Evation

Proceeding & Work Book of

AGRI Vision 2020

January 27-28, 2020 | Bhubaneswar, Odisha-India

International Conference on Agriculture

Sponsors & Supporters

Skill India
कौशल भारत - कुशल भारत

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

IFFCO

NABARD

एन एस सी
NSC

राष्ट्रीय चावल अनुसंधान संस्थान
NRRI
Estd.1946

www.evationbusiness.com

National Bank for Agriculture and Rural Development

NABARD

Our Mission: Promotion of sustainable and equitable agriculture and rural prosperity through effective credit support, related services, institution development and other innovative initiatives.

- Research and Development on matters of importance pertaining to agriculture, agricultural operations and rural development including the provision of training and research facilities.
- Consultancy services related to Agriculture & Rural Development through subsidiary (NABCONS).

Our Functions:

- Provide Credit/Refinance for production credit and investment credit to eligible banks and financing institutions.
- Development functions undertaken through Farm Sector Promotion Fund (FSPF), Financial Inclusion Fund (FIF), Watershed Development Fund (WDF), Tribal Development Fund (TDF), Rural Infrastructure Development Fund (RIDF), etc.
- Supervisory functions in respect of Cooperative Banks and Regional Rural Banks.

Head Office Plot C-24, 'G' Block Bandra Kurla Complex, Bandra (East) Mumbai - 400 051

भाकृअनुप - राष्ट्रीय चावल अनुसंधान संस्थान, कटक -७५३००६, ओडशिा
ICAR-National Rice Research Institute, Cuttack 753006, Odisha
(An ISO 9001:2015 Certified Institute)

Message

It gives me immense pleasure to know that Evation Business Solutions Pvt. Ltd, Cuttack, Odisha is bringing out its Conference Booklet of Agri Vision,2020.

I hope the Booklet reflecting the achievements and aspirations of business solutions to the clients and will be useful for the farming community.

On the behalf of ICAR-National Rice Research Institute, Cuttack, I congratulate the team and wish the programme a grand success.

H. Pathak
Director, ICAR-NRRI
Cuttack

Phones: 91-671-2367757 (Off.); +9437579257 (Cell); Fax: 91-671-2367663
E-mail: director.nrri@icar.gov.in ? crrictc@nic.in ? URL: http://www.icar-nrri.in

Sponsors & Supporters

N·S·D·C
National
Skill Development
Corporation

IFFCO

राष्ट्रीय चावल अनुसंधान संस्थान
NRRI
Estd. 1946

NABARD

एन एस सी
NSC

RCF

KRIBHCO

Coromandel
FUTURE POSITIVE

INSTITUTE OF LIFE SCIENCES

Including Media Partners &
other institutes who supported us
for this Agri Vision- 2020 Conference
in tearms of Venue & Speakers

Day-1 | Jan 27, 2020

Keynote Lecture


AGRI Vision 2020

Trichoderma in good agriculture practices for enhancing farmers' income

Arup K Mukherjee
ICAR-National Rice Research Institute, Cuttack, Odisha, India
Email: *arupmukherjee@yahoo.com, titirtua@gmail.com*

Abstract:

The major constraint of rice production is the incidence of different diseases causing serious yield loss. To combat these diseases huge amount of chemical pesticides are dumped as a result the cost of production is increased and environment is polluted seriously. Recently special focus is being given in organic practices for management of diseases of crops. But in rice the organic way of cultivation is very rare. So, in different research institutes and universities special focus is being given to find out different biofertilizers and biocontrol agents (BCA) to replace chemical fertilizers and pesticides. In a recent study we have identified different species of Trichoderma having different unique characters which are beneficial to the farmers. One such is T. erinaceum which not only protects paddy plants from soil and seed borne diseases but also enhances its growth and ultimately resulting in higher yield. We have tested this BCA in paddy and black gram in different farmers fields and experienced excellent plant health and more than 20% higher yield. While studying the mechanism we observed that the plants which are treated with T. erinaceum results in better germination, seedling vigour, more numbers of tillers, higher 1000 grain weight and filled grains besides higher expression of different defence enzymes. We feel this BCA will eb an excellent candidate for enhancement of farmers income in a sustainable way. Further study is going on to use genomics approaches to understand the mechanism of growth promotion and biocidal activity of this BCA.

Biography:

Dr. Arup is a Principal Scientist, Molecular Plant Pathology at ICAR-National Rice Research Institute, Cuttack, Odisha. He completed his graduation and post-graduation from the Visva Bharati University and then joined as SRF at CRRI, Cuttack with ICAR SRF ship. During his PhD. work he studied different components of slow blasting resistance in rice. He has developed different techniques to estimate the host tissue damaged during the host pathogen interaction. He has developed a technique to estimate accurately the lesion area of rice blast disease. He Has been selected as a Member of Asian Council for Science Editor till 2018. He Received Distinguished Achievement Award -2015 for innovative research at the frontiers of plant pathology and for exceptional potential to shape the future through intellectual and inspired leadership in Plant Biotechnology awarded by Association for the Advancement of Biodiversity Science, 2015.


AGRI Vision 2020

Day-1 | Jan 27, 2020

Oral Presentation


AGRI Vision 2020

Rice- Fish- Live Stock-Horticulture and Agroforestry based Integrated Farming System: A viable option for farm sustainability and doubling of farm income in Eastern India

P. K. Nayak, B. B. Panda, Anjani Kumar, B. S. Satpathy, A. K. Nayak and H. Pathak
ICAR-National Rice Research Institute, Cuttack, Odisha, India
Email: *nayakpra@yahoo.com*

Abstract:

Doubling farmers income by 2022 is a goal and target set by the Hon'ble Prime Minister of India is a challenging and daunting task within the time frame. The economic think-tank at Niti Aayog has put forth four- point action plans to double the incomes of India's farmers i.e. provisioning of remunerative prices, increasing productivity, reforming agriculture policy and provisioning of adequate relief measures. Experts engaged in searching the options recommended integrated farming system (IFS) approach adoption is considered one of the potential farming for enhancing the productivity and income of small and marginal farmers within a reasonable time frame. IFS has becoming more important in the eve of declining natural resources, increasing water scarcity, climate change and increasing energy costs while provisioning for protecting environment. Targeting higher production through intensive cultivation without adequate replenishments of nutrients threatening the very cause of sustainability of agricultural production systems. Therefore, integration of rice -fish-livestock-horticultural and agroforestry system and allied enterprises can contribute towards sustainability, enhancing productivity and possibly, doubling the farm income.

Biography:

Dr. P.K. Nayak obtained his Ph.D.from Banaras Hindu University, Varanasi in 1986, and presently working as Principal scientist at ICAR- National Rice Research Institute, Cuttack since 2006. Dr. Nayak earlier worked at ICAR Research complex for NEH region, Barapani and ICAR- Central Freshwater Aquaculture, Bhubaneswar in various capacities as a scientist and Senior Scientist since 1986. He has published 52 research paper in peer reviewed journals of national and international repute. He is recipientof Jawaharlal Nehru award for outstanding post graduate Agriculture research and attended training at SEAFDEC, Philippines under Japan International Cooperation Agency (JICA) fellowship during 1998. His research interest includes critical analysis and mechanism of sustainability and rice based integrated farming system.

Association of physical and physiological trait with seed vigour in rice

P Sanghamitra*, TB Bagchi, Supriya Priyadarsini, Nabaneeta Basak,Gaurav Kumar
ICAR-National Rice Research Institute, Cuttack, Odisha, India
***Email**: p.sanghamitra1@gmail.com*

Abstract:

Rice is the lifesaving grain for the people of developing and poorest countries which accounts for around 23 percent of global caloric intake.To meet the challenging and eventual food demand, a quantum increase in agricultural productivity is very much essential for which production and distribution of high quality seed is becoming increasingly important. Seed is one of the efficient and economic input for agricultural development and good quality seed alone can contribute up to 25-30% increase in productivity. High seed vigour an important characteristic of seed quality, is necessary for seedling establishment and sustainable crop productivity. Seed vigour is an important characteristic of quality seed which is influenced by many physical and physiological traits in rice. 120 diverse rice genotypes were phenotyped based on 25 physical and physiological traits to identify the traits associated with seed vigour. Wide variations in the physical-physiological traits were observed in the population with highest variability was observed for rate of root growth (77.78%) followed by swelling index of seed (61.83%). Among physical traits, seed vigour index (germination value x seedling length) was found significantly positively correlated with seed breadth, thickness, L/B ratio and thousand seed weight with highest correlation value observed with seed breadth (r2=0.111).Whereas highest correlation of germination index (r2 =0.721) with seed vigour index was observed of all the physiological traits considered. The trait association with seed vigour identified will be useful for selection of trait for improvement of seed vigour and will contribute to increase in productivity in rice.

