JUNAGADH AGRICULTURAL UNIVERSITY, JUNAGADH

RECOMMENDATIONS FOR SCIENTIFIC COMMUNITY
DEVELOPED BY THE UNIVERSITY DURING LAST 11 YEARS
(2004-05 TO 2014-15)

Total 130 scientific recommendations were developed in various disciplines as described below.

I. CROP IMPROVEMENT

Year: 2004-05

Male sterile line: Bajra

The male sterile (A) line 95444 B and inbreds J-2340 and J-108 were assessed to be drought which can be used for the development of drought resistant hybrids.

(Main Pearl Millet Research Station, JAU, Jamnagar)

Year: 2012-13

Testing of fresh seed dormancy in bunch groundnut varieties

For scientific community a recommendation was proposed to avoid production losses due to pod germination in field under late and excess rainfall conditions during *kharif* at maturity time. The fresh seed dormancy was studied in nine high yielding bunch groundnut varieties and it was recommended to grow groundnut varieties TG-26, TPG-41 and GG-6 possessing higher degree of seed dormancy.

(Main Pearl Millet Research Station, JAU, Jamnagar)

II. CROP PRODUCTION

Year: 2006-07

Economics and yield potential of summer groundnut under different irrigation methods

The results of three years study revealed that the pod yield recorded with porous pipe irrigation system was as good as that obtained with drip or sprinkler method of irrigation.

(Department of Agronomy, JAU, Junagadh)

Study on evapotranspiration and crop coefficient during different phenophases of sorghum and green gram (Alternate year)

Mean Kc values during different phenophases of *kharif* sorghum and green gram.

Sorghum			**Green gram**		
Phenophases	***Period(days)***	***Kc***	***Phenophases***	***Period(days)***	***Kc***
Germination	03	0.69	Germination	03	0.55
Vegetative	50	0.82	Vegetative	39	1.24
Booting	12	0.86		-	-
Flowering	11	0.72	Flowering	11	1.30
Milky	08	0.51	Pod development	13	1.00
Maturity	07	0.44	Maturity	17	0.72
Total	91	4.04	Total	83	4.81

(Main Dry Farming Research Station, JAU, Targhadia)

Year: 2007-08

Soil test based fertilizer application for targeted yields of castor crop

The Soil Testing Laboratories of the state are recommended to adopt following equations for achieving targeted yield (25 q/ha) of castor.

N: FN = 6.13 x T - 0.23 SN,
P: FP_2O_5 = 3.35 x T - 0.77 SP,
K: FK_2O = 3.38 x T - 0.11 SK

Where,
T = Targeted yield in quintal/ha
S = Soil test value of respective elements
F = Fertilizer

(Dept. of Agril. Chemistry & Soil Science, JAU, Junagadh)

Crop-weather relationship of *kharif* groundnut

Based on the results of crop-weather relationship study, the farmers of South Saurashtra Agro-climatic Zone are advised to sow the spreading and semi-spreading varieties of groundnut from 21st May to 10th June with one or two pre-monsoon irrigations to harness benefits of favorable weather conditions during the monsoon period and to obtain higher yields.

(Department of Agronomy, JAU, Junagadh)

Year: 2008-09

Feasibility of micro irrigation and organic manures in okra

In South Saurashtra Agro-climatic Zone, summer okra (Gujarat Okra-2) irrigated by drip system at 1.0 PEF gives 11 per cent net higher return. Moreover, application of recommended dose of fertilizer (100:50:50 NPK kg/ha) and FYM @ 10 t/ha further increases yield by 26 per cent and net realization to the extent of 100 per cent.

The system details are:

1. Lateral spacing=60cm
2. Dripper spacing=60cm
3. Dripper discharge=4 lph
4. Operating time = 1 hour and 45 minutes at alternate day
5. Operating pressure = 1.2 kg/cm^2

(Department of Agronomy, JAU, Junagadh)

Establishment of critical limit of zinc in cotton in medium black calcareous soils

The critical limit of DTPA extractable Zn content in soil is worked out to be 0.89 ppm. The critical Zn content in 4th developed leaf of cotton at 30 DAS is worked out to be 57.50 ppm.

