**Recommendations for scientific community (in brief with title) / Patent**

**Year 2015-16**

**1. QTL Mapping and development of SCAR marker for Fusarium wilt (*Fusarium oxysporum f. sp. ricini*) in castor (*Ricinus communis*).**

The scientific community involved in castor improvement are recommended to use below mentioned JAUC series of primers to transfer resistance toward fusarium wilt into the new genotype through Marker Assisted Selection (MAS) or Marker Assisted Backcrossing (MAB).

| Sr. No. | Primer name | Sequence | Product Length |
|---|---|---|---|
| 1 | JAUC1F | CAATGTCGAGCATAGCTGCC | 312 |
| | JAUC 1R | ACAATTGGCGAAGCAAGCTG | |
| 2 | JAUC 2F | GTCGAGCATAGCTGCCAACA | 166 |
| | JAUC 2R | ACGTTCAGCCAACAAAAGCC | |
| 3 | JAUC 3F | TGTCGAGCATAGCTGCCAAC | 853 |
| | JAUC 3R | ATGCCACCTCCAGCATACAC | |
| 4 | JAUC 4F | GTCAATGTCGAGCATAGCTGC | 389 |
| | JAUC 4R | GGTCCCTGATTACCAGACGC | |
| 5 | JAUC 5F | AATGTCGAGCATAGCTGCCAA | 864 |
| | JAUC 5R | TCACTAGCAATGCCACCTCC | |

**2. Sex determination of papaya (*Carica papaya*) through Molecular characterization.**

The scientific community involved in papaya improvement are recommended to use below mentioned JAUP series of primers to determine pre-flowering stage sexuality in 'Madubindu' variety of papaya.

| **Sr. No.** | **Name of Primer** | **Primer Sequence** | **Product Length** |
|---|---|---|---|
| 1 | JAUP1F | GCGTTTCGAGGAGATGGTCA | 410 |
| | JAUP 1R | ACCTAACAAACTTGGCTGGC | |
| 2 | JAUP 2F | TTTATTTCTTTCGGCTGCGGG | 782 |
| | JAUP 2R | AGCTGCTTCTTCACGCTCAT | |
| 3 | JAUP 3F | ACCCTCGGAAACAGGACAAG | 427 |
| | JAUP 3R | TTGGCATAACGGGTGTTGGA | |
| 4 | JAUP 4F | CCGCTCCCTCTTTTTCTGGT | 487 |
| | JAUP 4R | ACATGCAAGAGTGTAGCGCA | |

**3. QTL Mapping and development of SCAR marker for Macrophomina root rot in castor (*Ricinus communis*).**

The scientific community involved in castor improvement are recommended to use below mentioned JAUC series of primers to transfer resistance toward root rot into the new genotype through Marker Assisted Selection (MAS) or Marker Assisted Backcrossing (MAB).

| Sr. No. | Primer | Sequence | Product Length |
|---|---|---|---|
| 1 | JAUC6F | TGGTATTCGGGGCAGGAATG | 851 |
| | JAUC 6R | GAAAGCCCTCTGCCATCCAT | |
| 2 | JAUC 7F | GTGGGCATGGGTGGTATAGG | 622 |
| | JAUC 7R | CGCTCACCAAGTCCCACATA | |
| 3 | JAUC 8F | GTCTATGGATGGCAGAGGGC | 345 |
| | JAUC 8R | TCCAGGAAGGCGAGCTATCA | |
| 4 | JAUC 9F | GATGCCCTTGGGCTAAGCAT | 157 |
| | JAUC 9R | AGCCATTGCAATCGGTCTGA | |
| 5 | JAUC 10F | GGGGCAGGAATGAGGACAAG | 97 |

| | | | |
|---|---|---|---|
| | JAUC 10R | CCTATACCACCCATGCCCAC | |

**Year 2016-17**

**1. Biochemical and molecular characterization of phosphate solubilizing bacteria from different soil rhizosphere.**

It is informed to scientific community that among 17 PSBs, isolate derived from chickpea rhizosphere exhibited highest phosphate solubilizing index followed by isolates from pigeonpea rhizosphere and poultry farms. The best PSBs were confirmed as *Pseudomonas putida* and *Pseudomonas fulva.*

**Year 2017-18**

**1. Development of cultivar specific markers for the hybrids released by JAU in pearl millet.**

The scientific community involved in pearl millet improvement are recommended to use below mentioned JAUB series of primers for the identification of hybrids.

| **Primer Name** | **Primer Sequence** | **Product Length** | **Hybrid** |
|---|---|---|---|
| JAUB5F | CTGCTTCTTCTCGTAAT | 941 | GHB 538 |
| JAUB5R | TTCGCCAGGAGGGCGT | | |
| JAUB7F | ATCGCTACGTCTACGATG | 527 | GHB 558 |
| JAUB7R | TCTCCGATTAGGTCGTTG | | |
| JAUB17F | TACCTTTGTGTTGATGGTTT | 415 | GHB 577 |
| JAUB17R | CTACTCTTGTTCCTCCTCT | | |
| JAUB10F | CAACATACCTCTCGTACGGT | 1020 | GHB 719 |
| JAUB10R | TTTTCGGATAGTTCAAACAGT | | |
| JAUB1F | TAGCTGGGTAGAGGCTGACT | 249 | GHB 526 |
| JAUB1R | GCCTGTTGACAGTCCGTAGA | | |
| JAUB22F | CGCAGTGGATTATCCCTCTC | 354 | GHB 732 |
| JAUB22R | GGATGACCCTCGAAACCATA | | |
| JAUB24F | GGCATCTCGTTGTACCTCGT | 339 | GHB 744 |
| JAUB24R | AACAGCATCAGAGCGGACTT | | |
| JAUB27F | CTTGTGCCTTGGAGCTGTTT | 550 | GHB 757 |
| JAUB27R | GTGGCTGTTGTCATGAATGC | | |
| JAUB30F | TTAGCATTTTGCGCTTTGTG | 250 | GHB 905 |
| JAUB30R | GCATGAATCAGCCCATACAA | | |
| JAUB15F | TGTGTTCTAATGTGCTATGTA | 330 | GHB 941 |
| JAUB15R | CACTAAGCTTCATGACGTGAT | | |

**2. Development of cultivar specific markers for the varieties released by JAU in Groundnut**

The scientific community involved in Groundnut improvement are recommended to use below mentioned JAUG series of primers for the identification of groundnut varieties.