Biography:

Dr. Priyadarsini Sanghamitra is a Scientist, Economic Botany at Crop Improvement Division, National Rice Research Institute, Cuttack, Odisha. She has completed her Ph.D (Seed Science & Technology) from Indian Agricultural Research Institute, New Delhi, India. She has published 12+ research papers in repute journals, 4 Book chapters, 15+ article in popular magazines with one technical bulletin.

Assessing effects of elevated carbon dioxide and water deficit stress on nitrous oxide emission and soil enzyme activities in tropical rice soil

Anjani Kumar, Soumya Ranjan Padhy, Rasmita Rani Das, Mohammad Shahid, Upendra Kumar, Pradeep Kumar Dash, Dibyendu Chatterjee, Totan Adak, Rahul Tripathi and A K Nayak

ICAR-National Rice Research Institute, Cuttack, Odisha, India,

Email: *anjaniias@gmail.com*

Abstract:

Anticipated rise in atmospheric carbon dioxide concentration and decreasing water availability for rice production are expected to alter rice productivity and environmental quality. We designed a field experiment under open top chambers (OTCs) to examine the influence of elevated CO2 (ECO2) and different water regimes on N mineralization and nitrous oxide (N2O) emission from rice soil. Experimental data revealed that labile N fractions such as microbial biomass-N increased by 31% whereas NH4+ and NO3- concentration decreased by 41 and 33%, respectively under ECO2 over ambient CO2 (ACO2). Rhizospheric denitrifier population was 35% higher whereas, nitrifier population decreased by 38% under ECO2 as compared to ACO2 in well-watered condition. Decrease in denitrifier population under WDS condition for ACO2 and ECO2 was 26 and 18%, respectively as compared to well-watered condition, whereas the decrease in nitrifier population was 29 and 38%, respectively. The ECO2 increased N2O emission and decreased mineralization rate of N in rice soil. Increased N2O emission under ECO2 was due to increased denitrifier and decreased nitrifier population and enhanced activities of extracellular enzymes. This information is of potential value towards identifying precise N management practices for ensuring higher N use efficiency under future drier and high CO2 conditions.

Keywords: *Elevated CO2, Nitrous oxide emission, labile nitrogen pool, Nitrogen mineralization, Water deficit stress*

Biography:

Dr. Anjani Kumar is serving as a Scientist, Soil Science & Microbiology at Crop Production Division, ICAR - Central Rice Research Institute, Cuttack, Odisha. His area of specialization is Soil Science and Agricultural Chemistry, Agronomy, Plant Physiology and Microbiology. He has published 58 research papers, 3 book chapters, 15 popular articles, 28 abstract papers, 4 training manual and authored 1 Book.

Processing and evaluation of most popular value-added products of rice

Supriya Priyadarsani*, P Sanghamitra, Sutapa Sarkar, TB Bagchi, AK Nayak
ICAR-National Rice Research Institute, Cuttack, Odisha, India
Email: *Spriyadarsani23@gmail.com*

Abstract:

Globally rice has established itself as a major energy source for its population. In India, share of energy intake contributed by cereals is about 57% for rural India and 48% for urban India. Besides, the technological advancement and focus on food waste has led to focus on value added products of rice to be consumed as a refreshing food and snacks at any time in the day. In this study, three most commonly value-added products of rice namely popped rice, puffed rice and flaked/flattened rice have been developed from high protein rice variety (CR Dhan 310) from ICAR-NRRI, Cuttack. The physical properties (the average 1000 grain weight, major and minor diameter, volume, surface area, sphericity, aspect ratio, bulk density and porosity etc.) of products have been studied that has huge impact on the design of packaging material. The relationship between mass and dimensions of the value-added products was established using linear, quadratic and power models. A good relationship was established between mass and geometrical dimensions of the products with a high coefficient of determination R2 = 0.95 with a minimum regression standard error, R.S.E for the study. Apart from this, the textural parameters and colour of the products have been explored to meet the consumer acceptance. It was found that the variety gave good popped grains followed by flattened rice however the puffing was not at par. The texture of popped rice was found to be good and the colour values (L*, a* & b*) of popped rice was whiter as compared to the other products. The rice-based value-added products can provide substantial employment to the rural youths and farm women thereby enhancing nutritional and livelihood security of the farm families.

Keywords: High protein rice, physical properties, textural parameters

Real time nitrogen management using leaf colour chart enhanced yield and N use efficiency of rice

Sangita Mohanty*, A.K. Nayak , C.K. Swain, Anjani Kumar, Rahul Tripathi, Md Shahid, H Pathak
ICAR-National Rice Research Institute, Cuttack, Odisha, India
Email: *sangitamoha@gmail.com*

Abstract:

Field experiments were conducted to assess the performance of real time application of neem coated urea (NCU) using a customized leaf color (CLCC) chart in relation to yield and nitrogen use efficiency of direct seeded aerobic (AR) and puddled transplanted (PTR) rice in a split plot design. Six nitrogen management treatments viz-0 N, 100 kg N ha-1 as prilled urea (PU) applied conventionally, 100 kg N ha-1 as neem coated urea (NCU), applied conventionally, 100 kg N ha-1 as PU, applied on the basis of CLCC recommendation, 100 kg N ha-1 as NCU, applied on the basis of CLCC recommendation, 100 kg N ha-1 as PU and farm yard manure (FYM) in 1:1 ratio were assigned to sub plots. As compared to PU, NCU increased yield by 7.1-13.4 % and 6.8-10.0 % respectively, in AR and PTR when both applied conventionally but when it is applied on the basis of CLCC reading the yield enhancement was 21.2-22.9 % and 14.6-15.9 % respectively. Similarly NCU resulted 6.6-8.9 and 6.2-6.5 % higher as compared to PU, which was further increased to 16.3-18.0 and 11.4-14.6 % in AR and PTR respectively when applied following CLCC reading. Application of N on the basis of leaf colour chart reading synchronized N supply with that of crop demand therefore enhanced N uptake and improved N use efficiency and yield.

Key words: Real time N application; leaf colour chart; neem coated urea; aerobic rice; N use efficiency

Biography:

Dr. Sangita work as a senior scientist (Soil Science & Microbiology) at Indian Council of Agricultural (ICAR)-National Rice Research Institute, Cuttack, Odisha. The core area of research is soil nutrient dynamics particularly Carbon and Nitrogen dynamics in soil-plant –atmosphere continuum which is integral component of soil quality and soil health. The significant contributions include measurement of greenhouse gas (N2O, CH4 and CO2) emission from direct seeded aerobic and puddled transplanted rice under different N management. Development of agglomerated urea briquettes by mixing urea with locally available suitable amendments and testing their performance in terms of yield and N use efficiency of low land rice. Development of a five-panel customized leaf colour chart (CLCC) for N management in rice for different ecologies Identification of Improved N management strategy for enhancing nitrogen use efficiency and regulating N loss in aerobic rice production system. Quantification of carbon and nitrogen mineralization rates in soils of rice-rice system under long term application of chemical fertilizer and farm yard manure.