(Department of Agril. Chem. & Soil Science, JAU, Junagadh)

Year: 2009-2010

Establishment of critical limit of phosphorus for black gram grown on medium black calcareous soils

The critical limit of available P_2O_5 (Olsen's method) is 24 kg P_2O_5 ha^{-1} in medium black calcareous soils and that for P content in leaves (3rd leaf) of black gram at 30 DAS is 0.471 per cent.

(Department of Agril. Chem. & Soil Science, JAU, Junagadh)

Determination of thermal requirement for different *kharif* crops under rainfed condition

Based on the field experiment, it was concluded that with delay in onset of monsoon, the Growing Degree Days (GDD) and Heat Use Efficiency (HUE) of different crops were tended to decline. The phenophase wise GDD is given herein.

Sr. No.	Particular	Short duration crops								
		Sesame			Pearl millet			Black gram		
		I	II	III	I	II	III	I	II	III
	Yield (kg/ha)	747	547	158	1980	1709	539	667	384	94
	HUE	0.40	0.34	0.10	1.20	1.18	0.38	0.41	0.24	0.07
	Phenophase	Growing Degree Days (GDD)								
1.	Germination	105	125	118	105	132	124	76	94	87
2.	Branching	752	583	558	644	551	569	455	421	355
3.	Flowering	722	377	361	407	298	293	347	318	247
4.	Capsule/pod/ear head formation	370	312	311	327	300	261	525	544	414
5.	Maturity	212	221	172	158	170	128	306	258	254
	Total	**1862**	**1619**	**1517**	**1641**	**1452**	**1375**	**1708**	**1635**	**1356**

Sr. No.	Particular	Long duration crops								
		Cotton			Castor			Spreading G'nut		
		I	II	III	I	II	III	I	II	III
	Yield (kg/ha)	531	357	96	1597	1350	467	665	443	36
	HUE	0.17	0.13	0.04	0.51	0.49	0.19	0.29	0.22	0.02
	Phenophase	Growing Degree Days (GDD)								
1.	Germination	115	113	123	153	133	123	153	153	123
2.	Branching	808	715	679	876	768	639	700	647	463
3.	Flowering	1093	1009	749	1156	1051	821	443	422	326
4.	Capsule/pod/ boll formation	722	620	417	545	486	308	593	495	401
5.	Maturity	384	336	257	365	257	277	436	451	402
	Total	**3120**	**2792**	**2224**	**3092**	**2694**	**2167**	**2325**	**2066**	**1715**

Where, I Onset of monsoon, II 15 days after onset of monsoon, III 30 days after onset of monsoon

(Main Dry Farming Research Station, JAU, Targhadia) and Department of Agronomy, JAU, Junagadh)

Relative salt tolerance of different groundnut (*Arachis hypogaea* L.) genotypes in simulated saline soils

Based on the biomass yield and Na/K ratio in haulm of spreading type GG 13, semi-spreading type GG 20 and bunch type J 33533 varieties of groundnut were found tolerant to salinity (ECe 2 dS/m). Whereas, GG 20 (semi-spreading) and J 33533 (bunch) were found more tolerant to higher salinity (ECe 4 dS/m) than other varieties.

(Dept. of Agril. Chem. & Soil Science, JAU, Junagadh)

Year: 2010-2011

Soil test based fertilizer recommendation for targeted yields of onion crop

The fertilizer prescription equations of N (FN=0.84 x T–0.45 SN), P (FP_2O_5 = 0.72 x T–2.21 SP) and K (FK_2O = 0.43 x T–0.17 SK) is fit up to yield target of 225 q/ha in onion. The yield targeting approach is also found effective in economic return and soil fertility build up for cultivation of onion in Saurashtra region.

(Department of Agril. Chem. & Soil Sci., JAU, Junagadh)

Soil test based fertilizer recommendation for targeted yields of garlic crop

The fertilizer prescription equations of N (FN= 3.73 x T–0.52 SN), P (FP_2O_5 = 2.10 x T–2.36 SP) and K (FK_2O = 2.90 x T–0.45 SK) is fit up to yield target of 70 q/ha in garlic. The yield targeting approach is also found effective in economic return and soil fertility built up for cultivation of garlic in Saurashtra region.

