JUNAGADH AGRICULTURAL UNIVERSITY, JUNAGADH

RESEARCH RECOMMENDATIONS FOR SCIENTIFIC COMMUNITY

VI. BASIC SCIENCE

Thirty four scientific recommendations developed by basic science disciplines are described below.

Year: 2005-06

Groundnut *(kharif)*

Growth regulator paclobutrazol (25 to 100 ml/L) sprayed at flowering and pegging stage has no stimulating effect on pod yield and other ancillary characters in groundnut during *kharif* season.

(*Main Oilseed Research Station, JAU, Junagadh*)

Year: 2007-08

Testing of male sterile (B) and inbred lines of pearl millet against drought

The b*ajra* male sterile maintainer line, 92777 B and inbred, J.2405 were found to be terminal drought resistant/tolerant, which may be used for the development of terminal drought resistant hybrids. The terminal drought resistant/tolerant entries had higher harvest index and dry matter and lowest drought susceptibility index.

(Main Pearl Millet Research Station, JAU, Jamnagar)

Studies on drought tolerance in pearl millet genotypes using PEG

Models for the prediction of relative agronomic performance of *bajra* genotype i.e. grain yield are developed for drought stress and potential irrigated conditions.

Exponential Model-1: For Drought Stress Condition

$$Y = 1.448*(1.002\text{^}X_1)*(0.999\text{^}X_2)*(2.748\text{^}X_3)*$$
$$(0.582\text{^}X_4)*(1.875\text{^}X_5)*(0.218\text{^}X_6)*$$
$$(0.851\text{^}X_7)*(1.110\text{^}X_8)*(0.984\text{^}X_9)\ (1.007\text{^}X_{10})*$$
$$(0.665\text{^}X_{11})*(2.315\text{^}X_{12})*(3.232\text{^}X_{13})*$$
$$(7.306\text{^}X_{14})*(0.744\text{^}X_{15})*(0.575\text{^}X_{16})$$

Where, Y = Predicted yield under drought stress

Parameters	Regression coefficients	Std. Error	T values	F value	R^2value	DF
Root Length (3 BAR) X1	1.001971 M1	0.002876	348.4135***	9.6311**	0.798029	39
Shoot length (3 BAR) X2	0.999175 M2	0.001955	511.1348***			
Root Dry Wt. (3 BAR) X3	2.747784 M3	0.702572	3.911035***			
Shoot Dry Wt. (3 BAR) X4	0.5822 M4	0.313369	1.857873			
R/S Len. Ration (3 BAR) X5	1.875495 M5	0.563899	3.325945**			
R/S D Wt. Ratio (3 BAR) X6	0.218307 M6	0.528226	0.413283			
V I-1 (3 BAR) X7	0.85125 M7	0.325346	2.69942*			
V I-2 (3 BAR) X8	1.110188 M8	0.208844	5.315876***			
Root Length (6 BAR) X9	0.984297 M9	0.004884	201.5419***			
Shoot Length (6 BAR) X10	1.006705 M10	0.002227	452.1029***			
Root Dry Wt. (6 BAR) X11	0.665572 M11	0.774979	0.858825			
Shoot Dry Wt. (6 BAR) X12	2.314506 M12	0.697078	3.320294**			
R/S Len. Ration (6 BAR) X13	3.231776 M13	0.516116	6.26173***			
R/S D Wt. Ratio (6 BAR) X14	7.306595 M14	0.565178	12.92793***			
V I-1 (6 BAR) X15	0.744265 M15	0.274739	2.708986**			
V I-2 (6 BAR) X16	0.574586 M16	0.274833	2.090672*			
Constant B	1.44758					
Exponential Model: Y = B*(M1^ X1)*(M2^ X2)*(M3^ X3)…*(M16^ X16), where Y – Predicted Yield under Drought Stress						