Impact of Soil Health Card on Crop Productivity and Farmers' Income

JP Bisen[a] and Shivaramane N[b]
[a]*ICAR-National Rice Research Institute, Cuttack, Odisha, India*
[b]*ICAR-National Academy of Agricultural Research Management, Hyderabad-Telangana*
Email: *jpbisen.iari@gmail.com*

Abstract:

In India, Soil Health Card (SHC) scheme has been started with anticipation that the usage of SHC would promote the judicious use of fertilizers and by restricting its indiscriminate usage and thereby reducing the input cost. This study is based on primary data from 320 farmers from Andhra Pradesh, Madhya Pradesh, Maharashtra and Telangana states. The result indicates that, SHC based fertilizer mix does not have any significant effect on yields of the crop in short run. On the other hand, SHC usage has increased total fertilizer expenditure of the farmers by Rs. 401 per acre. Even though, NPK consumption has declined after following SHC recommendations, micronutrient consumption has increased at the same time. It is a good indication that the concept of soil health management is picking up even with slightly higher cost. This short-term increase in cost on fertilizer usage and change in pattern of fertilizer consumption is expected to have positive effect on soil health in the long run which further would affect net returns from farm. The results also indicate that the SHC usage does not have any significant effect on the net returns per acre to the farmer in short run.

Key words: SHC, Crop productivity, Fertilizer expenditure, Soil Health

Screening and identification of Rice Genotypes for tolerance at cellular level using Temperature Induction Response Technique

Prashantkumar. S. Hanjagi, Sushma. M. Awaji, Padmini Swain and M J Baig
ICAR-National Rice Research Institute, Cuttack, Odisha, India
Email: *psh7160@gmail.com*

Abstract:

The major abiotic stresses that are predicted to worsen as the consequences of climate change include drought and high temperature stresses. These abiotic stresses act as yield limiting factors in the unfavorable environments of tropical Asia. Incorporating stress tolerance into high-yielding varieties has proven to be a very effective approach to developing varieties that can cope with these situations. Thus, identifying rice genotypes that are tolerant to drought and high temperature stresses and resilient to changing climate is need of the hour.

The present study aimed at screening and identifying rice genotypes with higher tolerance at cellular level (TCL) to high temperature stress. A novel approach called temperature induction response (TIR) technique was used to phenotype a set of diverse rice genotypes comprising 96 numbers for tolerance at cellular level. The genotypes showed significant genetic variability in parameters linked with intrinsic tolerance. The per cent reduction in recovery growth (%RRG) varied from 45 per cent in N22 to 100 per cent in Moroberekan and other nineteen genotypes, with a mean of 78.9 per cent. Genotypes such as Padmini, Sahbhagidhan, N22, Luna Barial, CR DHAN 201 And Luna Sankhi recorded the highest intrinsic tolerance in terms of lowest reduction in recovery growth. This study identified rice genotypes that are having higher tolerance at cellular level under high temperature stress.


AGRI Vision 2020

Day-1 | Jan 27, 2020

Young Investigator Presentation

Chlamydospore of Trichoderma promotes plant growth and imparts higher stress tolerance as compared to conidia

Harekrushna Swain[a,b#], Totan Adak[a], Sarmistha Sarangi[a], Ansuman Khandual[a], Soumendra K Naik[b], and Arup K Mukherjee[a*]

[a]*Division of Crop Protection, ICAR- National Rice Research Institute, Cuttack, Odisha, India*

[b]*Department of Botany, Ravenshaw University, Cuttack, Odisha, India*

Email: **arupmukherjee@yahoo.com/ titirtua@gmail.com; #harekrushnaswain21@gmail.com*

Abstract:

The population of the world is increasing very fast and it is expected in 2050 the world population to be around 9.6 billion. So one of the challenging problem is being able to cover the nutrition need of the fast increasing population. Rice is India's pre-eminent crop and is the staple food of the people of eastern and southern parts of the country. Hence, yield increase in rice has been the major focus in all the rice growing countries under agricultural research programmes. The production of rice is mainly affected by different rice diseases and to overcome this huge amount of fungicides, pesticides are used which pollutes the environment. The major constrain of rice production is different biotic and abiotic stresses which reduces yield considerably and also postharvest losses due to climatic and other factors. So in order to manage the disease due to biotic stress in an eco-friendly manner it is needed to search for alternative management practices. Several organisms being used presently as biocontrol agent (BCA) to control diseases and pests of crops but Trichoderma based biocontrol agents possess better ability to promote plant growth and soil remediation activity compared to their counter parts (Harman 2006; Harman et al. 2004; Howell 2006; Lorito et al. 2010; Mukherjee et al., 2014; Schuster and Schmoll2010; Shoresh et al. 2010; Swain et al., 2018; Verma et al. 2007). However, most of the Trichoderma based formulations available in market are based on either conidia or fragments of mycelia (Mastouri et al. 2012) which are not that much of stable in the changing climatic conditions (i.e. exposure to high temperature and UV radiation). So, there is a need to find out a better alternative and the chlamydospore (thick-walled hyphae-derived asexual structures important for survival of a fungus), which is stable and remain active for a longer period can be a suitable one. But, the main problem is that most of the Trichoderma spp. doesn't form chlamydospore naturally. Numbers of workers have tried to induce chlamydospore artificially but with little or no success. In the present study the formation of chlamydospore is artificially induced in Trichoderma spp. and they are separated from mycelia by using physical and chemical methods. In-vitro and In-vivo experiments were carried out for disease management, growth promotion and defense related enzyme activity. On the basis of the experiments we found that Chlamydospore can be used as a better alternative for management of rice diseases. **Keywords**: Chlamydospore; Conidia; Trichoderma; Rice; Biocontrol Agent; Disease Management; Growth Promotion; Defense Enzyme.

Population structure of *Xanthomonas oryzae* pv. oryzae: A problem and solution within itself to combat Bacterial Blight of Rice in Eastern India

Ansuman Khandual[a,b], Harekrushna Swain[a], Soma Samanta[a], Mihira Kumar Mishra[b], Raghu S.[a], Meera Kumari Kar[c] and Arup Kumar Mukherjee[a]*

[a]*Crop Protection Division, ICAR-National Rice Research Institute, Cuttack, Odisha, India*

[b]*Department of Plant Pathology, College of Agriculture, OUAT, Bhubaneswar*

[c]*Crop Improvement Division, ICAR-National Rice Research Institute, Cuttack, Odisha, India*

***Email:** *arupmukherjee@yahoo.com/ titirtua@gmail.com*

Abstract:

The half of the global population depends upon rice as its major staple food. Its production is threatened by a number of biotic as well as abiotic stresses. Insect pests, rodents, diseases causing pathogens (fungi, bacteria, viruses, phytoplasmas) and nematodes are the main incitants of biotic stress, either singly or in combination. During Green Revolution, the traditional agricultural strategies were replaced by modern ones. As a result, the adoption of modern high yielding semi-dwarf rice varieties along with chemical fertilizers and pesticides came to limelight compromising the resistance gene pool of the landraces. Consequently, the emergence of previously minor and unreported diseases became evident. Bacterial blight (BB), which was earlier thought to have no significant damaging effect on the crop, emerged causing up to 50% yield loss. The disease attacks the crop at all growth stages, but the typical blight symptom starts from the active tillering stage while maximum yield loss occurs in the seedling stage due to Kresek. Many resistance varieties were developed by several research institutes as well as universities and deployed for conferring resistance to BB. But the changing agroclimatic conditions, injudicious nitrogenous fertilizer application and monoculture forced the directional evolution of new prominent races (pathotypes) of the phytopathogenic causal organism of BB, Xanthomonas oryzae pv. oryzae (Xoo). There are also many reports where the resistance gene(s) is defeated by the pathogen. Since paddy is grown over a large area in the field, host resistance is the cheapest and feasible strategy for management of the disease rather than application of synthetic pesticides, antibiotics and biocontrol agents. However, thorough understanding of the pathogen population structure is the pre-requisite for resistance breeding and to formulate proper management strategy. But the most critical aspect for the development of a resistant variety is the location specific deployment of resistance gene. For this purpose, in our present study, the isolates collected from several locations and varieties were screened against differentials hosts with different resistance gene(s) to determine their virulence profile. A set of differentials/NILs (Near Isogenic Lines) developed by IRRI, Philippines have been used for pathotyping analysis. On the basis of phenotypic manifestation of the disease reaction, the Xoo isolates were further categorized into pathotypes. Our study revealed 15 pathotypes from different samples collected across the Eastern India states.