(Department of Agril. Chem. & Soil Sci., JAU, Junagadh)

Establishment of critical limit of potassium for cotton (G. Cot. Hy-10) in medium black calcareous soils

The critical limit for cotton variety G. Cot. Hy-10, available K_2O (ammonium acetate-K) for cotton was obtained 152.0 kg K_2O/ha in medium black calcareous soil, while the critical value of K content in plant was observed 1.72 per cent at 30 DAS.

(Department of Agril. Chem. & Soil Sci., JAU, Junagadh)

Relative salt tolerance of different wheat genotypes in simulated saline soil condition

The wheat varieties GW-322 and KRL-119 were found tolerant to salinity up to ECe 4 dS/m.

(Department of Agril. Chem. & Soil Sci., JAU, Junagadh)

Potassium supplying power of soils of Rajkot district

- The soils of Rajkot district were neutral to moderately alkaline reaction, non calcareous to highly calcareous, low to medium in organic carbon content. The 33.6, 1.8, 32.1, 20.7, 36.4 and 3.9 per cent soils were found low in availability of P, K, S, Fe, Zn and Mn, respectively.
- The maximum and minimum values of various potassium fractions were recorded in soils of Malia-Miyana and Paddhari Taluka, respectively.
- The higher and lower values of various potassium fractions were recorded with cotton-cotton and cotton-*rabi* crops sequences, respectively.
- Availability of K and values of different K fractions were increased with increase in soil depth.
- The different K fractions and availability of K were lower in irrigated conditions as compared to un-irrigated conditions.

(Main Dry Farming Res. Station, JAU, Targhadia)

Year: 2013-14

Status of sulphur fractions in medium black soils of Rajkot district (Gujarat)

- In general, minimum and maximum values of various sulphur fractions were recorded in soils of Tankara and Upleta, respectively.
- The higher and lower values of various sulphur fractions were recorded with groundnut-groundnut mono sequence and cotton/groundnut-*rabi* crops sequences, respectively.
- The values of all the sulphur fractions were recorded higher with medium deep soil (>60 cm) in comparison to shallow soil (<60 cm).
- The higher and lower values of various fractions of sulphur were recorded with irrigated and unirrigated conditions, respectively.
- Value of organic sulphur was lower with irrigation applied through bore well in comparison to open or canal/river sources.
- District as whole 32.1 per cent soils fall under deficient category, while 44.6 per cent in medium and only 23.2 soils are in high range.

(Main Dry Farming Research Station, JAU, Targhadia)

Establishment of critical limit of sulphur under onion crop in medium black calcareous soils

For recommending sulphur application to onion crop grown on calcareous soils of Saurashtra, Soil Testing Labs (STLs) of Gujarat should consider critical limit of 10 ppm S in soil and 0.56 per cent in onion plant at 60 DAS.

(Department of Agril. Chemistry & Soil Science, JAU, Junagadh)

Establishment of critical limit of sulphur for garlic crop in medium black calcareous soils

For recommending sulphur application to garlic crop grown on calcareous soils of Saurashtra, Soil Testing Labs (STLs) of Gujarat should consider critical limit of 10 ppm S in soil and 0.45 per cent in garlic plant at 60 DAS.

(Department of Agril. Chemistry & Soil Science, JAU, Junagadh)

Relative salinity tolerance of different wheat genotypes

The relative salt tolerant of wheat varieties was found in order of GW 322 > GW 366 > Lok 1 > GW 273 > GW 496 up to EC 4.0 dS/m of irrigation water.

(Department of Agril. Chemistry & Soil Science, JAU, Junagadh)

Soil test based fertilizer application for targeted yields of Bt. cotton in Saurashtra region of Gujarat

The Soil Testing Labs (STLs) of Gujarat are advised to use following equation for achieving targeted yield (up to 30 q/ha) of Bt cotton grown in Saurashtra region.

