COMPENDIUM ON TECHNOLOGIES DEVELOPED AND IN THE PROCESS OF COMMERCIALIZATION/COMMERCIALIZED

BY

NIPGR, NEW DELHI (2015-2021)

Sl No	Title	Background	Technology Relevance & Application	TRL	Patent
1.	System for delaying ripening of agricultural produces	Farmers and retailers currently facing huge losses due to the increased activity of fruit ripening and fully ripened fruits are prone to infections and spoilage.	The developed device is based on the use of nitric oxide pathway in plants activated from a formula developed in this innovation. The device-based technology has been engineered using temperature sensors. The device operates to delay ripening and transport friendly and help to reduce the cost of refrigeration and transportation. A start-up venture with a name Fruvetech Pvt. Ltd. has been registered	TRL8	Granted
2.	Method for extending shelf-life of fruits and vegetables using hypoxia induced Nitric Oxide	Farmers are losing a proportion of their income due to a lack of post-harvest storage technology.	This technology accentuates the importance of nitric oxide NO in plants which are conceptualized as a formulation. The innovation is the first of its kind using a phenomenon of leaf nitrogen metabolism to enhance fruit shelf-life via modulating the ethylene metabolic pathway.	TRL7	Granted
3.	Development of a high-yielding protein-rich *desi* and *kabuli* variety in chickpea	The high-yielding Indian *desi* and *kabuli* varieties generally have low seed weight and less seed protein content. Hence, there is a need to improve these traits.	Two improved *desi* and *kabuli* lines are developed through marker-assisted breeding of the superior natural alleles of an ABC transporter gene that exhibited overall 7.8% increase in seed weight, 13% enhancement of yield/productivity as well as 15% increase in protein content.	TRL7	Under AICRP Trial
4.	Development of a semi-erect chickpea cultivar with enhanced planting density and productivity	Chickpea cultivars are mostly spreading/semi-spreading types and thus covers minimal planting density (low productivity) and also not amenable to mechanical harvesting.	Improved *desi* lines are developed through marker-assisted breeding of the superior natural alleles of a *CabHLH121* transcription factor gene which showed restructured semi-erect plant type with desirable canopy width and semi-dwarf plant height.	TRL7	Under AICRP Trial
5.	A formulation and a method for inducing defense response in plants	Agricultural produces suffer from an array of plant pathogens deteriorating the quality.	A simple and efficient method has been developed for inducing plant defense responses by a) coating a substrate with a composition comprising sodium dithionite, and (b) treating a part of a plant with the sodium dithionite coated-substrate, wherein the treating leads to induction of defense responses.	TRL6	Provisional granted

6.	Low glucosinolate transgenic mustard	Indian oilseed mustard (*Brassica juncea*) cultivars contain relatively high amounts of seed glucosinolates, which are known to be anti-nutritional and reduce the meal palatability.	Nutritionally improved transgenic mustard lines containing 'low levels of anti-nutritional seed-glucosinolates' on par with the Canola oil standards has been developed through targeted suppression of MYB28, a transcription factor gene. Evaluation of the agronomical performance and compositional analysis established the lines as the best performing low glucosinolate transgenic events at BRL-level trial.	TRL6	Filed Under event selection trial
7.	Development of drought tolerant high-yielding chickpea variety	Extensive loss of yield and productivity occurs in chickpea during drought stress.	Improved *desi* lines are developed through marker-assisted breeding of the superior natural alleles of a *CabHLH10* transcription factor gene that enhances yield and productivity during drought stress without compromising agronomic performance.	TRL6	Under AICRP Trial
8.	Enhanced shelf life of fruits & vegetables	The post-harvest losses of fruits and vegetables in the developing countries account for almost 50% of the produce. India, the world's second largest producer of fruits and vegetables, loses 35–40% of produce because of excessive softening, which influence the shelf life and limits storage and transportation.	Cell wall localized *N*-glycoproteins and free *N*-glycans induce fruit softening. Two novel genes encoding *N*-glycan processing enzymes, *α-Man* and *β-Hex* were targeted to control fruit softening during ripening using RNAi technology that provides a strategy for shelf life improvement in tomato and capsicum, which can be extended to other important fruit and vegetable crops as well.	TRL5	Granted
9.	A polynucleotide encoding an ergosterol biosynthesis enzyme, Δ7-sterol-C-5-desaturase from tomato to enhance stress tolerance.	Abiotic stress like drought and phytopathogens like *Sclerotinia sclerotiorum* cause substantial loss in crop yield each year throughout the world.	The present disclosure also provides recombinant DNA constructs that provides a method for obtaining a transgenic plant that expresses a polypeptide with C-5 sterol desaturase activity that confers enhanced drought tolerance, pathogen resistance, and nutritional quality	TRL5	Granted
10.	Method of producing stress tolerant plants overexpressing CaSUN1	There is a current pressing need to develop new varieties of food crops that are better equipped to handle water deficit.	The claims in the patent include the identification of a novel stress-responsive protein, CaSUN1, from a grain legume chickpea. The invention discloses a method of producing transgenic plants overexpressing CaSUN1 to enhance stress tolerance.	TRL5	Granted
11.	Method of generating stress tolerant plants over-expressing CaRRP1, reagents and uses thereof	The invention relates to the identification of extracellular matrix localized CaRRP1, isolation, and cloning of the gene encoding same from chickpea and its role in stress tolerance.	The technology relates to heterologous expression of CaRRP1 in a transgenic system to facilitate better adaptation under adverse environmental conditions.	TRL5	Granted