Keywords: Rice, bacterial blight, *Xanthomonas oryzae pv. oryzae*, pathotypes, virulence


AGRI Vision 2020

Day-1 | Jan 27, 2020

Poster Presentation


AGRI Vision 2020

Bio Control Potential of Rice Endophytes Against Rice Diseases

Rupalin Jena#, Soma Samanta, Harekrushna Swain, Arup K Mukherjee*
Molecular Plant Pathology Laboratory, ICAR-National Rice Research Institute, Cuttack, Odisha
Email: *arupkmukherjee65@gmail.com, rupalinjena2015@gmail.com*

Abstract:

Rapid population growth demands for increased food production. In a report by UN/FAO there is a need of 40% increase of food production by 2030 and 70% by 2050 (FAO 2009). Rice, one of the primary graminaceous crops constitutes the main nutrient resource for 60% world's population including most developing countries. Rice has been severely affected by several diseases and insect pests resulting the average productivity of rice is comparatively low in India. Abuse of chemical pesticides, which are the most common approach for control, can destroy the balance of ecosystems and the contamination by their toxic residues may cause harm to humans and domestic animals. Hence, it is needed to stop the using of chemical pesticides for yield loss and find out some suitable alternative approaches.

Endophytes the "hidden treasures", reside inside the plants without causing any harm instead offering a multitude of benefits like providing protection against plant pathogens, insects, nematodes. The relationship between the host and the endophyte may range from symbiotic to near pathogenic. Endophytic microorganisms are a significant reservoir of genetic diversity, and an important source for the discovery of novel bioactive secondary metabolites. As a general rule, a single endophytic strain will produce multiple bioactive substances. The reported natural products from endophytes include antibiotics, antipathogens, immunosuppressant, anticancer compounds, antioxidant agents and other biologically active substances. In present work different endophytic fungi and bacteria have been isolated from leaves, roots, stems and seeds of wild rice spp. namely Oryza rufipogon, O. nivara, O. longistaminata, O. barthii. These are screened on the basis of their morphological characteristics under microscope and will identified using molecular tools like ITS, TEF, RPB-II. The endophytes have been screened for their biocontrol efficiency against Sclerotium oryzae, Rhizoctonia solani etc. Selected endophytes are recently being used for seed treatment to know about their effect on rice plants both for protection against pathogens and growth promotion. Endophytic bacteria have been gram stained and mostly are gram –ve bacteria. These are tested for different biochemical analysis like Catalase test, Antibiotic test, Urease activity, Ammonia production etc. Further work will be done to know how diverse endophytes from wild rice specially oryza rufipogon, o. nivara, o. bartii, o. longistaminata can be of use for the growth promotion and management of rice diseases.

Management of rice straw by using Trichoderma for plant growth promotion and stress tolerance

Sarmistha Sarangi[a, #], Harekrushna Swain[a], Totan Adak[a], Gourav Kumar[b], Pratap Bhattacharya[c], S.T.Mehetre[d] and Arup K Mukherjee[a*]

[a] *Crop Protection Division, National Rice Research Institute, Cuttack, Odisha, India*

[b] *Crop Physiology and Bio-Chemisty Division, National Rice Research Institute, Cuttack, Odisha, India*

[c] *Crop Production Division, National Rice Research Institute, Cuttack, Odisha, India*

[d] *Nuclear Agriculture & Bio Technology Division, Bhabha Atomic Research Centre, Bombay, India*

Email: *[#]sarmisthasarangi@gmail.com. *titirtua@gmail.com*

Abstract:

India produces 98 million tons of paddy with roughly 250 million tons of straw as crop residue. The rice straw is mainly used for thatching of clay houses in rural areas and as a fodder for domestic animals, which is very less in compare to production. The rest is mostly burned in the fields, though a small amount is also consumed by brick kilns, paper and packaging industry. In the present scenario huge production of rice straw becomes menace, because its disposal is time consuming, constitutes an extra cost and lower use of clay house Currently, rice straw has no commercial value. Ploughing it into soils is time and energy consuming, and the residues take a long time to decompose. So, without effective use, farmers burnt the rice straw which is obviously not by choice but by compulsion. The reason is the lack of a market for the resource. In every year during winter the educational institutes closed for entire one-two weeks in Delhi due to huge burning of straw in Punjab, Haryana and surrounding areas. These open burning of straw in the field not only cause environment pollution but we lose a very viable amount of nutrients present in the straw.

Paddy straw which contains good quality of Carbon and Nitrogen can be used as biofertilizer if effectively decomposed by microorganism. Trichoderma species are well known for their ability to deconstruct lignocellulosic biomass. In the present investigation we have evaluated the decomposing capacity of Trichoderma isolates in in-vitro conditions according to the expression of various straw degrading enzymes like laccase, cellulase, endoglucanase, xylanase both qualitatively and quantitatively. Besides these we have tried to fill the gap between decomposed rice straw and its use as a biofertilizer for rice health management. For this we validated the decomposed rice straw not only for biofertilizer but also for management of soilborne and seed borne rice pathogens. This work is a new innovative idea which managed the decomposition of paddy straw in one hand and management of rice diseases on other hand by using novel Trichoderma strains isolated from above ground part. However, for the benefit of farmers it must be tested in larger scale under in-vivo condition.

Key words: Rice straw; Trichoderma; decomposition; biofertilizer; rice health management.

Genetic resources in tuber crops for food and nutritional security

Kalidas Pati, V. B. S. Chauhan, M. Nedunchezhiyan, and V. V. Bansode
ICAR-Central Tuber Crops Research institute, Regional Centre, Odisha, India
Email: *Kalidas9555@gmail.com*

Abstract:

Conservation of genetic resources is fundamental for attainment of food and nutritional security. Food and nutrition security exist when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life. Tuber crops play important role in food and nutritional security in India particularly tribal areas in Odisha, Chhattisgarh and Jharkhand. At Present 1242 germplasm accessions were conserved in different tuber crops at ICAR-CTCRI, Regional Centre. The use of these genetic resources and of desired traits selected from this resource, improve food and nutritional security. Remarkable examples include sweet potato varieties Bhu Sona with increased pro-vitamin A and Bhu Krishna with high anthocyanin content, a variety of taro with leaf blight tolerance, Orissa elite in yam with high yield and yield stability and good taste. Eighteen varieties of different tuber crops were developed from ICAR-CTCRI, Regional Centre, for different agro climatic region of Odisha and other parts of India. 400 cultures of released, pre released and exotic lines includes 10 varieties in Cassava, 11 varieties in sweet potato, 5 varieties in taro, 4 varieties in yam, 2 varieties in EFY and 4 varieties in Chinese potato were maintained in in in vitro at Regional Centre, ICAR-CTCRI. Both ex situ and on-farm conservation strategies are required to have genetic insurance against biological disasters or natural calamities to contribute to food security and sustainable development.

Genome editing in popular rice variety 'Swarna' targeting Ideal Plant Architecture (IPA1) gene for yield enhancement

Bandita S, Kishor J, Debashis S, Cayalvizhi B, Parameswaran C, Sanghamitra S*, Devanna B, Jawaharlal K, Awadhesh Kumar

ICAR-National Rice Research Institute, Cuttack, Odisha

Email: *smitraray@gmail.com*

Abstract:

Rice (*Oryza Sativa L*) is the major staple foods source for more than three billion people and cultivated throughout the world. It has been estimated that 40% more rice is needed by 2050 to meet the food demands of the ever increasing population. However, the rice yield is gradually declining in recent decades. The recent emergence of genome editing technologies has superseded the limitations of traditional breeding methods, starting a new era of crop improvement. CRISPR/Cas 9 (Clustered regularly interspaced short palindromic repeats) is the most advanced genome editing tool in plant biology. The present investigation aimed at increasing the yield traits in indica rice variety "Swarna" which is the highly popular variety known for providing reasonable yield and profit to the farmers even under low input management. The miRNA binding site of the *Ideal Plant Architecture* (IPA1) gene was targeted through CRISPR/Cas9 genome editing approach. A single guide RNA (sgRNA) specific to IPA1 and Cas9 protein were assembled to a specific expression vector specific for rice. The gRNA expression cassette was transferred into Swarna callus through Agrobacterium mediated transformation. The analysis of edited lines showed significant difference in the traits namely plant height, no. of panicle branches, panicle length and no. of spikelet per panicle relative to Swarna cultivar. Mean performance analysis in four out of 35 edited lines showed increase in plant height by 30.4%, 20.40% increase in number of panicle branches, 38.15% and 20.24% increase in the no. of spikelets and panicle length, respectively. In conclusion, utilization of CRISPR/Cas9 based editing approach could be useful in yield enhancement of other popular cultivars for the profit of the farmers.