$FN = 20.80 \times T - 1.55\ SN$

$FK_2O = 18.97 \times T - 1.47\ SK$

Where; FN = Fertilizer N to be applied (kg/ha)
SN = Available soil N (kg/ha)
T = Targeted yield (q/ha)
FK_2O = Fertilizer K_2O to be applied (kg/ha)
SK = Available soil K_2O (kg/ha)

(Department of Agril. Chemistry & Soil Science, JAU, Junagadh)

Year: 2014-15

Study of uptake pattern of phosphorus in different varieties of castor

In castor crop, phosphorus uptake was 47.6, 33.1 and 19.3 per cent by leaf, stalk and root at branching stage, while at flowering stage 23.8, 13.3, 5.3 and 57.6 per cent and at capsule formation stage 13.7, 16.9, 3.4 and 66.0 per cent by leaf, stalk, root and spike, respectively. Among the different stages of plant growth, the maximum phosphorus uptake was obtained at capsule formation stage (370 mg/plant) followed by flowering stage (118 mg/plant) and branching stage (29 mg/plant). Among the different varieties, maximum phosphorus uptake by crop was observed with GCH-7 at all the growth stages.

(Dept. of Agril. Chem. & Soil Sci., CoA, JAU, Junagadh)

Weed management in garlic

The scientific community is informed that application of oxyfluorfen 240 g/ha as pre-emergence followed by hand weeding at 40 days after sowing (DAS) or application of oxadiargyl 90 g/ha as pre-emergence followed by hand weeding at 40 DAS gave higher yield and net realization as well as effective weed management.

(Department of Agronomy, CoA, JAU, Junagadh)

Weed management in cumin

The scientific community is informed that application of pendimethalin 900 g/ha as pre-emergence followed by hand weeding at 45 days after sowing (DAS) gave higher yield and net realization as well as effective weed management.

(Department of Agronomy, CoA, JAU, Junagadh)

III. AGRICULTURAL ENGINEERING

Year: 2004-05

Recharging of Well

The scientists are advised to consider the following parameters for recharging of well in North Saurashtra Agro-climatic Zone.

1. Following equation can be used for calculating the runoff from rain fall in shallow soil and poor hydrological soil group C in small watersheds.
   Runoff (mm) = -1.075 + 0.0534 Rainfall (mm).
2. Recharge rate has significant relation with storage head of the well.
3. For trapping the sediment load from the runoff water, filter of 7.0 m x 1.5 m with three layers of 20 cm each of sand 1 mm (top layer), followed by gravel (10 to 20 mm) and pebbles (30 to 40 mm) should be used which can retain average sediment load of the runoff water up to 67 per cent.

(Main Dry Farming Research Station, JAU, Targhadia)

Year: 2005-06

Micro tube emitters

The technology is recommended to scientist, entrepreneurs and industrialists to adopt the following dimensionally homogeneous equation for micro tube emitters while designing drip system,

$Q = \{(20 \times g \times D^5 \times H) / L)\}^{1/2}$

Where Q = emitter rate (cm^3 /sec), g = gravity constant (cm/sec^2), D = micro tube diameter (cm), L= length (cm), H = Operating pressure (cm of water column). The dimensionally homogeneous equation holds good for all flow regimes. Further they may adopt/manufacture less than 1.5 mm diameter of tube as micro tubing emitters because greater than 1.5 mm tube behave as like conveyance pipe instead of pressure dissipation element.

(Department of SWE, CAET, JAU, Junagadh)

Greenhouse soil temp model

The mathematical model "GREENHOUSE SOILTEMP" given below can be used by the scientific community to predict the soil profile temperature of solarized (covered) and non-solarized (uncovered) soils inside the greenhouse by incorporating various input data like weather data i.e. solar radiation intensity and ambient temperature; soil properties i.e. bulk density, porosity, moisture content, thermal conductivity and specific heat of local place; physical properties of greenhouse covering and mulch cover i.e. specific heat and bulk density and optical properties of soil and covering material i.e. transmissivity, absorbtivity, and emissivity.

