



ONLY NEWS PAPER PUBLISHED IN INDIA FOR SCIENTIFIC COMMUNITIES

NESA

NATIONAL ENVIRONMENTAL SCIENCE ACADEMY

Vol. 20 Issue - 04 (MONTHLY)

April 2017



National Workshop
on
"Celebrating Earth Day:
A Step towards Nurturing Nature"

28th April, 2017

SCHOOL OF ENGINEERING
GD Goenka University (GDGU), Gurgaon

BROAD THEMES OF THE WORKSHOP

1. Water Management and Conservation
2. Soil Conservation
3. Biodiversity
4. Waste Management
5. Disaster Management

Organized By:

SCHOOL OF ENGINEERING
GD Goenka University (GDGU), Gurgaon
&
National Environmental Science Academy (NESA), Delhi

Dr. Shefali Gola
Organizing Secretary
Asst. Professor, GD Goenka University
shefali.gola@gdgoenka.ac.in
09650002737, 09968444832
0124-3315900, Ext.: 4076

Ms. Sapna Mehta
Joint Secretary
Asst. Professor, GD Goenka University
09711738804

Mr. Kushagra Agrawal
Joint Secretary
Asst. Professor, GD Goenka University
09996185556

Our Cities Need a Breathing Space

S. K. Basu

UFL, Lethbridge, AB Canada; email:saiikat.basu@uleth.ca

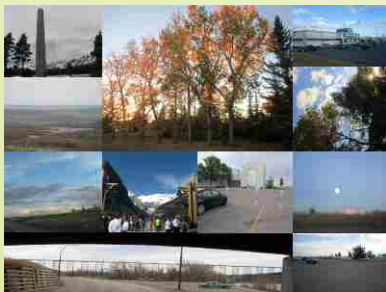


All major and minor cities around the globe are now being impacted by different forms of environmental pollution, the most notorious being air pollution. Irrespective of their status as developed or developing or under developed; most nations around the planets are now being impacted with serious pollution of their cities, towns, municipalities and

corporations. In several cases reported around the world, rural areas are also not free from serious impacts of environmental pollution predominantly due to various anthropogenic factors. Economics also has an important role to play in this ecological disaster. Poor economic growth is pushing populations from rural areas to migrate in large numbers to the nearest cities for employment, education and related opportunities; making the cities over populated beyond their manageable carrying capacities, particularly in poor developing and under developed nations. As a consequence, the highly pushed city infrastructure are unfortunately stretched way beyond their threshold level resulting in serious pollution and impacting quality of life for both people and city wildlife.



The real estate businesses have enjoyed big booms across many countries in the past two decades; transforming cities and towns around the globe into concrete jungles in the form of numerous high rises, commercial centers, high end showrooms, hotels, pubs, restaurants and eateries, multiplexes, giant malls and shopping complexes, giant parking lots, massive recreation centers, art galleries and museums, corporate hospitals and nursing homes, new schools and colleges, offices and other related business enterprises to mention only a few. As a matter of consequence, the precious green covers in most towns and cities have been rapidly shrinking over the past two decades, making the cities and towns vulnerable to severe pollution. Furthermore, unplanned growth and development of industrial areas within or adjacent to towns and cities mostly in developing and under developed nations are another important anthropogenic factor impacting the city environment.



Rapid urbanization and associated infrastructural development like building of more roads, highways, flyovers, bridges and connectors has been further adding to the dilemma of city based pollution. Furthermore, illegal encroachments, slums and illegal settlements are also equally responsible for the rapidly increasing city pollution levels. Last but not the least, cities being the center of transit communications as well as the economic development of the middle class communities in most countries across Asia, Africa and Latin America has been adding more vehicles to the city roads every year with the carbon credit going up even higher. The developed nations are also not far behind due to higher number of vehicles per family making the situation worse in most major global cities and towns across the planet.



All these anthropogenic impacts have contributed to the alarming reduction of open green areas, waterbodies and unused forested areas in and around the major towns and cities. Congestion due to over population; and streets packed with slow moving vehicles, frequent traffic jams and unscientific and unplanned growth and development is polluting our cities at an alarming rates. It is therefore, important for all city planners and administrators to accommodate breathing space for the cities and towns, her people and wildlife for a better life and quality environment. Elaborate planning for developing green city avenues and boulevards, protecting natural wetland areas and establishing new artificial wetlands within city limits



along with developing city parks and gardens and patches of artificial forests will be important. Although difficult to implement in developing and under developed nations; however, there needs to be some form of capping of maximum allowable population load for individual cities based on her infrastructure and carrying capacity. The rapid expansion of the real estate industry and old vehicles running on the city roads need to be sincerely monitored and regulated following stringent regulatory measures. Planting appropriate herbs, shrubs and trees at suitable locations around the cities need to be encouraged and enthusiastically implemented. Slum development is an essential component of sustainable city growth in developing and under developed nations. These are only handful measures to improve the environmental quality of the cities; however, more important is political will, proper environmental education and ecological consciousness of the citizens. Our cities need a breathing space for sustainability and their long term wellbeing and survival.



