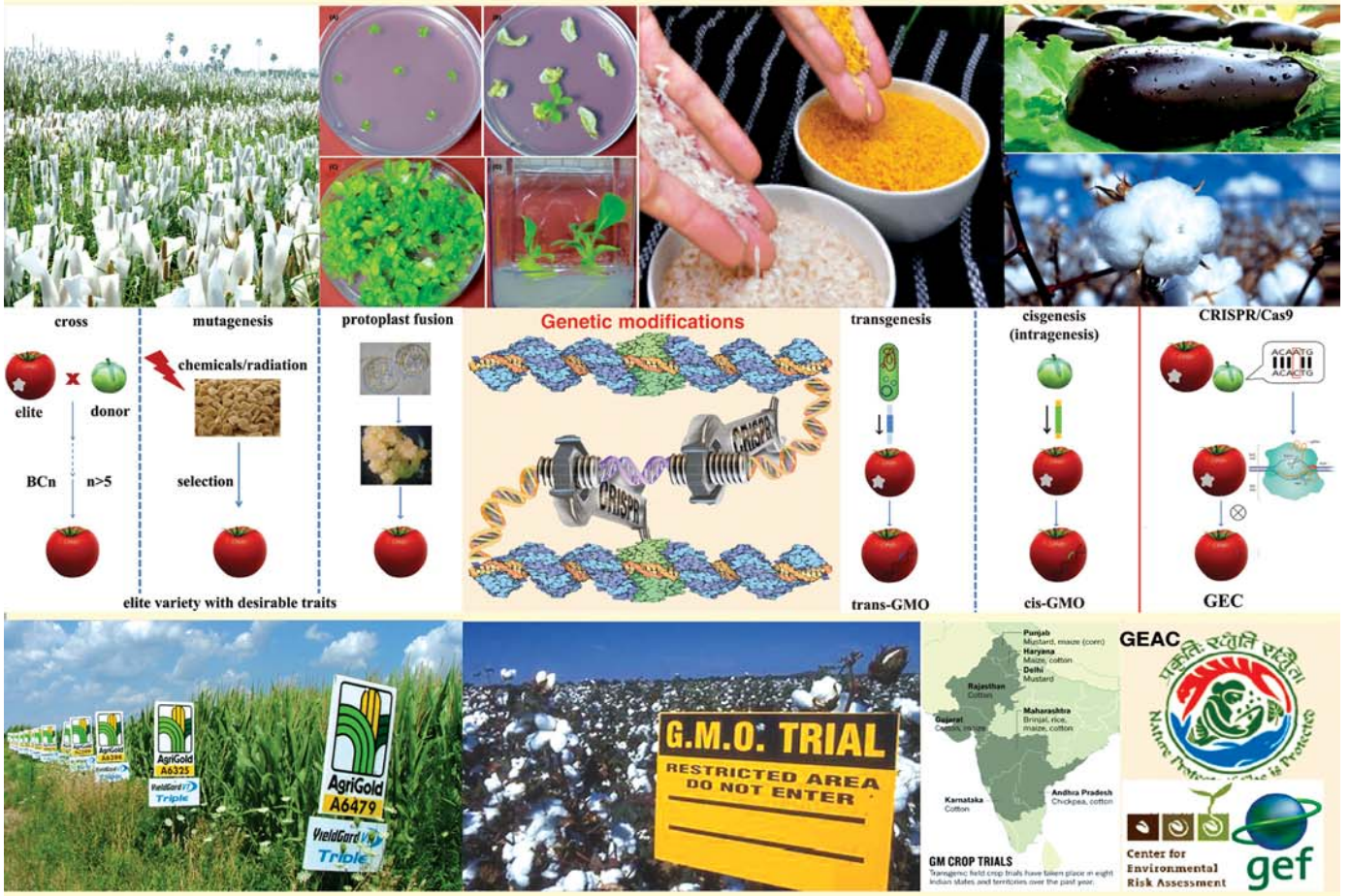
National workshop on

"Regulatory Mechanisms, Transgenic Technology and Applications in Plants"

RMTTAP 2018

2-3 August, 2018



Jointly organized by

Department of Botany and Microbiology
Acharya Nagarjuna University
Nagarjuna Nagar-522510
Guntur, Andhra Pradesh, INDIA

Indian Institute of Science Education and Research Tirupati (IISER Tirupati)
Mangalam, Tirupati -517507
Andhra Pradesh, INDIA

Venue: Diechman and John David Auditorium, Acharya Nagarjuna University

Dr. K. Mallikarjuna, Convener, convenerrmttap2018@gmail.com

Focal Theme: 'Emerging technologies for transgenic plant production and their potential applications for increased plant productivity and stress tolerance.'