1. Uncovered soil

For greenhouse covering:

$$M_{co}C_{co}dT_{co}/dt = \alpha_{co}I - h_{cogh}(T_{co}-T_{gh}) + h_{co\text{-}s(1)}(T_{s(1)}-T_{co}) - h_{coa}(T_{co}-T_a) \quad \ldots (1)$$

For greenhouse air:

$$M_{gh}C_{gh}dT_{gh}/dt = \alpha_{gh}I - h_{cogh}(T_{co}-T_{gh}) + h_{co\text{-}s(1)}(T_{s(1)}-T_{co}) \quad \ldots (2)$$

For surface layer:

$$\Delta H\ \rho_s C_s(1-\varepsilon)\ dT_{s(1)}/dt = \tau_{co}\ \alpha_{s(1)}I - h_{s(1)gh}(T_{s(1)}-T_{gh}) - h_{s(1)co}(T_{s(1)}-T_{co}) - K_s/\Delta H\ (T_{s(1)} - T_{s(2)}) \ldots (3)$$

For subsequent layers (I=2,n):

$\Delta H\ \rho_s C_s(1-\varepsilon)\ dT_{s(I)}/dt = h_{ss}(T_{s(I-1)}-2T_{s(I)}+T_{s(I+1)})$ …(4)

2. Transparent polyethylene covered soil

For greenhouse covering:

$M_{co}C_{co}dT_{co}/dt = \alpha_{co}I - h_{cogh}(T_{co}-T_{gh}) + h_{cog}(T_g-T_{co}) - h_{coa}(T_{co}-T_a)$ *... (5)*

For greenhouse air: $M_{gh}C_{gh}dT_{gh}/dt = \alpha_{gh}I - h_{cogh}(T_{co}-T_{gh}) + h_{ggh}(T_g-T_{gh})$ *... (6)*

Plastic film on soil surface:

$M_gC_gdT_g/dt = \tau_{co}\ \alpha_gI - h_{gco}(T_g-T_{co}) + h_{g\text{-}s(1)}(T_{s(1)}-T_g) - h_{ggh}(T_g-T_{gh})$ *... (7)*

For surface layer:

$\Delta H\ \rho_sC_s(1-\varepsilon)\ dT_{s(1)}/dt = \tau_{co}\ \tau_g\ \alpha_{s(1)}I - h_{s(1)g}(T_{s(1)}-T_g) - K_s/\Delta H\ (T_{s(1)}-T_{s(2)})$ *... (8)*

For subsequent layers (I=2,n):

$\Delta H\ \rho_sC_s(1-\varepsilon)\ dT_{s(I)}/dt = h_{ss}(T_{s(I-1)}-2T_{s(I)}+T_{s(I+1)})$ …(9)

Nomenclature

C	*specific heat*
f	fraction
H	depth of soil bed, m
h	heat transfer coefficient
I	radiation
K	thermal conductivity
M	mass, kg/m^2
T	temperatuire, ^{o}C
t	time, sec
V	volumetric, m^3

Greek

α	solar absorptance
ρ	density, kg/m^3
τ	solar transmittance
ε	*porosity, decimal*
ΔH	*spacing between two successive soil layers, m*

Subscript

a	*ambient*
co	greenhouse cover
cog	cover-mulch
co-gh	cover-greenhouse air
g	*mulch glazing*
gh	greenhouse air
ga	*glazing-ambient*
gs	*glazing-soilith layer*
s	*soilsg soil-glazing*
ss	*soil-soil*
t	*transparent*
(1)	*first layer*
cl	clay fraction

(Department of RE & RE, CAET, JAU, Junagadh & Directorate of Research, JAU, Junagadh)

Year: 2009-10

Determination of aquifer properties of the wells of Junagadh region

The aquifer properties *viz.*, transmissibility and storage coefficient for different talukas of the Junagadh district are recommended for the scientific community, Government/Non Government Organizations for crop planning and simulating groundwater behavior for adopted cropping pattern as below.