| Primer Name | Primer Sequence | Product Length | Variety |
|---|---|---|---|
| JAUG12F | CACCAAGTGGGAGAGGAAAA | 352 | GJG 22 |
| JAUG12R | CCAACACTACCCCATTCTGG | | |
| JAUG13F | GTGGCCAAAGATTTCACACA | 1201 | GJG 17 |
| JAUG13R | GTCCGATGGCAGCTCTATGT | | |
| JAUG1F | GTCGATGAGACGGCTAGTGG | 348 | GJG 31 |
| JAUG1R | TCGTGACGAGGGTGATCTCT | | |
| JAUG17F | TCGGGATGTGTTTATGTTGC | 386 | GJG 9 |
| JAUG17R | GGAGTTCGCACATTGTGTTG | | |

| | | | | |
|---|---|---|---|---|
| | JAUG20F | GCTGGTTAGTTGTGCGGATT | 409 | GJG HPS 1 |
| | JAUG20R | CTCCCCCTTATTGGATAGGC | | |
| | JAUG22F | CGAGTATCCCGAACCCTACA | 265 | GJG 20 |
| | JAUG22R | AAAAGGGTTGGTTTCGCTTT | | |
| | JAUG4F | CGCACGCATGCCCTAAATAC | 355 | GG 5 |
| | JAUG4R | TTGGGTGCGGATGAGAAAGG | | |
| | JAUG26F | TGAGGATTTGCCGTTTCTTT | 405 | GJG 7 |
| | JAUG26R | CCCGTCCCCAAATGATAGAT | | |
| | JAUG8F | AAACCGCTGTGTCTCTCTGC | 329 | GG 11 |
| | JAUG8R | GCCTGTTGACAGTCCGTAGA | | |

**3.** **Biochemical and molecular characterization of brinjal varieties and promising genotypes**

It is recommended to the scientific community that the most diverse varieties were found to be GOB-1 and JBGR-1 compared to the other promising genotypes and varieties based biochemical, nutritional analysis. The diverse GOB-1 contained higher protein, total soluble solids, soluble sugars, phenols, ascorbic acid, PPO activity and flavanoid content and lower in glycoalkaloids and acidity. The clustering pattern on the basis of molecular analysis (SSR) depicting diverse varieties GOB-1 and GJB-3 out grouped from other genotypes with 48 % similarity.

**4.** **Genome sequencing of pathogenic *Macrophomina phaseolina* isolated from castor.**

It is recommended to the scientific community involved in castor improvement that the sequencing of plant pathogenic fungi *Macrophomina phaseolina* showed the size of genome is 98.6 Mb. The draft genome having 3061 contings, 30756 genes, 183303 exon, 28096 SSR and 13947 repeat region present in the genome. In genome 24.30 % of genes involve in molecular function, 34.27% of genes involve in cellular component and 41.43% of genes involve in biological process. pathogenicity related genes identified in this study have high relevance in future fungicide designing and following primers will be used for the specific identification of pathogenic fungi *Macrophomina phaseolina*.

| Name | Primer 3'-5' | Product length | GC% | Tm |
|---|---|---|---|---|
| JAUMPF1 | GGAGAGTTTGCGTCAAGTCC | 202 | 55 | 59.85 |
| JAUMPR1 | ACTGTCGGAGAAACCGAAGA | | 50 | 59.84 |
| JAUMPF2 | GCGAACTCAATCCCAACATC | 226 | 50 | 60.47 |
| JAUMPR2 | TCGACCATGAGGGTTTTCTC | | 50 | 60.05 |
| JAUMPF3 | CGCACTAATAATCGGCCCTA | 193 | 50 | 60.07 |
| JAUMPR3 | GTAAAAGTGCGTTGGCGTTT | | 45 | 60.17 |

**5.** ***In situ* detection of potassium status in cotton plants**

It is recommended to the scientific community that silver and carbon nanoparticles based nano-biosensor developed for detection of potassium deficiency directly from the leaf sap of plants. The nano-biosensor works on the basis of ion-selective mechanism to detect potassium ion in the range of 10 mM to 120 mM. The deficiency of potassium below threshold line of 40 mM from sap with the sensor display indicating the voltage output below (-ve) 15 mV will be signaled. The onetime cost of the developed nano-biosensor is about Rs. 2500-3000 and worked to detect potassium deficiency level at any growth stage of cotton crop.

**Year 2018-19**

**1.** **Draft genome sequencing and analysis of fungal phytopathogen *Sclerotium rolfsii* to reveal insight into its genetic structure.**

It is recommended to the scientific community involved in Groundnut that the sequencing of plant pathogenic fungi *Sclerotium rolfsii* showed the size of genome is 73 Mb. The draft genome having 8919 contings, 16830 genes and11171 SSR present in the genome. In genome 3507 and 261 genes involve in Transporter and catalytic function

| | |
|---|---|
| | respectively , 1571 genes involve in cellular component and 709 of genes involve in biological process. pathogenicity related genes identified in this study have high relevance in future fungicide designing and following primers will be used for the specific identification of pathogenic fungi *Sclerotium rolfsii.* |

| Name | Primer 3'-5' | Product length | GC% | Tm |
|---|---|---|---|---|
| JAUSRF1 | GAAGAGTTTGCGTCGAGTCC | 250 | 55 | 59.85 |
| JAUSRR1 | GCTGTCAGAGAAACCGAAGA | | 50 | 59.84 |
| JAUSRF2 | ACGAACTCGATCCCAGCATC | 170 | 50 | 60.47 |
| JAUSRR2 | TCGATTATGAGGGTTTCCTC | | 50 | 60.05 |
| JAUSRF3 | CGGACTAATAATCGACCCTA | 230 | 50 | 60.07 |
| JAUSRR3 | ATAAAGGTGCGTTGACGTTT | | 45 | 60.17 |

**Year 2019-20**

**1. Qualitative and nutritional evaluation of promising genotypes of groundnut.**

The scientific communities involved in groundnut improvement are recommended to use below mentioned groundnut genotypes for the qualitative and nutritional improvement of groundnut crop.

| | **Trait for improvement** | | **Name of genotype** |
|---|---|---|---|
| 1 | Total Carbohydrate | : | GG-16, KDG-123, GG-4, RG-578 |
| 2 | Total Soluble Sugar | : | TG-51, ICGV-00440, JL-501 |
| 3 | True Protein | : | RG-510, TG-51, TG-37 |
| 4 | Total Oil | : | TLG-45, J SSP-35, ICGV-86156, GG-20 |
| 5 | Iron | : | JL-501, ICGV-91114, AG-2006-6 |
| 6 | Calcium | : | GJG-9, ICGV-02266, TPG-41, GJG-17 |
| 7 | Oleic Acid | : | ICGV-15055, ICGV-15050, ICGV-15035 |
| 8 | O/L ratio | : | ICGV-15035, ICGV-15033, Sunoleic |