Exponential Model No.2: For Potential Condition (Irrigated)

$$Y = 0.472*(1.004\text{^}X_1)*(0.997\text{^}X_2)*$$
$$(2.701\text{^}X_3)*(0.568\text{^}X_4)*(1.816\text{^}X_5)*$$

$$(0.238^{X_6})*(0.975^{X_7})*(1.497^{X_8})*$$
$$(0.985^{X_9}) *(1.007^{X_{10}}) *(1.324^{X_{11}})*$$
$$(4.413^{X_{12}})*(4.689^{X_{13}})*(4.088^{X_{14}})*$$
$$(1.044^{X_{15}}) *(0.441^{X_{16}})$$

Where, Y = Predicted yield under irrigated condition

Parameters	Regression coefficients	Std. Error	T values	F value	R^2value	DF
Root Length (3 BAR) X1	1.003568 M1	0.002336	429.6307***	7.9550.**	0.765457	39
Shoot length (3 BAR) X2	0.996655 M2	0.001588	637.6927***			
Root Dry Wt. (3 BAR) X3	2.700694 M3	0.570666	4.732528***			
Shoot Dry Wt. (3 BAR) X4	0.568393 M4	0.254535	2.233064*			
R/S Len. Ration (3 BAR) X5	1.815886 M5	0.458028	3.964573***			
R/S D Wt. Ratio (3 BAR) X6	0.238057 M6	0.429053	0.554843			
V I-1 (3 BAR) X7	0.974676 M7	0.25614	3.805242***			
V I-2 (3 BAR) X8	1.497066 M8	0.169634	8.825268***			
Root Length (6 BAR) X9	0.984644 M9	0.00396691	248.214579***			
Shoot Length (6 BAR) X10	1.006909 M10	0.0018087	556.7164***			
Root Dry Wt. (6 BAR) X11	1.324247 M11	0.629479	2.10372*			
Shoot Dry Wt. (6 BAR) X12	4.413096 M12	0.566204035	7.794181084***			
R/S Len. Ration (6 BAR) X13	4.688531 M13	0.419216	11.18404***			
R/S D Wt. Ratio (6 BAR) X14	4.087618 M14	0.459068	8.904163***			
V I-1 (6 BAR) X15	1.04443 M15	0.22316	4.68023***			
V I-2 (6 BAR) X16	0.441381 M16	0.223234	1.97721			
Constant B	0.471718					
Exponential Model: Y = B*(M1^ X1)*(M2^ X2)*(M3^ X3)…*(M16^ X16), where Y – Predicted Yield under Irrigated Condition						

(*Main Pearl Millet Research Station, JAU, Jamnagar*)

Year: 2008-2009

Yield assessment of some promising bunch groundnut genotypes with fresh seed dormancy

It is recommended to the groundnut breeders to utilize genotypes K-1375, ICR-4, BSG-9802, JALW-26, TG-50 and SG-99, as donor parents for incorporation of fresh seed dormancy of about 15 days without compromising yield in breeding programmes.

(*Main Oilseed Research Station, JAU, Junagadh*)

Year: 2011-2012

Regeneration protocol for Malkankani (*Celastrus peniculata*Willd)

A. Surface sterilization:
Seeds of *Malkankani* could be used for *in vitro* germination after surface sterilization with carbendazim 2.5 g/ litre of water for 30 minutes followed by 0.1% mercuric chloride treatment for 20 minutes and washed with sterilized distilled water for four to five times for removing traces of the chemicals.

B. Callus induction:
Shoot tips from *in vitro* grown seedlings, collected aseptically should be inoculated for callusing in MS medium with 15.0 µM BA (Benzyl adenine) and 30.0 µM AS (Adenine sulphate).

C. Shoot multiplication:
Proliferated compact green callus should be recultured in the same medium (MS + 15.0 µM BA + 30.0 µM AS) for multiple shoot induction and plantlet development.

D. *In vitro* rooting:
Maximum rooting, more number of roots and longer roots are achieved in half strength MS medium supplemented with 10.0 µM IAA (Indole Acetic Acid).