Aquifer properties of different talukas of Junagadh District

Sr. No.	Taluka	Tested site	Aquifer properties	
			Transmissibility (m^2 /h)	Storage coefficient
1	Vanthali	Vanthali	0.55	0.1919
2	Manavadar	Manavadar	1.187	0.0000358
3	Visavadar	Visavadar	0.7065	0.0002272
4	Mangrol	Mekhadi	6.439	0.1655
6	Junagadh	Junagadh, Bamangam	4.36057	0.0047
7				
8	Una	Keshariya	3.3697	0.00011264S

9	Kodinar	Vadanagar	1.141	0.0001614
10	Sutrapada	Amrapur	9.65	0.108223
11	Mendarda	Amargadh	9.072	0.0013881
12	Talala	Chitrod	33.8846	0.061592
13	Veraval	Supasi	44.553	0.1267303
14	Keshod	Pipari	13.30	0.0000982164
15	Bhesan	Sukhpur	14.2165	0.0252
16		Khambhaliya		
17		Bamangadh		
18		Samatpara		
18	Malia	Vadia	19.3192	0.033766
19		Panakava		
20		Itali		
21		Babara		
22		Dudhala		

(Department of Soil and Water Engineering, CAET, JAU, Junagadh)

Determination of water front advance under different dripper (emitter) discharge rate in medium black soil

(i) At any given duration of water application, the wetted diameter at soil surface increased with increase in dripper discharge rate.

(ii) Time to reach a particular wetted soil depth is more with low discharge rate of the dripper as compared to higher discharge rate of the dripper.

(iii) The following relationships between time of application and depth of soil can be used in medium black soils for emitter discharge rate of 2, 4, 8 and 16 lph, respectively.

$t = 16.889\ Z^{1.1951}$

$t = 12.474Z^{1.3325}$

$t = 11.574Z^{1.2625}$

$t = 6.0753Z^{1.5547}$

where, t = Time of application (time to reach water at funnel outlet), min.

Z = Depth of soil (depth of funnel placement), cm.

(iv) The following relationships between diameter of wetted soil at surface and depth of soil can be used in medium black soils for emitter discharge rate of 2, 4, 8 and 16 lph, respectively.

$W = 7.175\ Z^{0.4534}$

$W = 7.242\ Z^{0.5545}$

$W = 7.807\ Z^{0.6138}$

$W = 8.208\ Z^{0.6858}$

where, W= Diameter of wetted soil surface, cm ; Z= Depth of soil, cm.

(Main Dry Farming Research Station, JAU, Targhadia)

Year: 2010-11

Drying air variables tomato slices

The influence of drying air variables i.e. drying air temperature and velocity on drying rate constant "k" of tomato slices is recommended in the form of Arrhenius-type model, given below, for describing the thin layer drying behavior of 5.0 ± 0.5 mm thick tomato slices. The

value of constant "c" did not show any regular dependence on drying air variables and recommended to be equal to mean value of 1.005.

$k = 587.83\ v^{0.36} \exp(3487.79 / T_{ab})$

(COD, $r^2 = 0.998$, $\chi^2 = 9.541 \times 10^{-8}$ for $0.25 m/s \leq v \leq 1 m/s$ and $50°C \leq T \leq 80°C$)

(Department of RE & RE, CAET, JAU, Junagadh)

Year: 2011-12

Water balance and assessment of groundwater recharge in Meghal river basin of Saurashtra region

The efficient utilization of available water in Meghal river basin is recommended using surface as well as micro irrigation systems. The total groundwater recharge through rainfall and water harvesting structures in the study area was found 12,592 ha m. The possible options for efficient utilization of groundwater using different irrigation systems are as below:

Option 1: Using surface irrigation methods

In Meghal river basin, if surface irrigation system is adopted at 60 per cent application efficiency, about 9,084 ha of wheat crop (irrigation water requirement 457 mm) can be irrigated using 5,187 ha m of water. The remaining amount of water can be used for irrigating horticultural crops viz., coconut, mango and sapota (gross irrigation requirement 1097, 453 and 768 mm) of about 3,669, 1,005 and 596 ha area, which covers about 2/3rd area of horticultural crops.

