Agronomic improvements can make future cereal systems in South Asia far more productive and result in a lower environmental footprint. Glob Change Biol 22: 1054-1074.

(3) **Sharma S**, Rajendran R, Ravi V, Panneerselvan P, Janarthanan P, et al. (2016) Improving Resource Use Efficiency of Cereal Based Cropping Systems with Integration of Best Management with Conservation Agriculture Under Changing Agricultural Scenarios in Cauvery Delta of Tamil Nadu. J Ecosys Ecograph 6: 213.