Identification of improved rice genotypes for grain protein and quality traits

Shuvendu Shekhar Mohapatra, Nutan Moharana, Padmalochan Dehuri, Torit Baran Bagchi and Krishnendu Chattopadhyay

ICAR-National Rice Research Institute, Cuttack, Odisha

Email: *mohapatrashuvendushekhar@gmail.com*

Abstract:

With the increasing global urbanization and population the need for both quality and quantity in food grain production is enormously felt. Rice is the most preferable, affordable and cultivated food that meets the hunger of almost worlds half of the population. To combat the protein energy malnutrition and provide quality food to the society we need to focus on improvement of rice for grain nutrition and quality. The average protein content of rice is low (6-7%) as compared to other cereals. In this present work we focused on the identification of breeding lines having high protein contain as well as good grain quality. By using donors for high protein content ARC 10075 and ARC 10063, we have developed many breeding lines. In this study we took 57 advanced lines derived from pedigree and backcross breeding method. Some of them were introgressed lines in the background of high yielding popular varieties such as Swarna and Naveen. The gain protein content (GPC) was estimated by using calibrated Near-infrared (NIR)-Spectrophotometer. Grain quality traits were estimated using standard procedure. The statistical analysis revealed the significant difference ($p<0.05$) in all parameters. The range of different parameters such as hulling percentage (72.5-79), milling percentage (62.5-71), head rice recovery (42-70%), length of grain (4.4-6.45 mm), breadth of grain (1.55-2.21 mm), amylose content (15.26-22.65%), grain length after cooking (7.5-10.8 mm), volume expansion ratio (2.8-4.25), water uptake by cooked rice (57.5-122.5 ml/100gm) and grain protein content (6.75-11.55%) varied widely. It was observed that various breeding lines such as CR 2818-1-11-1-B-3-1-B, CR2829-PLN-23-7, CR 2829-PLN-98-9, CR 2829-PLN-114-13, CR2830-PLS-57 along with released varieties, CR Dhan 310 and Mukul were showing more than 60% head rice recovery, desired amylose content (20-22%) as well as high protein content (10-11.5%). These breeding lines could be tested further in multilocation and also could be used in breeding programme for further improvement of rice for protein and quality traits. This may facilitate unspeakable new opportunities for generating biofortified rice varieties to achieve the food and nutritional security for the rapidly expanding global population.

Identification of donors for grain protein and Zinc content for biofortification in rice

Nutan Moharana, Shuvendu Shekhar Mohapatra, Padmalochan Dehuri and Krishnendu Chattopadhyay

ICAR-National Rice Research Institute, Cuttack, Odisha, India

Abstract:

One of the major causes of malnutrition is the inadequacy to supplement food in terms of both quality and quantity. More than half of the Asians rely on rice as the major food crop which is having modest concentration of protein and micronutrients. To encounter this micronutrient deficiency there is an urgent need for developing varieties with enhanced protein and micronutrient content along with meeting the quantity needs of this era. In this present study we have targeted to identify donors for grain protein and Zinc content in brown rice to be used as donors in breeding program. 34 germplasm were collected from various locations and were grown at ICAR-National Rice Research Institute, Cuttack, India under standard agronomic management practices. The grain protein content (GPC) was estimated by using calibrated Near-infrared (NIR)-Spectrophotometer and Zn content estimated through calibrated X-ray fluorescence (XRF) machine at ICAR-IIRR, Hyderabad. Data on agronomic traits were collected. The statistical analysis exhibited a wide range of variation for different parameters. The mean value of grain protein content in all germplasm was 9.64% ranging from 6.14% in RRG-11 to 13.13% in ARB-6027. The mean value of Zn concentration in all germplasm was 37.37ppm ranging from 21ppm in RRG-9 to 51.1ppm in IARI-3. The range of agromnimic traits were 69.17-175.5cm for plant height, 17.77-34.5 cm for panicle length, 1.09 -2.97g for 100 grain weight, 1.86 -25.53 kg for plot yield and 0.137-2.59 g for protein yield. The germaplsm with elevated protein content were identified ARB 6027 (13.12%), Bindli (12.30%), Kalinga-III (12.21%) and RRG-9 (12.08%). And germplasm with higher Zn content were IARI-3 (51.1 ppm), Edavaukudi Pokkali (48.2 ppm), Bindli (47.00 ppm), RRG-10 (44.90 ppm). Grain protein content and Zn concentration were found to be positively correlated (r=0.285). Hence, these identified germplasm can be used as donors for grain protein and zinc content in breeding for high yielding elite lines with high nutrition value. These potential donors for high nutrient content in seed could be the strength in the development of the biofortified rice leading to nutritional security for millions of rice eating population in India.

Integrated Methods to Manage the Agricultural Produce along with Increase in Employability

Arpita Dash and Mousumi Tripathy
Department of Botany, Centurion University of Technology and Management, India

Abstract:

The prosperity of a country depends upon the welfare of its farmers and majority of the Indian farming communities follow traditional forms of agriculture to support their livelihood. Strategies made by the government in the past primarily focussed on increasing the agricultural yield and improving food security. As a result, poverty and financial instability has become quite common in farm households. Realizing the need to pay special attention for the welfare of farmers, the government has devised several developmental initiatives like Seven-point Strategy, Pradhan Mantri Krishi Sinchai Yojana and several other acts and policies to double the farmer's income by the year 2022-23. An annual growth rate of 10.4% is required to achieve this goal. Use of good quality seeds and bio-fertilizers is essential for proper growth and productivity. Linking farmers to industries through contract farming would promote food processing in rural areas and generate employment. By using modern technology, plants with desired traits can be engineered which can provide better yield without interfering with the genetic makeup. Agricultural strategies like Smart farming and Integrated farming system can help in doubling farmer's income. Improvement in storage system is crucial for minimizing post harvest losses. Establishment of Agribusiness hubs is essential for forming better marketing strategies and advertisement of agricultural machineries and products.

Keywords: Agricultural, Agribusiness, Bio-fertilizers, Farmer, Pradhan Mantri Krishi Sinchai Yojana


AGRI Vision 2020

Day-2 | Jan 28, 2020

Keynote Presentation


AGRI Vision 2020

Chitin deacetylase for improved production of chitosan with bio adsorption efficiency for agricultural sustainability

Poonam Das, Sabuj Sahoo*
Post Graduate Department of Biotechnology, Utkal UniversityBhubaneswar, Odisha, India
Email: *sabujbiotech@utkaluniversity.ac.in*

Abstract:

Chitosan is a deacetylate product of chitin, which is an abundant natural biopolymer having immense potential in various field of applied science including waste water treatment (heavy metal ions, radioisotopes, extracellular polymeric substances, poly chloro biphenyls, dyes, solid materials from food processing waste), agricultural fields (fungicide, feed additive and seed coating), medical and pharmaceuticals (artificial skin, contact lenses, antitumor, media etc due to the characters like having defined chemical structure, biodegradable and biocompatible with many organs, tissues and cells. It can be chemically and enzymatically modified to flakes, fine powders, membranes, sponges and gels. In agricultural fields chitosan act as an elicitor by inducing accumulation of lignin, callose, phytoalexin which help in plant defence mechanism. It also promotes plant growth, resistance against biotic and abiotic stress. Chitosan is extensively used as a seed coating element due to its antimicrobial activity and ability to change the permeability of seed plasma membrane. It can be considered as a potent bio pesticide. The cationic nature of chitosan is considered as one of the most promising bio adsorbent for extensive application in waste water treatment. The protonated NH2 and OH group present facilitates the electrostatic interaction between polymers and negatively charged contaminants. It can effectively bio adsorb heavy metals like (Cu(II), Cd(II), Pb(II), Fe(III), Zn(II), Cr(III), Poly chloro biphenyls (PCBs), Extracellular polymeric substances (EPS) including the proteins lipids and carbohydrates promoting bioremediation and sludge treatment. Commercialized chitosan is manufactured from chitin suffered disadvantages viz., grievous, thermochemical process, multistep chemical procedure, requirement of high alkali and high temperature, environmentally unsafe, leading to a broad and heterogeneous range of products. Employing a novel chitin deacetylase (CDA) from microbial source enzymatically deacetylase the chitin into chitosan addressing bioadsorption of heavy metals and pollutants. Bio derived chitosan is more efficient than the chemically derived. The major hurdle in this approach is to improve the chitosan yield and solubility which can be achieved by increasing CDA activity.