**2. Phytochemical, antioxidant and antidiabetic characterizations of custard apple (*Annona squamosa* L.) genotypes**

It is informed to the scientific community that fruit pulp of custard apple genotypes DS-1, Aml-10 and Aml-6 acquired higher antidiabetic potential (as α amylase inhibition) and antioxidant activity (as % DPPH free radical scavenging). The ascorbic acids and phenols contributed positively for both antidiabetic and antioxidant potentials in fruit pulp of custard apple. Phytochemicals analysis illustrated that terpenoids and flavonoids present in fruit pulp are positively correlated with antioxidant activity and that of alkaloids contributed significantly positive correlation for antidiabetic potential.

**Year 2020-21**

**1. Studies on Phytochemicals And Metabolomics Profiling of Seaweeds**

The seaweed resources viz., Green, Red and Brown seaweeds analyzed through MS/MS based platform showed presence of 375 unique compounds. These seaweeds were found to contain important oil content, vitamin D3 and many bioactive compounds that can be used as nutraceutical products. In case of ω-3 polyunsaturated fatty acids, eicosapentaenoic acid (EPA) was found in seaweed species, viz., *Sarconema filiforme* (5.02%) and *Spatoglossum asperum* (4.04%). Vitamin D-3 was found in *Caulerpa Lenthilifolia* (16.7%), *Caulerpa sertulorioides* (8.5%), *Ulva fasciata* (10.7%), *Halimeda tuna* (12.7%), *Hydroclatharus clathratus* (18.9%), *Halymenia venusata* (6.5%), *H. porphyraeformis* (20.6%), *Dictyopteris marginatum*, *Gelidiopsisrepens* (18.2%) and *Heterosiphonia muelleri* (26.1%). Some species of seaweeds viz, *Dictyopterisdelicatula* (2.68%), *Heterosiphonia muelleri* (0.24%), *Dictyopterismarginatum* (*stoecospermum*) (4.07%), *Spatoglossum asperum* (8.1%), *Padina gymnospora* (4.86%), *Caulerpa lenthilifolia*

(0.96%) contained docosahexaenoic acid (DHA). These compounds are not found in plants.

**2. Transcriptome and Proteomic Characterization for Identification of Candidate Genes Responsible for Pistillate Inflorescence and Its Reversion in Castor**

The scientific community involved in Castor improvement are recommended to use the set of 14 primers as mentioned below to distinguish the pistillate and monoecious plants in castor. They are also advised to use the castor database developed (http://webtom.cabgrid.res.in/castdb/) for the identification of gene of interest and selection of SSRs and their primers to be used under Marker Assisted Selection and molecular breeding.

| Sr. No | Name of the gene Gene | Forward primer | Reverse Primer | Gene Function |
|---|---|---|---|---|
| 1 | Dynamin-2A | GCTAAGCAAGGG T TC GTCAG | CTGGCAGGTCG ATCAA TTTT | Response to hormone stimulus |
| 2 | Auxin response factor | CACACATGGTGG G TT CTCAG | TGAGTTGGTGGTTGCA TTGT | Organ development; and post-embryonic development |
| 3 | ATP-binding protein | CATTGGACAGGT CCT CCACT | AAGCAAGGTGAAGCA AGGAA | Regulation of ARF protein signal transduction |
| 4 | Spermidine synthase | GGTGCTGCATTTC TC TCCTC | TGCCCTGGAATAAATC TTGC | Polyamine biosynthetic process |
| 5 | Xaa-pro amino peptidase | GGATGGAAGCTTT GG CATAA | GCCCTTCTCACCAAAA TTGA | Auxin transport |
| 6 | Conserved hypothetical protein | TCGAATGAAGAG GCC ATTCT | GTGAGAAGGGCAAAA GCAAG | Abscisic acid metabolic process |
| 7 | MADS box protein | AAAGGTTGGCCTG A GGAGTT | GTCACTTGCCTGTTGC TTGA | Transcription, DNA-dependent |
| 8 | RNA polymerase sigma factor rpoD1 | GATCTTCAGGCAA G CACTCC | ATATCCTCCCCTTGGT C CAC | DNA-dependent transcription, initiation |
| 9 | Protein with unknown | TTGTCAAGGGCCA G TTCTTT | TTGACCTGCTGTGTCC C ATA | Guanylribonucleotide binding |
| 10 | Arginine/serine-rich splicing | CGGAAGCTTGATG A CACTGA | GGCTTCTACTTCGGCT C CTT | Sex differentiation |
| 11 | Acid phosphatase | TCCTGTAACCGTT CC TTTCG | TGTTCAGGCTCGAAAC CTCT | Phosphatase activity |
| 12 | DNA replication helicase dna2 | AGGCTGTGAATA ACC CAACG | CCCAATATCTTCGCCT T GAA | DNA metabolic process |
| 13 | Eukaryotic translation initiation | CACGACTTTTTCC CG TTGAT | GAACTCCCTCTGGTGG CATA | Translation |
| 14 | s-adenosyl-methyltransferase | TCTCCGTTCTTTC GT CGATT | GGGTCAACATCCATTC CAAC | rRNA methylation |

**3. Genome Sequencing of Cumin (*Cuminumcyminum*L.) to Reveal Insight of its Genomic Architecture**

The scientific community involved in Cumin improvement are recommended to use genomic information generated (https://drive.google.com/file/d/ 1ukln R77l YWJcR Ip8m40lLpm OP_ujqJz/view ?usp=sharing) for cumin in Marker Assisted Selection for the improvement of cumin. They are also advised to use the genes identified as mentioned below and SSRs identified in Marker Assisted Selection.