Option 2: Allocating all crops under micro irrigation system

In Meghal river basin, if drip irrigation system is adopted (90 per cent application efficiency) for existing horticultural crops of coconut, mango and sapota in 5,595, 1,602 and 796 ha area water required is 6,137, 725 and 611 ha m respectively. The remaining water can be utilized through sprinkler irrigation (80 per cent application efficiency) for irrigating wheat crop will cover about 11,950 ha area. This can bring under irrigation all horticultural crops and an additional area of 2,866 ha (31.6 %) of wheat crop.

(Department of Soil &Water Engg., CAET, JAU, Junagadh)

Rainfall analysis for crop planning

1) Rainfall amount of 25.4 mm & 37.1 mm and 8.98 mm & 30.64 mm will be received at 75% and 60% probabilities in 27th and 29th Meteorological Standard Week (MSW), respectively. The conditional probability of getting 30 mm is 66.64 % and 65.17 % during 27th and 29th MSW, respectively. Therefore sowing operation can be carried out during this period.
2) Annual, seasonal rainfall and rainy days followed the increasing trend after 2000. The average length of the rainy season was observed 99 days. Drought resistance, low water requirement, short duration crop and its varieties having crop growth period maximum 99 days should be grown.
3) During 32 MSW, probability of a dry spell of length 7 is higher (0.64).Therefore, this period can be used to carry out interculturing operations and formation of ridges. Fertilizer top dressing needs to be done when the soil is sufficiently moist i.e. before 32 MSW. During 35 MSW to 37 MSW, probability of a dry spell of length 21 or

more is higher; therefore spraying of anti-transparent and mulching can be done to reduce evapo-traspiration losses.

4) Excess rain water received during 28th to 31st MSW can be harvested and later used as a life saving irrigation at times when prolonged dry spells occur.

(Main Dry Farming Research Station, JAU, Targhadia)

Year: 2012-13

Summer sesame response to irrigation under drip and mulching technology

The models for summer sesame crop response to irrigation scheduling levels and seasonal irrigation depth under drip irrigation with and without mulch are proposed for the scientific community**.**

(a) The yield response to irrigation scheduling level with and without mulch for summer sesame crop can be described by the mathematical model as below.

$Y = -400.0 (IW/ET_c)^2 + 998.3 (IW/ET_c) + 592.2$ for no mulch application.

$Y = -808.6 (IW/ET_c)^2 + 1874 (IW/ET_c) + 355.7$ for mulch application.

Where, Y is the sesame grain yield (kg/ha) and IW/ET_c is the ratio of irrigation water depth (mm) to crop evapo-transpiration depth (mm).

(b) The yield response to seasonal irrigation depth under no mulch and mulch application for summer sesame crop can be described by the mathematical model as below.

$Y = -0.002 (W)^2 + 2.537 (W) + 652.8$ for no mulch application.

$Y = -0.006 (W)^2 + 4.977 (W) + 444.6$ for mulch application.

Where, Y is the sesame grain yield (kg/ha) and W is the seasonal irrigation depth (mm).

(Department of Soil &Water Engg., CAET, JAU, Junagadh)

Drought investigation using Standardized Precipitation Index (SPI) index for Junagadh

The recommendation is Scientists, Policy makers and Irrigation planners of South Saurashtra Agroclimatic Zone are advised to plan their irrigation water schedules to the crop based on the following guidelines:

1) Moderately dry and severe dry years appear once in seven years 7 years and 10 years from 2002
2) Moderately dry July, August and September months appear once in 10 years, 9 years and 5 years respectively from 2002
3) Severe dry July, August and September months and years appear once in 9 years, 18 years, and13 years respectively from 2002
4) Abnormal weeks appear once in six years from 2002
5) Severe dry spell of 15 days occur once in 15 years during July and August
6) Dry spells of 10 days occur once in 7 years in July (July 1-10) and once in 13 years in August (Aug 10-20).