12.	Novel Protein Against Fungal Pathogens	Fungal diseases, like sheath blight are posing a great challenge, as many of them are polyphagous and a natural source of complete disease resistance is not available.	The invention relates to the identification of a novel protein from *Burkholderia gladioli* strain NGJ1 which demonstrates strong anti-fungal activity against a wide range of fungi, including *Rhizoctonia solani*, *Magnaporthe oryzae*, *Phytophthora sp*., *Saccharomyces cerevisiae*, *Candida albicans.*	TRL5	Granted
13.	A conjugate comprising gold nanoparticles and *Venturia inaequalis* specific probes and kits comprising the same for the detection of apple scab	The innovation relates to the development of a simple, sensitive, cost-effective and onsite visual (colour change based) detection system for detection of *Venturia inaequalis*, the cause of apple scab disease.	The system can detect the pathogen in the asymptomatic samples collected from the field as well as artificially samples under control greenhouse conditions. The system can be adopted in the apple scab disease management program and could be useful in recommending the need-based spray of fungicides.	TRL5	Filed
14.	Method for producing transgenic plants overexpressing non-symbiotic hemoglobin class-1 gene, and applications thereof	Tomato yield is important because, tomatoes and tomato products are some of the most familiar consumables in the normal human diet.	Transgenic plants overexpressing the non-symbiotic hemoglobin class-1 gene was developed. The developed transgenic tomato plants showed an increased number of fruits per plant, which can be directly correlated with the enhanced yield per plant.	TRL4	Provisional granted
15.	Method of producing thermotolerant wheat overexpressing Ta2CP.	The invention is directed to a method of developing thermotolerant plants by overexpression of wheat Ta2CP.	Thermotolerance in wheat is achieved by overexpression of Ta2CP involved in redox pathway.	TRL4	Under consideration
16.	Novel genes and method for developing vascular wilt disease tolerant chickpea	Fusarium oxysporum, a hemibiotrophic ascomycete is a major constraint and ranks fifth among plant pathogens of economic importance, which highly threatened the chickpea production worldwide.	The invention relates to functional genomics and fungal stress responsive genes & novel regulators from chickpea and development of genetically engineered wilt resistant chickpea cultivar for better climate resilience and higher productivity.	TRL4	Granted
17.	Method of producing virus tolerant and healthy crops tolerant to *Tomato leaf curl New Delhi virus*	Plant viruses are responsible for major losses in worldwide crop production. *Tomato leaf curl New Delhi virus* (ToLCNDV) causes severe yield loss (upto100%) in tomato.	Present disclosure relates to a method of generating *SlMyb33* overexpression transgenic tomato plant lines with significantly tolerance to ToLCNDV.	TRL3	Filed
18.	Nucleic Acids Encoding Artificial RNA against *AC1* Gene and Methods of Developing Tolerance against ToLCNDV Infection	*Tomato leaf curl New Delhi virus* (ToLCNDV), a bipartite Begomovirus (family Geminiviridae) has been found to causes partial to complete (upto 100%) yield loss in tomato.	Present method provides artificial miRNA (amiRNA-AC1) targeting ATP/GTP binding domain of *AC1* gene. Transgenic lines of tomato over-expressing amiR-AC1 showed reduced disease symptoms.	TRL3	Filed

19.	A method for enhancing heat tolerance and photosynthetic efficiency in rice plant	Prolonged heat stress severely affects productivity of rice.	Transgenic rice lines expressing *SisHSP21.9*, a chloroplast-localized molecular chaperone, exhibited thermotolerance and improved plant architecture together with enhanced yield.	TRL3	Filed
20.	Development of a Pan-genome Genotyping Array for accelerated crop improvement of rice and chickpea	Pan-genome based genetic mapping approach is emerging as an attractive strategy to identify trait-associated genetic variants that are missing from the traditional reference genome.	A first-ever pan-genome based SNP genotyping assay i.e., "Pan-genome 90K SNP Genotyping Array" for two major cereal and legume food crops, rice and chickpea have been developed. It enables researchers to target population-specific genomic variation by assaying SNP markers unique to different populations in addition to markers from reference genome.	TRL3	Under consideration
21.	A metabolite to increase insect tolerance in plants	Insect herbivores cause great amount of crop loss in vegetable crops by feeding on leaf and diverse plant parts	Chlorogenic acid (CGA) is one of the most abundant polyphenols in plants and a nutritional antioxidant in plant-based foods. Effectiveness of chlorogenic acid in insect growth deterrence has been shown in tomato. To check efficacy of chlorogenic acid as an anti-herbivore defence molecule against wide range of insect pests under field conditions.	TRL3	Under consideration
22.	Apoplast based detection of sugar as a diagnostic marker for identification of bacterial speck disease in tomato	Bacterial speck of tomato causes considerable loss in crop yield worldwide. Till date only PCR based techniques are available for in planta detection of pathogens.	The technology relates to sensing pathogen presence in crop by early detection of marker metabolites in the crop using a kit based on-site detection system.	TRL2	Under consideration