Since the dawn of human intellect, mankind had been trying to domesticate plants and use them in a sustainable way. He domesticated plants by selective and cross-breeding, and introduced genetic variations through random mutagenesis. The dramatic change in agriculture production was evident with the green revolution propounded by Norman Borlaug, MS Swaminathan, and G. Kush, that enabled the world's food supply to be tripled during the last three decades of the 20th century. The extraordinary increase in agricultural productivity was made possible with improved varieties of crops coupled with advances in crop management. Green revolution driven intensive agriculture (high input and high yield) has served the needy population but has affected soil health and caused enormous damage to the environment. Mean while, world's population has increased from 2.5 billion to 6.1 billion in the last 50 years and it is unlikely to stabilize before 2100 by which time another 3 billion people will inhabit the planet. Thus there is desperate need to produce more food from less land with less water and reduced agrochemical inputs. The required high yield / high quality / low cost / low environmental impact crops can be delivered by the exploitation of the techniques of plant biotechnology in molecular breeding strategies.

With the discovery of DNA as genetic material, various gene regulatory mechanisms, molecules and pathways involved in the determination of novel plant phenotypes were uncovered. Several agriculturally beneficial trait genes are functionally validated in model plants like *Arabidopsis*, Rice and *Chlamydomonas* with a scope for their expression in agricultural plants. Plant transformation involving a stable integration of the functionally characterized gene of interest into the plant genome was initially developed using a modified strain of *Agrobacterium tumefaciens.* Plant transformation using *A.tumefaciens* Ti-plasmid derived vectors have been successfully achieved in several pulses. Though it gives a low percentage of transformation without transgene rearrangement and silencing, it has been widely adapted. The restricted host range of *Agrobacterium* renders infection of monocots difficult. Because of this reason, maize was transformed by particle bombardment. In contrast, particle bombardment is encountered with high copy numbers along with transgene rearrangement and silencing. In addition to *A.tumefaciens* mediated based method, biolistics, protoplast uptake, and *in planta* transformation using flowers and shoot tips of young seedlings were commonly used. Transgenic plants with tolerance to herbicides and insects in Maize, Soybean, Cotton, Canola, Sugar beet, Alfalfa were successfully produced. Papaya and Squash plants with resistance to the virus, and Soybean and Canola with high oleic acid content are generated. Potato with reduced asparagine content and Apple with delayed browning generated.

Genome Editing (GE) Technologies

Though above methods represent first-generation plant transformation technologies, they cause random and multiple integrations of transgenes into the host genome resulting in unwanted phenotypes. With the advent of 'OMICs' era, several agricultural plant genomes have been sequenced paying the way for very precise genome editing for genetic improvement of them.

The current and latest approaches for precise, efficient gene targeting or genome editing are highly important for functional genomics analysis of plants and for production of genetically engineered crops. The efficient genome editing technologies rely on induction of double-strand breaks (DSBs), integration of transgene or modification of target sequence at the site of cleavage followed by repair of double-strand breaks (DSBs) via non-homologous end-joining (NHEJ) and homology based repair

(HR) pathways. For creating DSBs at target loci, sequence-specific nucleases, like Zinc Finger Nucleases (ZFNs) and Transcription–Activator Like Effector Nucleases (TALENs) have emerged as powerful tools for targeted genome editing in eukaryotic organisms. Very recently, another DSB based breakthrough technology for genome editing, the Clustered Regularly Interspaced Short Palindromic Repeat (CRISPR) associated system (CRISPR/CAS9) was developed. *Agrobacterium*–mediated transformation is a routine method used to generate transgenic plants, and a few binary vectors have been designed to deliver CRISPR/CAS9 system into plant genomes. The integration of Genome Editing (GE) with plant breeding and genetic engineering collectively referred to as New Breeding Technologies (NBTs) will impact the productivity of current food crops, and develop underutilized wild species to improve global food security.