Key words: Chitin, Chitosan, Chitin deacetylase (CDA), polychlorinated biphenyls (PCBs), extracellular polymer substance (EPS).

Tuber crops based integrated farming system for doubling farmers income

M. Nedunchezhiyan
Regional Centre of ICAR-Central Tuber Crops Research Institute, Bhubaneswar, India
Email: *mnedun@gmail.com*

Abstract:

Tuber crops are rich source of energy and carbohydrates although each of them also provides other important nutrients as well. Tropical tuber crops supply 28.5 kg food annually and 75 kcals energy/head/day. This amounts to 3.9% of total energy consumed by a person in a day. Tropical tuber crops include cassava (Manihot esculenta), sweet potato (Ipomeas batatus), greater yam (Dioscorea alata), white yam (D. rotundata), lesser yam (D. esculenta), taro (Colocasia esculenta), tannia (Xanthosoma sagittifolium), elephant foot yam (Amorphophallus paeniifolius), yam bean (Pachyrrhizus erosus), coleus (Solenostemon rotundifolius) etc.

Tropical tuber crops are having varied growth habit, drought and flood resistance and crop duration. Though tropical tuber crops are perennial in nature but domesticated as seasonal/ annual. This provides an opportunity for staggered harvesting as per household and market needs. Tropical tuber crops are also having great flexibility in planting and can fit into any cropping/ farming system. This is possible because the propagating material is asexual stem or vine or tuber cuttings. As the economic part is swollen roots or modified stem, photoperiod has no significant effect on yield forming factors. Thus tropical tuber crops are both thermo and photo insensitive. However, extreme high and low temperature affects the growth and yield. Tropical tuber crops grow well in marginal soil with fewer inputs where other crops usually fail to grow. They are tolerant to drought and some of them grow fast and provide a wide soil cover to prevent erosion. It also produces high amount of dry matter per unit area per unit time compared to cereals. They are most efficient in converting solar energy, for example cassava producing 250x103 kcal/ ha and sweet potato 240x103 kcal/ha as compared to on 76x103 kcal/ha for rice, 110x103 kcal/ha by wheat and 200x103 kcal/ha for maize. Thus tropical tuber crops are suitable candidature to include in crop diversification programme. These crops have great flexibility in mixed cropping systems to generate additional employment and income. Crops like yam and elephant foot yam grow as intercrops in horticultural and plantation crops. Tuber crops are capable to utilize available resources more efficiently especially in partial sunlight and residual moisture (Nedunchezhiyan and Laxminarayana, 2006). Tropical tuber crops are rich in minerals and vitamins.

Biofortification in rice and its potential impact on increasing farmers' income and achieving food and nutritional security in India

Krishnendu Chattopadhyay
ICAR-National Rice Research Institute, Cuttack, Odisha, India
Email: *krishnenducrri@gmail.com*

Abstract:

Biofortification refers to the genetic enhancement of major food crops with for grain nutrients such as micronutrients (Fe, Zn, etc.), protein, essential amino acids, vitamins, etc. Rice is the major caloric supplement for two thirds of Indian population with a consumption of around 220gm per day. But it is deficient in protein (7-8%) and micronutrients such as Zn (10-15 ppm) and Fe (2-3 ppm) in polished rice. In India ICAR-National Rice Research Institute, Cuttack has released two high protein (10%) rice varieties, CR Dhan 310 and CR Dhan 311 (Mukul). ICAR-Indian Rice Research Institute, Hyderabad and Indira Gandhi Krishi Viswavidyalaya, Raipur have released two high Zinc (22 ppm) rice varieties, DRR Dhan 45 and Zinco Rice –MS, respectively. All these varieties have been released and made available for cultivation in last 3-4 years. First high protein (10.2%) rice variety, CR Dhan 310 was released in 2016 for cultivation in Odisha, Uttar Pradesh and Madhya Pradesh. Subsequently Mukul (CR Dhan 311) with high protein (10.1%) and moderately high level of zinc content (20 ppm) also was released in Odisha and notified in 2019 as nutrient-rich rice variety. Both of them are in the genetic background of cv. Naveen, a well adopted popular rice variety of Odisha and eastern India as a whole for irrigated ecosystem. The high protein varieties have been well accepted by the farmers due to their resemblance for grain and plant type to recurrent parent, Naveen. They are the valid replacement of more than 10 years old variety, Naveen for irrigated ecosystem. The rapid detection technique has been standardized for differentiating Naveen with its high-protein counterpart. Higher content of glutelin and some of the essential amino acids such as Lysine was found in high protein lines with quantitative trait loci (QTL) for grain protein content, qGPC1.1. High protein lines (CR 2830-PLS-17, CR 2830-PLS-156) in the background of the high yielding variety, Swarna (MTU 7029) were found promising in national and state level multilocational testing. Rice based food and feed industry is growing very fast. High protein and high zinc rice varieties can significantly contribute in this industry. At present no support price for farmers for cultivation of high nutrient rich is available. Therefore, for popularization of the variety in suitable lands and for increasing the higher commercial value of this rice initiatives from Institutional and extension machinery as well as modification in policy decision are collectively required. Higher support price for growers and subsidy for mid-day meal rice are required to give benefits both the poor rice-farmers and our underprivileged children in villages of India. Therefore, high yielding rice varieties with high nutritional values developed through biofortication breeding intervention have significant potentiality to contribute towards the better nourishment of millions of poor who depend mainly on rice for their nutrition and also in improving the economic level of the farming community.

Salinity stress: a threat to rice cultivation in coastal agro-ecosystem

Koushik Chakraborty, Krishnendu Chattopadhyay and Ramani K. Sarkar
ICAR-National Rice Research Institute, Cuttack, Odisha, India
Email: *koushikiari@gmail.com; Koushik.Chakraborty@gov.in*

Abstract:

Salinity, recognized as major threat in agriculture causes 4.0-6.3% yield loss annually across the world. The problem is aggravated due to increasing irrigation with sub-optimal quality of irrigation water and more salinization of coastal area due to rise in sea level because of climate change. Rice cultivation in coastal area possesses inherent risk of sea water intrusion subjecting the standing crop to concomitant stresses of flooding and salinity. In saline soil, excessive concentrations of Na+ and Cl− impairs absorption of other beneficial ions such as K+, Ca2+ that in turn inhibit plant growth and productivity. Maintenance of cellular K+ level and K+/Na+ ratio is still considered the most important factor for salt-tolerance. Under high Na+ environment, excess Na+ competes with K+ thereby hindering its uptake. Tolerant plants by employing number of stategies restricts Na+ movement to young meristematic tissues and allow greater movement and/or tissue retention of K+ to physiologically more active tissues. Under salt stress different K+ and Na+ specific transporter viz. SOS, NHX, HKT family transporters (regulate cellular Na+ movement) and HAK, AKT, KT, KUP (regulate K+ movement) either by up-regulation or down-regulation controls cellular ion homeostasis and salt-tolerance in plants. SOS1, a plasma membrane bound Na+/H+ antiporter, mostly active in root tissue, removes the excess salt from the plant body by pumping them back to rhizosphere in an energy dependent process. Tonoplast bound vacuolar Na+/H+ antiporters (NHX family transporters) play crucial role in Na+-compartmentalization inside vacuole in mature cell in both root and leaf tissues. Storing excess salts in vacuole imparts tolerance in multifaceted manner viz. imparting tissue- and osmo-tolerance. Biosynthesis of organic osmolyte, a more energy expensive process sometimes substituted by the accumulation of excess Na+ in non-active tissues under salt stress. Improved Ca2+ status inside plant tissue is another important factor for salt-tolerance as it acts as a key signalling molecule to initiate Na+-exclusion. Several QTLs and miRNAs were also reported to impart salt-tolerance in rice and other crops.