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Green Super Rice (GSR)

P. Zandi^{1*} & S. K Basu²

¹Institute of Crop Science, Beijing 100081, P. R. China Tel:1861214438

²UFL, Lethbridge AB Canada T1K 3M4; *E-mail: z_rice_b@yahoo.com

Climate change is an out of reach global crisis that has notable negative impact on smallholder farmers with limited land and financial resources. Abrupt changes in weather conditions can cause irreparable damage to their final harvest, which makes them more vulnerable. Releasing GSR varieties with multiple stress-resistant features can relieve farmer's pains and assist them in creating a more successful livelihood.

GSR varieties are composed of almost 500 promising rice varieties and hybrids with the capability to withstand abiotic stresses including salinity, floods and drought, which are particularly more deleterious. They have proven to be more resistant despite receiving less inputs, such as pesticides and chemical fertilizers, that have an adverse impact on human beings and the environment.

Objectives of the Green Super Rice Project

The GSR project, which at first was funded by the Chinese Government and the Bill & Melinda Gates Foundation, has pursuing the following goals:

- Development of the second generation of GSR inbred and hybrid rice varieties for rice growing countries in Africa and Asia through implementing a shuttle breeding (or molecular marker assisted breeding) approach;
- Resequencing 3,000 rice accessions belonging to the core collection of rice germplasm and parental lines in the GSR breeding programs and making and extending a global genotyping platform for rice molecular breeding programs;
- Examining and releasing FRESHLY developed PROMISING GSR varieties in the considered African and Asian nations;
- Development of highly efficient and the most updated approaches in seed production technology and distribution of developed GSR rice varieties in the considered African and Asian nations;
- Adoption and development of appropriate crop management technologies with national agricultural research and extension systems for newly developed GSR varieties in diverse target environments;
- Building a reasonable trajectory in target African-Asian countries from the perspective of GSR breeding technology and seed production;
- Testing project effect; and
- Efficient management of the GSR project.

Rice is the main staple food for more than one fourth of the world population. In the last 50 years ago, rice yield performance has encountered two big leaps. Increasing harvest index through reducing plant height, utilization of semi dwarf genes or even making use of heterosis phenomena by producing hybrid rice could possibly increase rice yield (genetic improvement). Moreover, rapid population growth and economic development tend to increased food production. During the last decades several major national and international attempts have been made to break the present yield ceiling in rice through developing super rice or super hybrid rice.

In north part of Iran farmers usually suffer from permanent climatic disasters, such as water shortage, low rainfall during cropping season, heat stress or even flooding.

The GSR project is very useful for the rice growing regions as to help farmers grow rice with peace of mind. Before writing over the main challenges ahead of the GSR project we should repeatedly emphasis



Fig 1 : Rice field showing temporal climate changing effect (drought stress) on Hashemi rice variety in north part of Iran (Guilan Province, Fouman County, rural zone) Photo courtesy: Peiman Zandi.

that local farmers usually disregard to accept new techniques because they have to be sure that their final harvest will be sold with ease.

In Iran particularly in Guilan province farmers have their own policy and do not easily change the local rice varieties like 'Hashemi' or 'Ali Kazemi' with newly introduced or promising varieties irrespective of possessing superior features. Dr Johar Ali, a senior researcher in the field of Green super rice project, has been working in Rasht Research Institute for more than 5 years. He came to Iran as to introducing hybrid rice technology and replacing it with traditional varieties. Later late Dr Dorosti has also been working with Dr Johar Ali. His contribution to this project was undeniable as he introduced new Hybrid Rice variety known as Bahar 1. Unfortunately, after all efforts made by Dr Johar Ali the Hybrid rice project, regardless of some regional progress, could not be proceeded any further and remained inchoate. Anyhow, as in any new project there must be a number of challenges to achieve the goal of increasing rice production following a sustainable trajectory (Yorbe et al., 2014):

1. The vast majority of insects (stemborers, leafrollers, brown plant hoppers, *Nilapar-vata lugens*) and diseases (blast, bacterial blight, sheath blight) in most rice-growing areas. For a long period, insect/disease control was deeply contingent upon indiscriminate applications of chemical pesticides. Intensive use of chemicals has been found to be less effective since it poses producers and consumers to severe health crises, eradicate natural enemies and creates serious environmental pollutions.
2. Over application of fertilizers application. This challenge has been started since 40 years ago and triggered several main (lodging, pest damage, yield loss, poor eating and cooking quality) side effects, such as reduction in economic return and placing an unbearable burden on the farmers and out of range enrichment of water with nutrients in the environment. Therefore, relying on crops that are less dependent on excess application of fertilizers is a turning point in sustainable agriculture.
3. Water shortage is a global crisis. Drought stress is the most important limiting factor in rice producing regions. Insufficient rainfall, uneven dissemination of rainfall and variation in rainfall patterns are known as the main factors in inducing stress.
4. The productivity level in marginal lands where rice is mostly cultivated in is low due to combination of several constrains including drought, soil's poor fertility and some other adverse environmental conditions.