RNAi Mediated Genetic Engineering

RNA interference (RNAi) is a natural mechanism that regulates gene expression and defense against pathogens and has been exploited for targeted silencing of genes of interest in many eukaryotes. RNAi using double or single-stranded RNA with sequence complementary to endogenous RNAs are widely used to knock- down the expression of genes to know their biological function in various organisms. RNAi holds a great promise for effective management of agricultural pests and in crop protection and relies on stable expression of double-strand (ds) RNAs that target essential genes in pest insects. In plants, short RNA (microRNA) mediated RNAi is critical for regulating host immunity against microbes. Host induced gene silencing (HIGS) by transgenic expression of pathogen gene-targeting dsRNA has the potential to become vital disease control method. Emerging strategies for crop protection involve the extended treatment of plants with dsRNA to trigger RNAi.

Uses of Transgenic Plants

Transgenic crops have the potential to promote revolutionary change in agriculture, industry, nutrition and even medicine. By manipulating plant genomes, crops can be engineered to provide enhanced nutritional value and to be resistant to biotic and abiotic stresses. Further, plant raw materials can be better adapted to the requirements of industry, and ‘green factories’ can be used to produce a host of novel products, including pharmaceuticals, in an environmentally benign and sustainable manner.

Bio-safety of Genetically Modified Crops

There is a lot of resistance from general public and environmental activists owing to the association of foreign and antimicrobial genes in transgenic plants due to following reasons. Primary worry is the transfer of antibiotic resistance from GM food consumed by people into the human gutmicrobiota, which might result in a disease-causing bacterial population to become resistant to antibiotics.

Transgenics may affect population dynamics of the target and non-target pests and may lead to the evolution of new insect biotypes. The transgene may escape into environment by horizontal gene transfer (HGT) into local flora and selective breeding of superior and elite genotypes may cause erosion of biodiversity and may push some of the land races out of cultivation. Production of transgenic plants may confer potential benefits to consumers and farmers, but due to increasing seed market, the developing countries may get dependent on few suppliers. Countries with effective and efficient technology will obtain and sustain advantage of the international market.

Classical and Marker Assisted Breeding Techniques

With the association of bio-safety, bioethical, environmental and socio-economic issues surrounding the production and use transgenic plants, plant breeders have changed the paradigm by focusing on the natural genetic diversity as a mean of adaptive potential and focused on germplasm of unknown and unexplored, wild and rare genotypes. In addition to this, extensive work is going on marker-assisted selection and breeding involving back crosses. Marker-assisted selection or marker-aided selection(MAS) is an indirect selection process where a trait of interest is selected based on a marker (morphological, biochemical or DNA/RNA variation) linked to a trait of interest, rather than on the trait itself. For example, using MAS to select individuals with disease resistance involves identifying a marker allele that is linked with disease resistance rather than the level of disease resistance.

Sub-themes of the Workshop

1. rDNA and tissue culture based classical *A.tumefaciens* mediated transformation.
2. Application of precision breeding mediated by genome-editing tools like ZFNs and TALENs for crop improvement.
3. Low-cost simple, technology of the day, CRISPR-CAS9 genome-editing of crop plants.
4. RNA interference (RNAi) mediated plant transformation.
5. Forward genetics approaches for improving the yield.
6. Next generation tools and their applications in plant genomics.
7. Marker assisted selection and breeding.
8. Bio-and environmental-safety issues and transgenic plants.

Objectives of the Workshop

1. To bring awareness on technological advancements in the field of transgenic and non-transgenic plant improvement.
2. To transfer the knowledge for generating knowledge and information-based bio-economy and growth in less developed areas by practical training and theoretical lectures.
3. To train the manpower in the field of plant transformation technology.
4. To generate wealth of knowledge or products out of the traditional knowledge back ground of UG and PG teachers, researchers and students by exposing them to latest genetic engineering and genome-editing technologies.
5. To fully explore the latest technology for national development to meet the growing agricultural produce demand due to population explosion.
6. To bring awareness on next generation and high through put tools, molecular markers and their assisted breeding and bio-safety issues concerned with transgenic plants.
7. Information on how gene regulatory mechanisms and their elements were identified may spur innovations in other allied fields of biology.