Resurgence of Doubled Haploid Breeding: exceeding our expectations in rice improvement

Sanghamitra Samantaray
CID, ICAR-National Rice Research Institute, Cuttack, Odisha, India
Email: *smitraray@gmail.com*

Abstract:

Considering the rapidly growing population and diminishing cultivation area throughout the world, it is required to develop high yielding rice varieties for which currently traditional breeding is being followed. However, the ability to generate homozygous and homogeneous lines is an important time constraint in plant breeding. Utilization of doubled haploid (DH) technology can substitute the traditional breeding in achieving stable homozygous lines which can be produced in two rather than, five or more generations. Other advantages include reduced costs to produce cultivars, more precise evaluation of phenotypic traits, effective elimination of undesirable genes, and trait fixation in haploids using marker-assisted selection, leading to effective use of molecular markers and more efficient combination of traits. Because the success of breeding programs depends on the genetic gain per unit time, the use of DH technology plays a major role in the breeding of the self-pollinated cereal species including rice.

Though the generation of efficient DH technology in rice can be utilized to accelerate plant breeding programs, the anther culture-based rice doubled haploid generation does not fulfill the demand of the breeders as it requires expertise along with variability in responses of different genotypes under in vitro culture in indica rice. Therefore, a novel approach like seed-based haploid induction technology could be adopted, allowing routine germplasm-independent doubled haploid line production. Knock-out of OsMATL gene in rice has generated immense hope to develop such technology. Developing a Haploid Inducer (HI) line exploiting CRISPR/cas9 genome editing technology in different genetic background will enable us to compare the haploid induction frequency in different backgrounds and find a suitable system for DH production in rice. This research may mobilize rice breeding into a new era.

Biography:

Dr. Samantaray is a Principal Scientiest, Agri Biotechnology at ICAR-NRRI, Cuttack. She was awarded with a prestigious fellowship i.e. Dr. K.S. Krishnan Fellowship funded by Department of Atomic Energy, Government of India, Bhaba atomic Research Centre, Mumbai and did her Ph.D. in Utkal University. She started her service in 1991 as a scientist in Regional Plant Resource Centre, Bhubaneswar. During that period, she visited Liverpool University, U.K. and also did her D.Sc. in Utkal University. Thereafter, she joined Directorate of Medicinal and Aromatic Plants Research (DMAPR), Anand, Gujarat, ICAR, Govt. of India as a Senior Scientist (Biotechnology) in 2003 and from 2010 she is working at ICAR-NRRI (Formerly CRRI), Cuttack as a Principal Scientist in Biotechnology.


AGRI Vision 2020

Day-2 | Jan 28, 2020

Oral Presentation


AGRI Vision 2020

Engineering rice for resistance to blast and sheath blight diseases

Devanna BN[a], Richa K[b], Singh J2, Kumari M[b], Parameswaran C[a], Katara J[a], Samantaray S[a], Sharma TR[c]*

[a]*ICAR- National Rice Research Institute, Cuttack, Odisha, India*
[b]*ICAR- National Institute for Plant Biotechnology, New Delhi, India*
[c]*National Agri-Food Biotechnology Institute, Mohali, Punjab, India.*
Email: *trsharma@nabi.res.in*

Abstract:

Rice is the source for more than half of the global population. The production of rice is subjected to various biotic and abiotic stresses. Among the biotic stresses, blast and sheath blight are the major threats for rice cultivation.Among the available approaches, deployment of resistance (R) and pathogenesis related (PR) genes, respectively are both eco-friendly and environmentally viable approaches. Using the biotechnological tools, we could identify the genes for these two diseases. Major resistance (R) gene Pi54of for blast resistance was identified and characterized from Oryza officinalis.Docking analysis found that Pi54of protein interacts with AVR-Pi54 through novel STI1 and RhoGEF domains, which are the components of rice defensome complex. Therefore, Pi54of has differential domain specificity in comparison to Pi54 and Pi54rh orthologs proteins during interaction with the AVR-Pi54 and is localized to cytoplasm and nuclei. Transformation in both indica and japonica rice with Pi54ofenhanced resistance for multiple M. oryzaestrains. Further, Pi54of was found to inherit stable resistance in the later generations as well. Indica rice cv. Tetep is known sources of resistance for sheath blight. A major QTL region (qSBR11-1) was characterized and a chitinase gene LOC_Os11g47510was cloned and characterized from this region using rice genetic engineering. Therefore, the novel genes identified here could be usedfor molecular breeding of rice for resistance to blast and sheath blight diseases.

Development of mapping population (s) for 21 days submergence tolerance in rice: characterization of Sub1 locus using CRISPR-Cas9 approach

J.L. Katara*, Madhuchhanda Parida, C Parameswaran, Devanna, N. Umakanta, Byomkesh Dash, Sudhansu Sekhar Bhyuan, S. Samantaray

ICAR-National Rice Research Institute, Cuttack, Odisha, India

Email: *jawaharbt@gmail.com*

Abstract:

Submergence stress unfavorably affects poor farmers' living in 15 million ha of rice-growing areas in the rainfed lowlands in south and south-east Asia. Cultivation of non-tolerant submergence high yielding rice varieties endures crop losses to the farmers due to periodic flash floods in the monsoon season. India has the largest area (17.2 million hectares) under rainfed lowland amongst the South-east Asian countries while about 75% of the world lowland rice is in the belt across Eastern India, Bangladesh, Myanmar and Thailand. To address such problem, development of rice varieties with tolerance to flood is the need of the hour. Though the Sub1 gene possessing 14 days (two weeks) tolerance to submergence has been identified, cloned and characterized from FR13A and transferred to number of rice varieties through marker assisted introgression, additional genes imparting flood tolerance for 21 days (3 weeks) or more is required because of regular flooding in India and south-east Asia due to climate change. Therefore, ICAR-NRRI, Cuttack identified a genotype, AC 20431B which imparts submergence tolerance up to 21 days. The mapping population, Recombinant Inbreed Lines (RILs, F7) and BC2F2 have been developed for genotyping and mapping of 21 days submergence tolerance genes. Moreover, the Sub1 locus in AC20431B was also assessed using a total of 10 gene based markers. It was found that Sub1A tolerant allele is also present in AC20431B along with Sub1B and Sub1C genes. Further, CRISPR/Cas9 based gene editing approach will be followed which will help in understanding the Sub1 association with 21 days tolerance.

Genome editing of yield related traits of rice in rainfed ecologies using CRISPR-Cas9 approach

Parameswaran C[a], Sanghamitra S[a], Devanna BN[a], Umakanta N[b], Jawaharlal K[a], Awadhesh Kumar[a]
[a]*ICAR-National Rice Research Institute, Cuttack, Odisha, India*
[b]*ICAR-Research Complex for North Eastern Hilly Region, Umiam, India*

Abstract:

Rice is a major staple food crop in India. The productivity of rice in India shows high variability with average yield of ~ 2.665 t/ha. Besides, rate of increase in productivity in India over the last two decades is only ~50 kg/ha in India. The varietal development program for rice in India has resulted in green revolution and enhanced rice production by 3-5 folds in the last five decades. Though >1000 rice varieties are released in India for cultivation, the average yield of rice varieties has increased from ~ 4 t/ha in 1970 to 5t/ha in the year 2018-19. However, yield gap for rice in India is around 28% considering the high yielding varieties in India. The yield gap can be significantly reduced through enhancing the genetic potential of yield and yield related traits of rice. Among the several traits, number of spikelets per panicle is one of the important yield contributing traits for rice. But the average number of spikelets of rice varieties is only 133.3 spikelets. CRISPR-Cas9 (Clustered Regularly Interspaced Short Palindromic Repeats) is one of the genome-editing technologies which shows its potentiality in enhancing the genetic gain and reduce yield gap of rice in India. Several genes have been identified for regulating panicle architecture in rice. Genes namely Ideal Plant Architecture 1 (IPA1), dense and erect panicle (DEP), grain number, plant height and heading date (GHD7) have been reported to increase the yield of the rice plants. The genome-editing of yield related genes in japonica rice increased the yield by 10-15% in rice. Thus, utilization of CRISPR-Cas9 based genome editing approaches in indica rice could potentially improve the yield stability of rice in India which could increase the productivity and income of farmers in India. The development of genome edited lines has the potential to increase the average yield by 5-6t/ha and reduce the yield gap by 10% in India.