| Sr. No. | Character | Number of genes | Gene identified |
|---|---|---|---|
| 1 | Flavonoid | 21 | U78D2, C75A2, 75A4, C75B3, C93C F3PH, FAOMT, FL3H3, MOMT, SOMT SOT5, UFOG, UFOG1, UFOG2, UFOG UFOG4, UFOG5, UFOG6, FOG7, UGF and Y1103 |
| 2 | Chalcone synthase | 9 | 6DCS, CHS1, CHS2, CHSA, CHSB, CHS CHSL1, CHSY, PKS5 |
| 3 | Chalconeisomerase | 4 | CFI, CFI1, CFI2B, CFI3 |
| 4 | Flavanone synthase | 3 | C93C1, FNSI, C93B1 |
| 5 | Terpenoid synthase | 15 | BAMS, GBIS1, GBIS2, HUMS, TPS TPS05, TPS07, TPS08, TPS09, TPS TPS18, TPS22, TPS26, TPS29, TPS30 |
| 6 | Disease resistance | 89 | ADR2, CDR1, CHS1, CSA1, DF230, DR206, DRL12, DRL13, DRL14, DRL15, DRL16,DRL17, DRL18, DRL19, DRL2, DRL20,DRL21, DRL23, DRL24, DRL25, DRL26,DRL27, DRL28, DRL29, DRL3, DRL30,DRL31, DRL32, DRL33, DRL34, DRL36,DRL37, DRL38, DRL39, DRL4, DRL40,DRL41, DRL42, DRL43, DRL45, DRL5,DRL7, DRL8, DRL9, DSC1, DSC2, EDR1,EDR2, EDR2L, EDR4, LAZ5, LOV1A,NDR1, R13L1, R13L2, R13L3, R13L4,RFL1, RGA1, RGA2, RGA3, RGA4,RLM1B, RLM3, RP8HA, RP8L2, RP8L3,RP8L4, RPM1, RPP1, RPP13, RPP4, RPP5,RPP8, RPS2, RPS4C, RPS4L, RPS4W,RPS5, RPS6C, RPS6R, RPS6R, SUMM2,TAO1, WR52C, WR52N, WR52R, WR52W,Y4117 |
| 7 | Antifungal | 4 | DEF1, DEF15, DEF2, DEF4 |
| 8 | Early flowering | 13 | ASHH2, EFM, ELF3, ELF6, HD16N, PA PIE1, REF6, RUP1, RUP2, SKIP, SWC VIP6 |
| 9 | Aromatic | 11 | 5MAT, ANTA, AVT3A, AVT3B, AVT3 DDC, ISS1, PGL1, PGL2, PGL3, SOT16 |
| 10 | Drought | 8 | AL7A1, DIS1, ERG14, HDG11, LSM5, SAD2, SDIR1, SSP1A |
| 11 | Nematodes | 2 | ELF3, HSPR2 |

**4. Transcriptome Analysis in Coriander for Identification of Candidate Genes Against Stem Gall Disease**

The scientific community involved in Coriander improvement is recommended to use the following set of 7 primers in the process of marker assisted selection for the identification of disease defence genes in coriander genotypes

| Sr. No | Gene Name | Forward Primer | Reverse Primer | Function |
|---|---|---|---|---|
| 1. | RL31 | GCCAAACCAAAAG GTGAGAA | CGGATACCCTTA GCCCAGAT | Jasmonic acid Mediated signaling pathway |
| 2. | A0A2Z5D8 54 | CCACCGTTTCCAAT GCTAGT | GGAATCTCTCGG GCCTAAAC | Metal ion binding |
| 3. | A0A166CJ74 | ATTGGCTGAGCTTT GGATTG | GGCTTGATGCTC CATTGTTT | Regulation of Transcription DNA-template |
| 4. | A0A166CJ74 | CACGCATTTCTCCT CCTGAT | TCAGAGGGGGT TTTCTGATG | DNA-template |
| 5. | Y1934 | ACTCGGTGTCACGG TTTTTC | CAAAAGCCGAG ATTGTGGAT | Molecular function DNA-binding |
| 6. | TGA10 | CCCTGTTGGGAAAC TTCGTA | GCTGCAAAGGT CCAGCTATC | Nitrogen-activated protein kinase binding |
| 7. | A0A164XUZ0 | GAGTTGGAGTTCAG GGAGGA | GATGAGCGGGA TATCTGGAA | Affects Fungal Development and Pathogenicity of *Fusarium graminearum* |

**5. Elemental, Nutritional and Microbiological Analysis of Panchagavya (Ancient Liquid Organic)**

The Scientific community involved in Panchagavya research or microbial research are recommended to use 19th day old Panchagavya to study maximum microbial diversity. The higher proportion of α-proteobacteria was observed in 19th day of Panchagavya preparation while 21st Day Panchagavya formulation was found to be dominated by Firmibacteria, β-proteobacteria or Actinobacteria. The presence of unknown /novel microbes were higher in 21st day old Panchagavya on the basis of results of Metagenomic analysis.

**a) Panchagavya** contained dominant bacteria of nitrogen fixing, phosphate solubilizers and potash mobilizers. Moreover, it showed antagonism towards plant pathogenic fungi like *Helminthosporium* (47%), *A. flavus* (45%), *A. niger* (35%) and *Sclerotiumrolfsii* (40%) *in vitro*. Elemental composition of Panchagavya showed higher concentration of Fe (158.94 ppm), Ca (2789.99 ppm), Mg (1553.76 ppm) and Mo (25.50 ppm). It also contained N-Methyl-2-pyrrolidinone used as insecticide, herbicide and fungicide. Phenylacetaldehyde is a second major compound found which has very important antibiotic compound.

**b) Bijamrut** elemental analysis revealed that it contains Cu (4.19 ppm), Fe (111.16 ppm), Mn (1.56 ppm), Zn (2.40), Ca (1211.63 ppm) and Mg (1084.65 ppm) which can provide immunity against various diseases and improve seed germination. It also contained important compound 5(6)-EpETrE-EA which has antagonist activity against pathogenic microbes. 17 beta-Nitro-5alpha-androstane is the aza-steroid which enhances the germination of plant seed.