National Scientific Advisory Committee

Prof. BJ Rao
TIFR, Mumbai and IISER-Tirupati

Prof. MV Rajam
Delhi University, South Campus, New Delhi

Prof. Arjula R Reddy
University of Hyderabad, Hyderabad

Prof. Sudip Chattopadhyay
National Institute of Technology (NIT), Durgapur

Prof. MK Reddy
ICGEB, New Delhi

Prof. Subra Chakraborthy
National Institute of Plant Genome Research, New Delhi

Prof. P. Suprasanna
Bhabha Atomic Research Center (BARC), Mumbai

Organizing Committee

Chief Patrons :
Prof. A. Rajendra Prasad
Vice-Chancellor, Acharya Nagarjuna University

Prof. K.N. Ganesh
Director, Indian Institute for Science Education and Research, Tirupati

Patrons :
Prof. Basuthkar. J Rao
Indian Institute for Science Education and Research, Tirupati

Prof. K. John Paul
Registrar, Acharya Nagarjuna University

Prof. K. Chandan
Principal, University College of Sciences, ANU.

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Vice-chair : **Dr. SM. Khasim**

Treasurer : **Dr. V. Umamaheswara Rao**

Members : **Prof. M.Vijayalakshmi, Dr. M.Raghuram, Dr. A. Amruthavalli, Dr. J. Madhavi, Dr. YRKV Tirupati Rao, Dr. P.S.N.Raju**

CONVENER
Dr. K. MALLIKARJUNA
ANU-GUNTUR
convenerrmttap2018@gmail.com
Cell: 09866402962

CO-CONVENER
Dr. ESWARAYYA RAMI REDDY
IISER TIRUPATI
eswar.ramireddy@iisertirupati.ac.in
Cell: 08374573719

List of Speakers Consented for the Workshop

1. **Prof. B J Rao** - IISER Tirupati (Formerly, Senior Professor at TIFR, Mumbai).
2. **Prof. Arjula R Reddy** - Emeritus Professor at University of Hyderabad. Former VC, YVU.
3. **Prof. MV Rajam** - Senior Professor, Delhi University South campus, New Delhi.
4. **Prof. Sudip Chattopadhyay** - National Institute of Technology, Durgapur, West Bengal.
5. **Prof. MK Reddy** - International Centre for Genetic Engineering and Biotechnology, New Delhi.
6. **Prof. Shubra Chakraborthy** - National Institute for Plant Genome Research (NIPGR), New Delhi.
7. **Prof. P. Suprasanna** - Bhabha Atomic Research Centre,(BARC), Mumbai.
8. **Dr. C. Rajanikanth** - Bhabha Atomic Research Centre, (BARC), Mumbai.
9. **Dr. Anjan Banerjee** - Indian Institute of Science Education and Research (IISER), Pune
10. **Dr. Tanusri Kaul** - International Centre for Genetic Engineering and Biotechnology, New Delhi.
11. **Dr. P.V. Shiva Prasad** - National Centre for Biological Sciences (NCBS) (TIFR), Bangalore.
12. **Dr. Eswarayya Rami Reddy** - Indian Institute of Science Education and Research Tirupati.
13. **Dr. P. Sudhakar Reddy** - International Crop Research Institute for Semi Arid Tropics, Hyderabad.
14. **Dr. P. Ratna Kumar** - Indian Institute of Oil Seeds Research (IIOR), Hyderabad.
15. **Dr. S. K. Ghosh** - Trimurthy Plant Sciences Pvt Ltd, Hyderabad.
16. **Dr. Akila Chandrasekhar** - Yogi Vemana University, Kadapa.
17. **Dr. G. Mallikarjuna** - Agribiotech Foundation, Rajendra Nagar, Hyderabad.

Registration

The organizing committee cordially invites applications and registration from research scholars, under graduate and post-graduate biology teachers with exposure to the field of biotechnology and allied fields of biology. All the participants are requested to register for the workshop by sending the filled-in registration form along with prescribed fee payable at **RMTTAP-2018, SBI A/C No. 37677149493 (IFSC Code: SBIN0004793),** State Bank of India, Acharya Nagarjuna University Campus on or **before 30th June, 2018**. **No spot registration will be entertained.**

	* Registration	
	Early bird registration **(up to 30th June, 2018)**	***Late Registration*** **(20th July, 2018)**
Delegate	Rs 2000/-	Rs. 2500/-
Accompanying person	Rs. 1000/-	Rs. 1500/-
Research scholars	Rs. 1500/-	Rs. 2000/-
Local M.Sc students	Rs. 500/-	Rs. 500/-

* Registration fee covers a kit with brochure, practical manual and reprints of reviews, food and coffee / snacks during the workshop.