E. Hardening:
For acclimatization of *in vitro* multiplied seedlings in greenhouse, a pot mixture of soil: sand (1:1) could be successfully utilized which gave the highest (78.33%) survival percentage.

				
A. Surface sterilization	**B. Callus induction**	**C. Shoot multiplication**	**D. *In vitro* rooting**	**E. Hardening**

(*Department of Genetics & Plant Breeding, CoA, JAU, Junagadh*)

Effect of brassinolide on germination and biochemical parameters of chickpea

The application of brassinolide as seed soaking treatment for 2hrs @ 0.25 mg/l in chickpea crop gives good and speedy germination as well as enhanced seedling vigour. This may be attributed to the activation in metabolism during germination through increased enzymatic activities and total soluble sugar content.

(*Department of Genetics & Plant Breeding, CoA, JAU, Junagadh*)

Year: 2012-13

Effect of pre-soaking treatments of growth regulators on germination and seedling vigour of cumin (Cuminum cyminum L.)

Pre-soaking treatment of 50 ppm gibberellic acid (GA_3) for 12 hrs to cumin seed at room temperature increases seed germination percentage with enhanced seedling vigour.

(*Department of Genetics & Plant Breeding, CoA, JAU, Junagadh*)

Allelopathic effects of different weed extracts on seed germination and vigour in groundnut, cowpea and green gram

Root extracts (5%) of *Parthenium* has maximum detrimental effect on seed germination and vigour as compared to other weeds tested *viz*., *Cyprus rotundas*, *Echinochloa crus-galli*, *Cynodon dactylon* and *Digera arvensis*in groundnut, green gram and cowpea crops.

(*Department of Genetics & Plant Breeding, CoA, JAU, Junagadh*)

Seed vigour as influenced by different seed priming in Okra [Abelmoschus esculentus (L.)Moench]

Seed soaked in brassinolide solution (0.2 mg/l brassinolide) for 6 hrs at room temperature followed by air drying at room temperature in okra gives improved and fast germination as well as enhanced seedling vigour.

(*Department of Genetics & Plant Breeding, CoA, JAU, Junagadh)*

Amelioration of simulated water stress by brassinolide application during germination and early seedling growth of groundnut

Application of brassinolide as seed soaking treatment for 2 hrs @ 0.50 mgl^{-1} in groundnut gives improved and faster germination enhanced seedling vigour and activated metabolism in artificially simulated water stress conditions up to -2 bar level of PEG. However, the same concentration of brassinolide sustained germination upto the level of -6 bar induced water stress.

(Department of Biochemistry & Biotechnology, CoA, JAU, Junagadh)

Physiological evaluation of some released varieties of bunch type of groundnut

Among six varieties of bunch groundnut tested for physiological attributes, varieties GG 5 and GG 7 performed better in respect to yield, yield attributes (shelling percentage, 100 kernel weight, 100 pod weight,) and physiological growth parameters (pod growth rate, crop growth rate, partitioning percentage, stem growth rate) under dry farming situation.

(*MainDry Farming Research Station, JAU, Targhadia*)

Quality differences in kesar mango of different location of Saurashtra

The ripened mango fruit of Talala region found to be the best with respect to nutritional quality as it contained higher amount of carotenoids (22.18 $\mu g.g^{-1}$), total soluble sugar (13.57 %) and dry matter (20.54 %); and lower amount of per cent acidity (2.16 %) and total phenol (7.64 mg%) as compared to the Junagadh, Vanthali and Dhari-Visavadar regions.