AGRI Vision 2020

Day-2 | Jan 28, 2020

Young Investigator Presentation


AGRI Vision 2020

Development of miR156 resistant Ideal Plant Architecture (IPA1) gene in 'HKR127' through CRISPR-Cas9: enhancing number of spikelets per panicle in rice

Kishor J, Debashis S, Bandita S, Cayalvizhi B, Parameswaran C, Sanghamitra S*, Devanna BN, Jawaharlal K, Awadhesh Kumar

ICAR-National Rice Research Institute, Cuttack, Odisha, India

***Email**: smitraray@gmail.com*

Abstract:

Rice (Oryza sativa L.) is the second most important cereal crop utilized exclusively as human staple food for 50 % of the world's population. World agriculture has been able to meet the rapidly growing global demand for food over the last half century. Hybrid rice is a viable practical genetic option for increasing the rice productivity as it gives 1.0-1.5t/ha additional yield over conventionally bred varieties. However, in recent years, yield growth rate of hybrid rice have slowed down notably in many countries due to climate change. Therefore, it is time to develop the climate resilient hybrid rice varieties which could cope with the prevailing climate variabilities. The need for diverse and multiple genetic ameliorations is generally accompanied by demanding time frames. Since, breeding programs in the conventional mode would not be able to measure up to these challenges. Therefore, an alternative approach like Double haploid breeding is gaining its popularity as it offers a rapid mode of truly homozygous line development that helps to expedite crop breeding programs where homogeneity is an absolutely essential parameter for rapid varietal development. Doubled haploid technology coupled with Marker Assisted Selection (MAS) could be potential in development of improved cultivars in rice. Currently, there is a need to develop hybrid rice which could cope with degenerating climatic conditions and evolving pathotypes. As development of hybrid rice cultivars, a three line system i.e. A, B, R lines were mostly employed as rice is a self-pollinated crop. Therefore, improving parental donor lines (Maintainer (B) and Restorer (R)) by pyramiding of bacterial blight genes such as (Xa21, xa13), submergence (Sub-1), tiller angle control (TAC1), heading date (Hd3a), phosphorus tolerant (PsTol) and spikelet fertility in high temperature (qHTSF4.1) through convergent doubled haploid breeding approach will assist in development of superior hybrids.

Development of climate smart genetic pool in rice (*Oryza sativa* L.) using Doubled Haploid approach

Sudhansu Sekhar Bhuyan, Byomkesh Dash, Ram Lakhan Verma, Parmeswaran C, Jawaharlal K, Devanna BN, Awadhesh Kumar, Sanghamitra Samantaray

ICAR-National Rice Research Institute, Cuttack, Odisha, India

Abstract:

Rice (Oryza sativa L.) is the second most important cereal crop utilized exclusively as human staple food for 50 % of the world's population. World agriculture has been able to meet the rapidly growing global demand for food over the last half century. Hybrid rice is a viable practical genetic option for increasing the rice productivity as it gives 1.0-1.5t/ha additional yield over conventionally bred varieties. However, in recent years, yield growth rate of hybrid rice have slowed down notably in many countries due to climate change. Therefore, it is time to develop the climate resilient hybrid rice varieties which could cope with the prevailing climate variabilities. The need for diverse and multiple genetic ameliorations is generally accompanied by demanding time frames. Since, breeding programs in the conventional mode would not be able to measure up to these challenges. Therefore, an alternative approach like Double haploid breeding is gaining its popularity as it offers a rapid mode of truly homozygous line development that helps to expedite crop breeding programs where homogeneity is an absolutely essential parameter for rapid varietal development. Doubled haploid technology coupled with Marker Assisted Selection (MAS) could be potential in development of improved cultivars in rice. Currently, there is a need to develop hybrid rice which could cope with degenerating climatic conditions and evolving pathotypes. As development of hybrid rice cultivars, a three line system i.e. A, B, R lines were mostly employed as rice is a self-pollinated crop. Therefore, improving parental donor lines (Maintainer (B) and Restorer (R)) by pyramiding of bacterial blight genes such as (Xa21, xa13), submergence (Sub-1), tiller angle control (TAC1), heading date (Hd3a), phosphorus tolerant (PsTol) and spikelet fertility in high temperature (qHTSF4.1) through convergent doubled haploid breeding approach will assist in development of superior hybrids.

Development of Haploid Inducer lines in indica rice using CRISPR-Cas9 approach

Byomkesh Dash, Sudhansu Sekhar Bhuyan, Parmeswaran C, Jawaharlal K, Devanna BN, Ram Lakhan Verma, Awadhesh Kumar, Sanghamitra Samantaray
ICAR-National Rice Research Institute, Cuttack, Odisha, India
Email: *dashbyom.k@gmail.com*

Abstract:

Doubled haploid, a novel approach provides a leading edge over traditional plant breeding techniques, hastening the development of homozygosity and maintains the developed genotypes as pure lines. Since, there are number of established haploid technologies available, androgenesis shows its potentiality in production of doubled haploids within a short period of time. Utilization of androgenesis could produce a number of rice varieties in japonica rice. However, indica rice is recalcitrant to anther culture. The most frustrating albino shoot regeneration along with the requirement of expertise skills hinders the wide spread use of DH technology through anther culture. Therefore, there is a need to identify an alternative of DH production technique which can be user friendly especially for the breeders; this could be answered by developing a haploid inducer line similar to maize; After extensive mapping efforts, a 4bp insertion in the carboxy terminus of MATRILINEAL (MATL) gene, which codes for pollen specific phospholipase was found to be causal factor of haploid induction system (Kelliher et al. 2017). Though the effect of MATL on Haploid induction was reported in rice, the induction rate is less than 6% (Yao et al. 2018). This could be enhanced by combining other related genes associated with pollen maturity. The cutting edge technology like CRISPR-Cas approach could be employed to generate HI line in rice. Keeping in view, a OsMATL gene-based marker was developed which was utilized to screen a number of indica rice genotypes like Swarna, N22, and DHs of 27P63 (M129-1), BS6444G (PA27-1, PA139) and CRHR32 (Y2-1, Y2-5, Y9-1), where the amplicon size is found to be ~400bp. Further, using the sequencing data a Cas9 guide would be generated for developing MATL knock-out lines using CRISPR-Cas.

Index

FORTUNE 500 INDIA

AWARDED Superbrands WORLDWIDE

IFFCO

पूर्णतः सहकारी स्वामित्व

Wholly owned by Cooperatives

1967 से भारतीय किसान के सच्चे साथी

मिट्टी की जान, किसान की शान.

नए उत्पाद

पानी में घुलनशील व विशेष उर्वरक

उत्तम खाद, उचित दाम

FOLLOW US:

YouTube IFFCO live iffcolive.com

IFFCO

पूर्णतः सहकारी स्वामित्व

INDIAN FARMERS FERTILISER COOPERATIVE LIMITED

IFFCO Sadan, C-1 District Centre, Saket Place, New Delhi - 110017, INDIA

Phones : 91-11-26510001, 91-11-42592626. Website : www.iffco.coop

august communications

Evation

Let us meet Again

AGRI Vision 2021

Jan 27-28, 2021 | Cuttack, Odisha

Evation Business Solutions (P) Ltd.
Das Villa, Jobra majhi Sahi,
College Square, Cuttack-753003, Odisha
www.evationbusiness.com
+91-79784 44300
contact@evationbusiness.com
evationbs@gmail.com