Accommodation

Limited accommodation is available in the University Campus; therefore, it will be provided on "first-come and first-serve basis". Those who need accommodation are requested to contact convener, E-mail: convenerrmttap2018@gmail.com and Mobile: 9866402962.

About the Host Institution

Acharya Nagarjuna University is one of the fastest developing universities in the State of Andhra Pradesh, India and is named after the great Buddhist philosopher, Acharya Nagarjuna. Acharya Nagarjuna University has been grown into a large university with 58 academic departments and 67 courses of study covering the colleges of Guntur and Prakasam districts. Now, the University has 341 affiliated colleges offering undergraduate and postgraduate courses in various disciplines of biological and physical sciences, engineering, pharmacy, mathematical sciences, social sciences including rural development, planning and architecture, commence and hotel management, education, legal studies, physical education, oriental languages, buddhist philosophy, physical education etc. The University has one PG Centre at Ongole in Prakasam district.

About the Department of Botany and Microbiology

The Department of Botany had its humble beginning in 1967 as one of the science departments of erstwhile Andhra University Post-Graduate Centre, Nallapadu (Guntur, Andhra Pradesh). Subsequently, this PG Centre was elevated as Nagarjuna University in 1976. The strong foundation for the Department of Botany in terms of its strength in teaching and research were laid down by former professors viz., A.S. Rao, Ph.D.(Cantab), P. R. Mohan Rao, Ph.D.(Delhi), Post-doc(Cambridge; Sydney Sussex Fellow), P. N. Rao, N. Lakshmi, D. Santha Kumari, T. N. Mary, K.V.Mallaiah, K.Bayyapu Reddy, Z.Vishnuvardhan and M.Vijayalakshmi. The legacy of the Department has been kept up through recruitment of highly qualified staff, succession of successful Heads of the department with efficient administrative activities and research scholars and students of outstanding quality. In 1992, Microbiology course was offered by the department and subsequently department was renamed as Botany and Microbiology in 2008. Several research projects funded by CSIR, UGC, DNES, APSEB, ICAR, DAE, BSI, SERB, DBT and DST have been successfully completed by the faculty and several projects are ongoing in the department. Our department was strengthened with UGC Non-SAP, SAP & DST- FIST. Further, Herbal Garden with nearly 300 species of medicinal plants is maintained in our Botanical Garden, serving the needs of researchers and professionals.

Location and Tourist Interest Places

Sprawling about 300 acres of area in serene environment with lush-green vegetation, Acharya Nagarjuna University is located 22 km from the south of Vijayawada and 5 km from the north of Guntur. It is now in New Amaravathi, the capital region of Andhra Pradesh. Vijayawada and Guntur are well connected by rail and road from all capital cities of India. Both the cities are roughly 280 km from Hyderabad and 400 km from Chennai. Vijayawada with a domestic airport, is well connected with Hyderabad, Chennai, Delhi and Bangalore by air. The nearest international airports are Hyderabad, Chennai and Bangalore. Reception counters will be put up at the exit point of airport in Vijayawada as well as railway stations in both Vijayawada and Guntur cities. Both Vijayawada and Guntur cities are known for their cultural importance, business and education. Famous places of religious, archaeological and tourist interest are also located in these cities. Kanakadurga Temple, St. Mary's Church, Victoria Museum and Bhavani Island of Vijayawada, Amaravathi, Mangalagiri and Kotappakonda of Guntur are important places of tourist interest.

Important dates` to be remembered

Deadline for early registration **: 30th June**, 2018
Deadline for late registration **: 20th July**, 2018

Acharya Nagarjuna University
and IISER Tirupati

Two-day Joint National Workshop on

"Regulatory Mechanisms, Transgenic Technology and Applications in Plants".

RMTTAP2018
2-3 August, 2018

REGISTRATION FORM

Title : Prof./Dr./Mr./Mrs./Ms.

Name :

Affiliation :

Address :

State :

Phone : Fax: Mobile:

Email :

Whether the registration fee paid:

Application and registration fee receipt should be sent through email attachment to convenerrmttap2018@gmail.com