**c)** Liquid organic preparation of **Jivamrut** has bacteria, fungi, actinomycetes, N- fixers and P-solubilizers and K-mobilizers. Jivamrut inhibited *Helminthosporium* (40%), *A. flavus* (30%), *A. niger* (25%) and *Sclerotiumrolfsii* (35%), *Fusarium*

| | |
|---|---|
| | *oxysporum* (35%). Jivamrut contains high concentration of Fe (115.09 ppm), Ca (1575.78 ppm), Mg (621.57ppm) and Co (88.90 ppm). LC-QToF analysis showed Pyropheophorbide is an antioxidant found in Jivamrut.<br>**d) Amrutpani** is a good source of micronutrient which includes high concentration of Fe (208.44 ppm), Ca (2276.73 ppm), Mg (1119.15 ppm) and Ti (73.05 ppm). LC-QToF analysis revealed that Adouetine Z is an insecticidal cyclic peptide and (5alpha, 8beta, 9beta)-5,9-Epoxy-3,6-megastigmadien-8-ol is an antioxidant compound found in Amrutpani.<br>**e) Sanjivak** has antagonist activity and micronutrient content with important compound like Methyl jasmonate. |
| **6.** | **Biochemical and Molecular Evaluation of A1 and A2 Casein Protein of Milk in Holstein Friesian Cow and Indigenous Gir Cow**<br>The scientific community involved in cow improvement is recommended to use DNA markers to detect or distinguish A1A2 and A2A2 genotypic frequency among the Gir Bulls and Cows using below mentioned marker. |
| **7.** | **Studies on Phytochemicals And Metabolomics Profiling of Seaweeds**<br>The seaweed resources viz., Green, Red and Brown seaweeds analyzed through Ms/Ms based platform showed presence of 375 unique compounds. These seaweeds were found to contain important oil content, vitamin D3 and many bioactive compounds that can be used as nutraceutical products . In case of ω-3 polyunsaturated fatty acids, eicosapentaenoic acid (EPA) was found in seaweed species, viz., Sarconema filiforme (5.02%) and Spatoglossum asperum(4.04%). Vitamin D-3 was found in Caulerpa Lenthilifolia (16.7%), Caulerpa sertulorioides (8.5%), Ulva fasciata (10.7%) , Halimeda tuna (12.7%) , Hydroclatharus clathratus (18.9%), Halymenia venusata (6.5%), H. porphyraeformis (20.6%), Dictyopteris marginatum, Gelidiopsisrepens (18.2%) and Heterosiphonia muelleri (26.1%). Some species of seaweeds viz, Dictyopterisdelicatula (2.68%), Heterosiphonia muelleri (0.24%), Dictyopterismarginatum (stoecospermum) (4.07%), Spatoglossum asperum (8.1%), Padina gymnospora(4.86%), Caulerpa lenthilifolia (0.96%)contained docosahexaenoic acid (DHA). These compounds are not found in plants. |
| **Year 2021-22** | |
| **1.** | **Development and characterization of polymer based nanofertilizers and their response to wheat**<br>Chitosan nanoparticles (CS-NPs) were synthesized and examined greater than 40 mV zeta potential indicating good stability. The urea, tricalcium phosphate and muriate of potash were used as sources for incorporation of N, P and K elements individually onto the CS-NPs and the elevation of size of the nanofertilizers, without aggregation of nanoparticles, were observed. Scanning electron micrograph illustrated spherical shape of the CS-NPs and gave the idea about the morphology of incorporated NPK nanofertilizers. The FTIR study indicated that there is a electrostatic interaction occurs between the charges of CS-NPs and the N P K elements, resulted to stretching of spectra (peak) at specific wavelength confirming the incorporation of N P and K elements on to the CS- |

Marker table (item 6):

| | | |
|---|---|---|
| 1 | A1 Forward | 5’ CTTCCCTGGGCCCATCCA 3’ |
| | A1 Reverse | 5’ AGACTGGAGCAGAGGCAGAG 3’ |
| 2 | A2 Forward | 5’ CTTCCCTGGGCCCATCCC 3’ |
| | A2 Reverse | 5’ AGACTGGAGCAGAGGCAGAG 3’ |

| | |
|---|---|
| | NPs. The application of 5% NPK nanofertilizers (10 time less) on wheat suggested higher nutritional seed quality and maintained yield equivalent to chemical fertilizers. The cost-effective NPK-nanofertilizers thus developed may save the forex (subsidy) about 38.22%. It has better controlled-release system in a liquid formulation to enhance nutrient use efficiency and sustained crop growth. |
| **2** | **Isolation and identification of entomopathogenic microorganisms from the soils of Junagadh district.**<br>The Scientific communities involved in microbial and entomological research are recommended to use native identified entomopathogenic microbes including 213 Pseudomonas putida (MK415028.1), P. monteilii (KT881478.1), P. knackmussii (KY324901.1), P. fulva (KC293832.1), Bacillus subtilis (MH141058.1), B. thuringiensis (KY003094.1), B. clausii (AB251924.1), Enterobacter asburiae (MK 467572.1), E. cloacae (JX514409.1), Beauveria bassiana (KC753382.1), Metarhizium anisopliae (KJ573520.1) and Verticillium lecanii (AJ292383.1) for the production of biofertilizer and biocontrol agent as they suppressed Helicoverpa armigera, and have PGPR activity |
| **3** | **Isolation and identification salt tolerant strains of beneficial microorganisms from the coastal soils of Saurashtra region.**<br>Native halophilic bacterial strains isolated from agricultural soils of coastal regions of Saurashtra have potential for application in both industries and agriculture. The promising performance of these isolates in terms of plant growth promoting characteristics such as nitrogen fixing capacity, solubilization of phosphate and potash, production of IAA, siderophore along with production of biochemically important enzymes and bioactive compounds such as chitinase, cellulase, protease, carotene, ectoine, glycine betaine was observed. Halophilic bacterial isolates were Halomonas pacifica strain_JAU_7B (MK955347), H. pacifica strain_JAU_20A (MK575078), H. pacifica strain_JAU_22A (MK042491), H. pacifica strain_JAU_22C (MK043087), H. pacifica strain_JAU_25A (MK116946), H. pacifica strain_JAU_29A (MK114047), H. pacifica strain_JAU_36A(MK114047), H. pacifica strain_JAU_36B (MK114047), H. stenophila strain_JAU_37A (MK961217), Oceanobacillus aidingensis strain_JAU_39B (MK148253), H. pacifica strain_JAU_40B (MK114047), Bacillus haynesii strain_JAU_41A (MK157609), B. licheniformis strain_JAU_43A (MK118996), B. haynesii strain_JAU_43B (MK157608) and B. haynesii strain_JAU_45A (MK157609) which confirmed through molecular characterization by 16srRNA |
| **4** | **Biochemical appraisal of enzymatic activities from soils of permanent plot experiment at JAU, Junagadh**<br>The soil enzyme activity studied viz., urease, acid phosphatase, alkaline phosphatase, −Galactosidase and nitrate reductase, from the plot having different fertilizer applications, remains higher during the mid-season and found to be lower before sowing and after harvest of the crop. Minimum variation of enzyme activity was observed in a plot of only FYM treatment (25 tons/ha). The activity of urease, $\beta$−Galactosidase and $\beta$−gluosidase as well as acid phosphatase and alkaline phosphatase was enhanced by balance fertilizer application (100 % NPK (25:50:50) as per soil test as well as 25 tons/ha FYM application. The pod yield of groundnut was remained highly positively correlated with urease, acid phosphatase and alkaline phosphatase enzyme activity. |
| **5** | **Diversity analysis of fresh water diatoms through SEM-EDX from surface microalgae of water bodies of Junagadh region**<br>The scientific community involved in diatom study of fresh water in context to climate change and environment are recommended to use cataloguing of fresh water diatoms collection images from water bodies in and around JAU, Junagadh. Total 46 species of diatoms were identified from water bodies of Junagadh, out of which eleven genera viz., Cyclotella, Melosira, Navicula, Achnanthes, Amphora, Synedra, Nitzschia, Gomphonema, |