(Department of Biochemistry & Biotechnology,CoA, JAU, Junagadh)

Molecular characterization of indigenous mango cultivars through DNA finger printing

Out of 50, fifteen ISSR primers produced 29 cultivar specific DNA finger prints. These were 22 unique fragments for identification of 12 indigenous cultivars and 7 fragments for the identification of 5 national cultivars. The three ISSR primers - UBC- 840, UBC-835, UBC-836 are most informative in identifying mango cultivars as they possess the higher primer index values. In clustering pattern, Kaju and Khodi was found to be most diverse indigenous cultivars and shared only 31% similarity with other 18 mango cultivars. The first three most informative PC components explained 56.61 % of the total variation. Five cultivars (Jamrukhiyo, Chappaniyo, Sopari, Jamadar and Kesar) appeared to be distinct from other cultivars in the Principal Coordinate Analysis.

(*Department of Biochemistry & Biotechnology,CoA, JAU, Junagadh)*

Year: 2014-15

Biochemical characterization of Trichoderma spp. for inhibition of *Macrophomina phaseolina* causing root rot in castor

It is recommended to the scientific community that among seven *Trichoderma* spp., *T. koningi* MTCC 796 was found the best antagonist to inhibit the growth of pathogen *Macrophomina phaseolina* followed by *T. harzianum* NABII Th 1 on PDA media. Cell wall degrading enzymes - chitinase and β-1, 3 glucanase are positively correlated to inhibit *in vitro* growth of fungal pathogen *M. phaseolina*. Two species specific SCAR primers, JAU-KON856-4 (F:5'ACCTTTCTGTCACTGCCCTG3'; R:5'AGGAGAAAGGAGTGGTCGGT3') for *T. koningii* MTCC 796 and JAU-HAR395-3 (F:5'CTTTTGGTTTGACACGGTTCT3'; R: 5'AAGCTTTGAAGTTGCGAGGA3‘) for *T. harzianum* NABII Th 1, were developed from sequenced, species specific, RAPD bands of OPA16. These two SCAR markers identified best antagonists inhibiting test pathogen *M. phaseolina*.

(Department of Biochemistry & Biotechnology, CoA, JAU, Junagadh)

QTL mapping and development of SCAR marker for Fusarium wilt (*Fusarium oxysporum* f. sp. *ricini*) in castor

JAUC1 to JAUC5 series of primers can be used in castor breeding programme to identify Fusarium wilt resistant genotypes in Marker Assisted Selection (MAS) or Marker Assisted Backcrossing (MAB).

(Department of Biochemistry & Biotechnology, CoA, JAU, Junagadh)

Sex determination of papaya (*Carica papaya*) through molecular markers

The scientific community involved in papaya improvement are recommended to use JAUP1 to JAUP4 series of primers for sex determination at pre-flowering stage in ‘*Madhubindu’* variety of papaya.

(Department of Biochemistry & Biotechnology, CoA, JAU, Junagadh)

QTL mapping and development of SCAR marker for *Macrophomina* root rot in castor

JAUC6 to JAUC10 series of primers can be used in castor breeding programme to identify root rot resistant genotypes in Marker Assisted Selection (MAS) or Marker Assisted Backcrossing (MAB).

(Department of Biochemistry & Biotechnology, CoA, JAU, Junagadh)

Yield assessment of some drought tolerant groundnut genotypes

It is recommended to the scientific community that the genotypes DRT-2004-7 and J-53 possessed drought tolerance under unirrigated condition. Both genotypes recorded higher pod, haulm and biological yield. Harvest index and partitioning to pod were also highest along with high LAI and number of nodules at 70 DAS, thereby having better assimilation of photosynthates towards sink under rainfed condition. These genotypes may be used as parents in breeding programme for development of drought tolerant varieties.


(Main Oilseeds Research Station, JAU, Junagadh)

Year: 2015-16

Effect of date of sowing and pre-treatment of seeds with GA_3 on seed germination and seedling vigour of cumin (*Cuminum cyminum* L.)

It is informed to the scientific community that sowing of cumin seed in the third week of November along with pre-soaking treatment of 50 mg/lit gibberellic acid (GA_3) for12 hrs to cumin seed at ambient temperature increases germination with enhanced seedling vigour in cumin.