Historically, many breeding programs built on the basis of rice grain quality. Primitive rice high- yielding cultivars and hybrids had relatively poor quality. Concurrent to the increased living criteria, a

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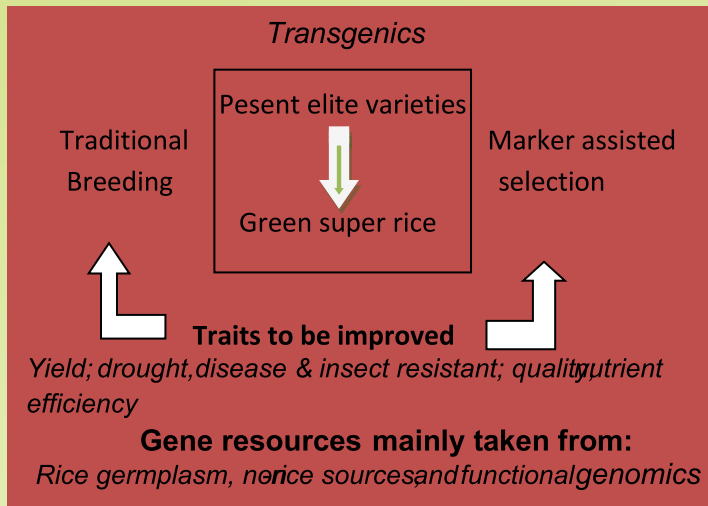


Fig 2: Development of GSR through a combination of approaches and related genes (Source: Zhan, 2007).

serious attention has been made toward cooking, eating and appearance quality of rice.

Almost more than half of the world's communities in developing nations are suffering from micronutrient malnutrition. Therefore, rice production should enhance in two dimensions of quality and quantity while being fully in coordination with its environmental growth (sustainable yield) condition. Ensuring a sustainable production requires a stepwise reduction in application of agricultural inputs, such as fertilizers, pesticides, and water. The main goal of Green Super Rice (GSR) is to increase both yield and quality consecutively while reducing rudimentary inputs.

To sum up, GSR should subtend at least five exclusivities: being adequately resistant to major diseases and/or insects, being highly efficient in nutrient absorption, transmission and utilization, being resistant to abiotic stresses namely drought stress, having favorable quality and high stability, and possessing advance yield potential (Figure 2).

As seen in Figure 1, development of GSR project is highly contingent on a compilation of various strategies to be formulated through amalgamating genomic resources, germplasm, molecular technology and breeding with target traits (i.e. N- and P-nutrient efficiency, quality, yield, insect and disease resistances, drought resistance) (Zhan, 2007).

For identification of genes/ germplasm with close association to the earlier defined traits we need to chase for the below mentioned approaches (Yorbe et al., 2014):

1. Screening of germplasm collections;
2. Mapping and identification of genes;
3. Screening of mutant libraries;
4. Microarray analysis of differentially regulated genes;
5. Functional test of candidate genes by transgenic analysis

It should be pointed out that any tangible progresses in identifying the corresponding genes and the GSR development have all been referring to the following items (Yorbe et al., 2014):

- Resistance to Stemborers and Leafhoppers
- Resistance to BPH
- Identification of Genes for Disease Resistance and Development of Disease-Resistant Rice
- Identification of Genes for Nutrient-Use Efficiency: Identifying genes for N-use/ P-use efficiency

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Vol. 20 Issue - 04 (Monthly) April 2017

From
NATIONAL ENVIRONMENTAL SCIENCE ACADEMY
 206 Raj Tower -1, Alaknanda Community Centre,
 New Delhi -110019. Ph.: 011-2602 3614
 E-mails: nesapublications@gmail.com; nesapub@yahoo.co.in

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For further details and **NOTES FOR AUTHORS**, please contact Academy at
nesapublications@gmail.com; nesapub@yahoo.co.in

- Identification of Genes for Drought Resistance and Development of Drought-Resistant Rice
- Identification of Genes for Quality Improvement
- Identification of Genes for Yield Traits

Then, the identified genes would incorporate into breeding lines through MAS and/ or transformation approach. Eventually, accumulation of desired genes would tend to prosperous improvement of rice cultivars (GSR technology).

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