Hantzschia, Pinnularia and Fragillaria were predominant.The sizeable variation among the elements presents on freshwater algae through SEM EDAX showed the presence of all macro elements except phosphorus and nitrogen. All species of diatoms had higher amount of diversity indices including Shannon-Wiener diversity index (3.57) and Berger Parker Dominance (30.57). Morphometric analysis showed wider variability in location and species wise according to length (7.049 µm to 43.08 µm) and width (2.53 µm to 23.44 µm) as well
as diversity indices too. Willington dam site showed maximum spp. variation of diatoms than the other location.

**Year 2022-23**

**1 Development of biochemical and molecular markers for heat tolerance in chickpea**

The chickpea genotype namely ICC-4958 was identified highly tolerant when exposed to 42/37 $^{o}$C temperature at germination stage. This genotype had high antioxidant activity, ascorbic acid, glutathione, super oxide dismutase, ascorbate peroxidase, glutathione reductase along with Quinone oxidoreductase, glutaredoxine and heat shock protein 70. SSR markers namely Cam1536, TA27, TR 58 could also reveal this genotype different at DNA level. Hence, this genotype can be exploited in breeding to develop heat tolerant lines/varieties of chickpea.

**2 Diversity analysis of marine diatoms through SEM-EDX from surface microalgae of saurashtra coastal belt**

The scientific community working on diatoms of coastal belt of Saurashtra are recommended to use diatoms diversity analysis done through Scanning electron microscopy as ready references. The diatom analysis of marine samples from three locations (Okha,Veraval and Aadri) identified fifty diatom species and most of them are pennate types. The Cocconeis spp, Grammatophora spp, Fragilaria sp, Nitzschia sp, Navicula sp., Achnanthes spp and Licmophora were found dominant diatoms on the surface of microalgae. Again, diatom abundance of Cocconeis scutellum was reported higher than 52% of total diatom considering three locations. The energy dispersive X-ray spectroscopy (EDS) graph prepared for individual species of diatoms from SEM images observed that the frustules of the diatoms wereother than Si. It has many elements at various sites attached to them. The catalogue of diatoms and alfa-diversity index revealed many diverse rich populations in coastal belt of Saurashtra

**3 Biochemical analysis based lipid indices of edible, non edible and medicinal herbs oils**

Scientific community involved in lipid indices of edible oil research is recommended to use the sets of following biochemical based fatty acids calculation for the quality of oils and their lipid indices.

| Edible oils | DR | ODR | LDR | MUFA | PUFA | SFA | DU | UI | AI | TI |
|---|---|---|---|---|---|---|---|---|---|---|
| GG -20 | 0.009 | 0.247 | 0.001 | 63.72 | 20.64 | 15.64 | 105.0 | 590.5 | 0.14 | 10.32 |
| GG-21 | 0.008 | 0.185 | 0.003 | 69.62 | 15.67 | 14.71 | 101.0 | 597.0 | 0.13 | 9.18 |
| GG-3 | 0.009 | 0.451 | 0.001 | 44.47 | 35.93 | 19.6 | 116.3 | 562.8 | 0.19 | 13.30 |
| Coconut seed | 0.007 | 0.396 | 0.011 | 11.43 | 7.05 | 81.52 | 25.5 | 129.4 | 20.73 | 34.60 |
| Corn oil | 0.012 | 0.563 | 0.005 | 33.24 | 41.43 | 25.33 | 116.1 | 522.7 | 0.67 | 23.17 |
| Cotton seed | 0.003 | 0.645 | 0.035 | 26.01 | 40.88 | 33.11 | 107.8 | 468.2 | 2.19 | 28.78 |
| Soybean | 0.022 | 0.612 | 0.025 | 23.5 | 53.88 | 22.62 | 131.3 | 541.7 | 0.36 | 14.30 |
| Sunflower | 0.007 | 0.630 | 0.019 | 30.71 | 47.09 | 22.2 | 124.9 | 544.6 | 4.32 | 17.60 |
| Brown | 0.181 | 0.647 | 0.439 | 57.51 | 30.26 | 12.23 | 118.0 | 614.4 | 0.06 | 40.74 |
| White sesame | 0.001 | 0.558 | 0.011 | 39.17 | 48.19 | 12.64 | 135.6 | 611.5 | 0.09 | 10.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Black sesame | 0.001 | 0.574 | 0.007 | 38.07 | 50.47 | 11.46 | 139.0 | 619.8 | 0.08 | 8.34 |

DR= Desaturation ratio; ODR= Oleic desaturation ratio; LDR= Linoleic desaturation ratio; MUFA= Monounsaturated fatty acid; PUFA= Polyunsaturated fatty acid; SFA = Saturated fatty acid; DU= Degree of unsaturation; UI= Index of unsaturation; AI= Atherogenic index; TI= Thrombogenic index