(Department of Genetics & Plant Breeding, CoA, JAU, Junagadh)

The study of fresh seed dormancy in sesame

It is informed to scientific community that the fresh seed dormancy of sesame variety G Til-10 is broken after storage for a month (30 days) after harvest followed by drying, this increases the seed germination percentage and seedling vigour.

(Department of Genetics & Plant Breeding, CoA, JAU, Junagadh)

Effect of plant growth regulators and detopping on morpho-physiological components of yield in cotton (*G. hirsutum* L.)

The scientific community is informed for detopping the cotton plant at 75 DAS with foliar spray of growth inhibitor maleic hydrazide (MH)* 30 ppm (0.3g /10 lit. water) at 90 DAS for balance growth to obtain higher seed cotton yield and net return. This is due to high chlorophyll content, increases in thickness of leaves, length, no. of sympodia, plant spread and no. of bolls.

*Use of MH is banned by Government of India.

(Cotton Research Station, JAU, Junagadh)

The effect of storage conditions, packing materials and seed treatments on viability and seedling vigour of onion (*Allium cepa* L.) seeds

It is informed to scientific community that onion seed may be stored in cold storage ($7^0C \pm 2^0C$) condition packed with cloth bag or polythelene bag (500 gauge) with seed treatment (Carbendazim 2g/kg seed or mancozeb 2g/kg seed or thirum 3g/kg seed or neem leaf powder 10g/kg seed) or without seed treatment for a period of two years without deterioration in germination and seedling vigour.

(Department of Seed Science and Technology, CoA, JAU, Junagadh)

Seed viability in soybean (*Glycine max* (L.) Merr.) under different storage conditions and seed treatments

It is informed to scientific community that soybean seed may be stored under cold storage ($7\ ^0C \pm 2\ ^0C$) condition in cloth bag with seed treatment of mancozeb 2g/kg seed or carbendazim 2g/kg seed or neem leaf powder 10 g/kg seed for a period of two years without deterioration in germination and seedling vigour.

(Department of Seed Science and Technology, CoA, JAU, Junagadh)

Qualitative and quantitative evaluation of seed vigour and viability by Tetrazolium test in pearl millet [*Pennisetum glaucum* (L.) R. Br.]

It is informed to scientific community that pearl millet seed may be stored in air tight plastic containers for a period of 16 months without deterioration in germination seedling vigour.

(Department of Seed Science and Technology, CoA, JAU, Junagadh)

Performance of *neem* products on the storability of mungbean [*Vigna radiata* (L.) Wilczek]

It is informed to scientific community that mungbean seed may be stored in normal condition packed in HDPE bags (500 gauge) with seed treatment of cloth bag or polythelene bag (500 gauge) with seed treatment (*Neem* seed kernel powder 5 to 10 g/kg seed or *Neem* cake 5–10 g/kg seed) for a period of two years without deterioration in germination and seedling vigour.

(Department of Seed Science and Technology,CoA, JAU, Junagadh)

Year: 2016-17

Effect of organic seed treatment on storability of wheat

It is informed to scientific community that wheat seed may be stored under ambient storage condition packed with cloth bag with seed treatment of neem leaf powder or sweet flag rhizome powder @ 2-5 g/kg of seed or neem seed kernel powder @ 2 g/kg seed for a period of 20 months without deterioration in germination and seedling vigour.

(Department of Seed Science and Technology, CoA, JAU, Junagadh)

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 pigeon pea rhizosphere and poultry farms. The best PSBs were confirmed as *Pseudomonas putida* and *Pseudomonas fulva.*

(Department of Biochemistry and Biotechnology, CoA, JAU, Junagadh)

Year: 2017-18

Effects of 2, 3, 5-Triiodobenzoic Acid (TIBA) on seed cotton (*Gossypium hirsutum* L.) yield

It is informed to scientific community that spray growth regulator TIBA 5g/ha/spray at 50, 60, 70, 80 & 90 DAS to achieve balanced growth and higher seed cotton yield in late maturing Bt cotton hybrids under irrigated condition in South Saurashtra Agro-Climatic Zone.
As TIBA is not listed by CIB.

(Cotton Research Station, JAU, Junagadh)

Biochemical and molecular characterization of brinjal varieties and promising genotypes

It is informed to the scientific community that brinjal variety GOB-1 was found most distinct among 14 promising genotypes and varieties based on biochemical, nutritional and molecular analysis. It contains higher protein, total soluble solids, soluble sugars, phenols, ascorbic acid, PPO activity, flavanoid contents; lower glycoalkaloids and acidity. The clustering pattern on the basis of biochemical parameters of brinjal varieties and genotypes correlates with molecular (SSR) based dendrogram depicting most distinct genotype GOB-1 out grouped from other genotypes with 48 per cent similarity.

(*Department of Biochemistry and Biotechnology, CoA, JAU, Junagadh*)

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

The scientific community involved in pearl millet improvement is informed to use below mentioned JAUB series of primers for identification of following 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		

(*Department of Biochemistry and Biotechnology, CoA, JAU, Junagadh*)

Development of cultivar specific markers for the varieties released by JAU in groundnut

The scientific community involved in groundnut improvement is informed to use below mentioned JAUG series of primers for identification of following 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		

(*Department of Biochemistry and Biotechnology, CoA, JAU, Junagadh*)

Genome sequencing of pathogenic *Macrophomina phaseolina* isolated from castor

It is informed to the scientific community involved in castor improvement that whole genome sequencing of plant pathogenic fungi *Macrophomina phaseolina* showed 98.6 Mb of genome size. The draft genome has 3061 contigs, 30756 genes, 183303 exons, 28096 SSRs and 13947 repeat regions. In this genome, 24.30 % of genes are involved in molecular functions, 34.27 % in cellular components and 41.43 % in biological processes. Pathogenicity related genes identified in this study have high relevance in future fungicide designing. The following primers can be used for 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

(*Department of Biochemistry and Biotechnology, CoA, JAU, Junagadh*)

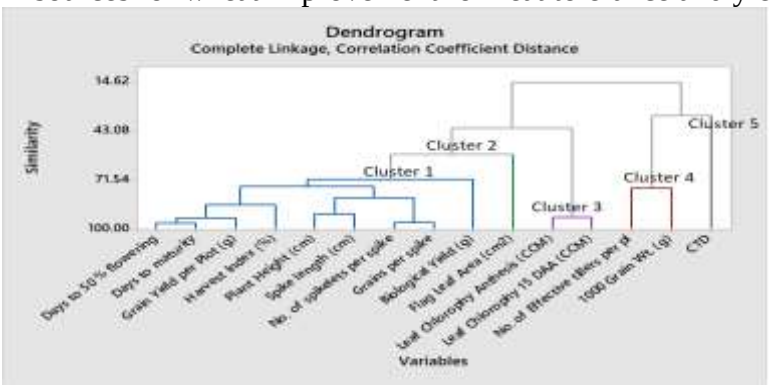
In situ detection of potassium status in cotton plants

It is informed to scientific community/industrialists that silver and carbon nano-particles based portable nano-biosensor has been invented for detection of potassium directly from the leaf sap of cotton plant with precision. The nano-biosensor works on the basis of ion-selective mechanism to detect potassium ion in the range of 10 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 invented nano-biosensor is about Rs. 2500-3000 and it works well to detect potassium deficiency level at any growth stage of cotton crop.

(Department of Biochemistry and Biotechnology, CoA, JAU, Junagadh)

Thermal stress tolerance in wheat (*Triticum aestivum* L.)

It is informed to scientific community that genotypes J 2010-09 (GW 463) and J 2010-05 are good germplasm sources for wheat improvement for heat tolerance and yield.



(Department of Genetics and Plant Breeding, JAU, Junagadh)