**4 Biochemical analysis based lipid indices of edible, non edible and medicinal herbs oils**

Scientific community involved in the essential oil research of the following crops are recommended to use marker bioactive compounds detected through GC MS platform

| Name of crops | Important Marker Bioactive compounds |
|---|---|
| Black pepper (*Piper nigrum* L.) | Piperine (α.-Phellandrene, 4.64%)<br>cis-sabinene (23.21%) Caryophyllene (13.58%) Caryophyllene oxide (0.33%)<br>1,4-Cyclohexadiene, 1-methyl-4-(1-methylethyl) (20.84%) |
| Volatile oil of Cardamom | α-Terpinyl acetate (37.05%)<br>Eucalyptol (25.79%) Sabinen (3.41%) |
| Volatile oil of Cinnamom | Cinnamaldehyde, (E) (77.55%)<br>Copaene (2.98%) |
| Volatile oil from leaves of cinnamom | Phenol, 2-methoxy-3-(2-propenyl) (79.17%).,<br>Spathulenol (3.26%) gamma.-Elemene (3.66%)., Caryophyllene (1.24 %) |
| Volatile oil of cloves | Caryophyllene (37.5%) and<br>Phenol, 2-methoxy-3-(2-propenyl)-(44.04%) |
| Volatile oil of coriander leaves | LINALOOL (63.23%), 2,6-Octadien-1-ol, 3,7-dimethyl-, acetate(7.78%).,1,6-Octadien-3-ol, 3,7-dimethyl(2.64%).,(1R)-2,6,6- Trimethylbicyclo[3.1.1]hept-2-ene (2.59%) |
| Volatile oil of cumin seeds | Beta.-Pinene (19.09%)<br>Benzene, 1-methyl-4-(1-methylethyl) (12.4%)<br>1,4-Cyclohexadiene, 1-methyl-4-(1-methylethyl) (10.69%)Benzaldehyde, 4-(1-methylethyl) (26.8%) TERPIN-7-AL <GAMMA-> DB5-1106 (12.36%) |
| Volatile oil of curry leaves | Bicyclo[7.2.0]undec-4-ene, 4,11,11-trimethyl-8-methylene-,[1R-(1R@,4Z,9S@)] (29.28%) Caryophyllene (4.44%),.alpha.-Caryophyllene(4.88%) Azulene, 1,2,3,3a,4,5,6,7-octahydro-1,4-dimethyl-7-(1- methylethenyl)-(21.24%) [1R-.alpha.,3a.beta.,4.alpha.,7.beta.)]-Caryophyllene oxide (4.05%). |
| Volatile oil of Dill seed | Tetrahydro carvone (19.82%)<br>trans-dihydrocarvone (14.53%) cis-Carvyl acetate (25.7%)<br>Eugenol (0.01%)<br>And Apiol (Abotion drug) (17.59%) |
| Volatile oil of Dry ginger | CURCUMENE (16.56%)<br>Zingiberene (21.03%);<br>FARNESENE <(E,E)-ALPHA (15.26%) beta-Sesquiphellandrene (7.61%) VALERIANOL (5.91%) |

| | | |
|---|---|---|
| | Volatile oil of fennel seed | Fenchone (8.93%)<br>Anisole, p-allyl(5.29%) (Estragole)<br>cis-Anethol (68.56%) |
| | Volatile of Garlic oil | 1,3-Dithiane (6.7%)<br>Dimethyl trisulfide (7.43%) Diallyl disulphide (17.72%)<br>Hydroperoxide, 1,4-dioxan-2-yl (26.34%) Trisulfide, di-2-propenyl (31.49%) |
| | Volatile oil of holy basil | 1,6-Octadien-3-ol, 3,7-dimethyl (18.47%)/(Linalool)<br>METHYL CINNIMATE (8.48%) and METHYL CINNIMATE <(E)-(45.94%) |
| | Volatile oil of mint leaves | Limonene (5%)<br>2-Cyclohexen-1-ol, 2-methyl-5-(1-methylethenyl)-, trans-(35.63%)<br>2-Cyclohexen-1-one, 2-methyl-5-(1-methylethenyl) (31.59%)<br>trans-Carveyl acetate (5.19%) |
| | Volatile oil of nutmeg | 1R)-2,6,6-Trimethylbicyclo[3.1.1]hept-2-ene/ (α-Pinene-14.64%)<br>Bicyclo[3.1.0]hexane, 4-methylene-1-(1-methylethyl)- ( cis-sabinene-18.5%)<br>Cyclohexene, 1-methyl-4-(1-methylethenyl)-, (S)-( Limonene-5.84%)<br>1,4-Cyclohexadiene, 1-methyl-4-(1-methylethyl) -( α- Terpinene-5.13%) 3-Cyclohexen-1-ol, 4-methyl-1-(1- methylethyl)-( (R)-(-)-; (-)-Terpinen-4-ol-8.05%) Benzene, 1,2-(methylenedioxy)-4-propenyl-, (E)-( (β- Isosafrole-5.4%) |
| | Volatile oil of nutmeg mace | α-Pinene-(15.97%);. cis-sabinene-(17.66%);α-Terpinene-(6.23%), L-4-terpineol-(9.11%) |
| | Turmeric oil & Oleoresin | Caryophyllene (6.74 %and 0.29,% )<br>ZINGIBERENE (18.86% and 4.59%)<br>Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl (9.49% and 0.45%)<br>SESQUIPHELLANDRENE <BETA(14.25% and 1.17% )<br>Tumerone (23.26% and 17.39%) Ar-tumerone (25.15% and 8.93%) |
| **5** | Dr PJ.Rathod is the one of the inventor in Patent Granted on A PROCESS OF ENZYMATIC PRE-TREATMENT ON VARIETIES OF PIGEON PEA which was filled in 29/01/2020 and Granted on 21/12/2023. Application number: 202021004030 | |
| **Year 2023-24** | | |
| **1.** | **Development of biochemical and molecular markers for heat tolerance in chickpea**<br><br>The chickpea genotype namely ICC-4958 was identified highly tolerant when exposed to 42/37 $^{o}$C temperature at germination stage. This genotype had high antioxidant activity, ascorbic acid, glutathione, super oxide dismutase, ascorbate peroxidase, glutathione reductase along with Quinone oxidoreductase, glutaredoxine and heat shock protein 70. SSR markers namely Cam1536, TA27, TR 58 could also reveal this genotype different at DNA level. Hence, this genotype can be exploited in breeding | |

to develop heat tolerant lines/varieties of chickpea.

2. **Biochemical analysis based lipid indices of edible, non edible and medicinal herbs oils**

**Recommendation-I**

Scientific community involved in lipid indices of edible oils research is recommended to use the sets of following biochemical based fatty acids calculation for the quality of oils and their lipid indices.

| Edible oils | DR | ODR | LDR | MUFA | PUFA | SFA | DU | UI | AI | TI |
|---|---|---|---|---|---|---|---|---|---|---|
| GG -20 | 0.009 | 0.247 | 0.001 | 63.72 | 20.64 | 15.64 | 105.0 | 590.5 | 0.14 | 10.32 |
| GG-21 | 0.008 | 0.185 | 0.003 | 69.62 | 15.67 | 14.71 | 101.0 | 597.0 | 0.13 | 9.18 |
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| White sesame | 0.001 | 0.558 | 0.011 | 39.17 | 48.19 | 12.64 | 135.6 | 611.5 | 0.09 | 10.00 |
| Black sesame | 0.001 | 0.574 | 0.007 | 38.07 | 50.47 | 11.46 | 139.0 | 619.8 | 0.08 | 8.34 |

**DR=** Desaturation ratio; **ODR=** Oleic desaturation ratio; **LDR=** Linoleic desaturation ratio; **MUFA =** Monounsaturated fatty acid; **PUFA** = Polyunsaturated fatty acid; **SFA** = Saturated fatty acid; **DU=** Degree of unsaturation; **UI=** Index of unsaturation; **AI=** Atherogenic index; **TI=** Thrombogenic index

**Recommendation- II**

Scientific community involved in the essential oil research of the following crops are recommended to use bioactive compounds detected through GC MS platform as a markers

| Name of crops | Important Marker Bioactive compounds |
|---|---|
| Black pepper (*Piper nigrum* L.) | Piperine (α.-Phellandrene, 4.64%)<br>cis-sabinene (23.21%)<br>Caryophyllene (13.58%)<br>Caryophyllene oxide (0.33%)<br>1,4-Cyclohexadiene, 1-methyl-4-(1-methylethyl) (20.84%) |
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|---|---|
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| Volatile oil of curry leaves | Bicyclo[7.2.0]undec-4-ene, 4,11,11-trimethyl-8-methylene-,[1R-(1R@,4Z,9S@)] (29.28%)<br>Caryophyllene (4.44%),.alpha.-Caryophyllene(4.88%)<br>Azulene, 1,2,3,3a,4,5,6,7-octahydro-1,4-dimethyl-7-(1-methylethenyl)-(21.24%)<br>[1R-.alpha.,3a.beta.,4.alpha.,7.beta.)]-Caryophyllene oxide (4.05%). |
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| Volatile oil of nutmeg | 1R)-2,6,6-Trimethylbicyclo[3.1.1]hept-2-ene/ (α-Pinene- |

| | | |
|---|---|---|
| | | 14.64%)<br>Bicyclo[3.1.0]hexane, 4-methylene-1-(1-methylethyl)-( cis-sabinene-18.5%)<br>Cyclohexene, 1-methyl-4-(1-methylethenyl)-, (S)-( Limonene-5.84%)<br>1,4-Cyclohexadiene, 1-methyl-4-(1-methylethyl)-( α-Terpinene-5.13%) 3-Cyclohexen-1-ol, 4-methyl-1-(1-methylethyl)-( (R)-(-)-; (-)-Terpinen-4-ol-8.05%)<br>Benzene, 1,2-(methylenedioxy)-4-propenyl-, (E)-( (β-Isosafrole-5.4%) |
| | Volatile oil of nutmeg mace | α-Pinene-(15.97%);. cis-sabinene-(17.66%);α-Terpinene-(6.23%), L-4-terpineol-(9.11%) |
| | Turmeric oil<br>& Oleoresin | Caryophyllene (6.74 %and 0.29,% )<br>ZINGIBERENE (18.86% and 4.59%)<br>Benzene, 1-(1,5-dimethyl-4-hexenyl)-4-methyl (9.49% and 0.45%)<br>SESQUIPHELLANDRENE <BETA(14.25% and 1.17% )<br>Tumerone (23.26% and 17.39%)<br>Ar-tumerone (25.15% and 8.93%) |

**3. Diversity analysis of marine diatoms through SEM-EDX from surface microalgae of saurashtra coastal belt**

The scientific community working on diatoms of coastal belt of Saurashtra are recommended to use diatoms diversity analysis done through Scanning electron microscopy as ready references. The diatom analysis of marine samples from three locations (Okha,Veraval and Aadri) identified fifty diatom species and most of them are pennate types. The *Cocconeis* spp, *Grammatophora* spp, *Fragilaria* sp, *Nitzschia* sp, *Navicula* sp., *Achnanthes* spp and *Licmophora* were found dominant diatoms on the surface of microalgae. Again, diatom abundance of *Cocconeis scutellum* was reported higher than 52% of total diatom considering three locations. The energy dispersive X-ray spectroscopy (EDS) graph prepared for individual species of diatoms from SEM images observed that the frustules of the diatoms were other than Si. It has many elements at various sites attached to them. The catalogue of diatoms and alfa-diversity index revealed many diverse rich populations in coastal belt of Saurashtra.

**Year 2024-25**

**1. Improvement of Groundnut oil quality for high oleic acid through CRISPR/Cas gene editing technology**

The scientific community involved in groundnut improvement through genome editing technology is recommended to use the optimized tissue culture protocol using de-embryonated cotyledone as explants (multiple shoot formation: MS + 25.0 mg/l 6-benzylaminopurine, shoot elongation: MS + 3.0 mg/l 6-benzylaminopurine, + 1.0 mg/l gibberellic acid, root induction: MS + 1.0 mg/l naphthalene acetic acid), CRISPR/Cas9 technology and binary vector for successfully editing the gene of interest (*AhFAD2B*) in groundnut for achieving high O/L ratio (8.52). A single guide RNA sequence (5'TGTGGTCTATGATCTGTTAATGG3'), designed by using CHOPCHOP, was utilized to guide the Cas nuclease for precise editing.

**2. Optimization of regeneration protocol using different plant growth regulator in pomegranate (*Punica granatum* L.) Cv.'Bhagwa' cultivar**

A regeneration protocol was successfully developed from using nodal explant for pomegranate (*Punica granatum* L.) cv. 'Bhagwa,' highlighting the following key findings:

- ❖ Surface sterilization with Carbendazim-50% @ 10 min + Cefotaxime @ 7 min +

| | |
|---|---|
| | Kanamycin @ 5 min + Ketokenazol @ 10 min + 0.1% $HgCl_2$ @ 3 min was effectively prevented contamination in nodal explant.<br>❖ Transfer of explants every 24 hours reduces 90% polyphenol accumulation.<br>❖ Shoot initiation was achieved using MS +0.2 mg/L BAP + 0.1 mg/L NAA.<br>❖ The highest number of multiple shoots was observed using MS + 0.2 mg/L BAP + 0.1 mg/L KIN.<br>❖ Root induction was optimal with MS + 0.3 mg/L IBA using WPM media for root development.<br>❖ Hardening was most effective when plantlets were acclimatized in a 3:1 soil-to cocopeat ratio, with a 94% survival rate. |