(Research Testing & Training Center, JAU, Junagadh)

Year: 2013-14

Geometry of wetting pattern under trickle irrigation

The scientists of South Saurashtra agro-climatic zone are advised to keep the following suggestions while using the following developed equations by various scientists for predicting the wetting geometry in Loamy Soils.

a) Healy and Warrick (1981) model predicted wetting geometry (width (R^2 = 0.3141) and depth (R^2 = 0.1918) at lower discharges with poor accuracy and failed to predict at higher emitter discharges (> 8 lph).
b) Philips (1984) model predicted wetting geometry (both width and depth) at lower and higher emitter discharges with good accuracy.
c) Accuracy of original Debral (2012) dimensional analysis model is low in predicting wetting geometry (both depth below the emitter (R^2 = 0.845) and width at the surface (R^2 = 0.895)).
d) BEN-ASHER Hemi Spherical Model (1985) predicted both depth (R^2 = 0.962) and width (R^2 = 0.9774) with good accuracy.
e) Steady state Wooding model (1968), Steady state Raats model and moment analysis approach predicted both steady width with low accuracy.

(Research Testing & Training Center, JAU, Junagadh)

Ambient temperature trend analysis for the North Saurashtra region in view of climate change

1. Weekly maximum temperature showed significantly increasing trend in MSW 8, 14, 15 and 18 where as significantly decreasing trend was observed in MSW 28, 37 and 39. Generally 28th MSW (9th July to 15th July) is the initial stage of groundnut, cotton and other *kharif* crops. Whereas MSW 37 and 38th (10^{th} Sept. to 23^{rd} Sept.) is the pegging stage of groundnut.

2. Weekly minimum temperature showed significantly increasing trend in MSW 3, 8, 9, 12, 13, 15, 19, 44, 45, 48, 51 and 52. The MSW 44-45^{th} (Oct. 29 to Nov. 11) is the mid season of cotton crop. MSW 48 (Nov. 26 to 2^{nd} Dec.) and MSW 51 and 52 (Dec. 17^{th} to 30^{th} Dec.) is the germination and booting stage of wheat and growing and flowering stage of cumin, respectively.

(Main Dry Farming Research Station, JAU, Targhadia)

Year: 2014-15

The Impact of Seawater Intrusion on the Qualitative Parameter of Ground Water

The following scientific information as models developed for rainfall and groundwater EC are released for the scientific communities / Line Departments of State / Central Governments/ NGOs working in the coastal belts of the Saurashtra region.

SN	Costal belt region	Best fit model	R^2
1	0-5 km	$EC_{PM} = 0.6364(EC_{bm}) - 0.00166(RF) + 2.9495$	0.83
2	5-10km	$EC_{PM} = 0.6965(EC_{bm}) - 0.000359(RF) + 1.2837$	0.64
3	10-15km	$EC_{PM} = 0.4171(EC_{bm}) - 0.000267(RF) + 1.5592$	0.64
4	15-20km	$EC_{PM} = -0.3577(EC_{bm}) - 0.0000683(RF) + 1.8636$	0.82

(Dept. of Soil & Water Engg., CAET, JAU, Junagadh)

An assessment of suitability of groundwater for drip irrigation in Saurashtra region

The following scientific information is released for the scientific community. The pH of the groundwater was observed higher (more than 7) in all districts of the Saurashtra region. The maximum ground water samples (99.14 %) were found in category scale forming but non corrosive class.

- Based on the EC, SAR and RSC of the groundwater, 56.24, 18.4, 6.64 and 18.68 per cent samples were found under categories of good water, saline water, high SAR saline water and alkali water class, respectively.
- The hardness of the groundwater in Jamnagar, Rajkot, Surendranagar, Junagadh and Porbandar districts were varying from 9 to 177, 12 to 206, 12 to 292, 10 to 221 and 12-176, respectively.

(Dept. of Soil & Water Engg., CAET, JAU, Junagadh)

IV. PLANT PROTECTION

Agricultural Entomology

Year: 2004-05

Castor

The castor genotypes having the plant characters of double bloom and triple bloom were found resistant against jassid and they gave the lowest jassid population and higher seed yield than the genotypes having the plant characters of no bloom and single bloom. Whereas, the castor genotypes having the plant characters of no bloom and single bloom were found resistant against whitefly and thrips and they gave the lowest pest population than the genotypes having the plant characters of double bloom and triple bloom. So, these genotypes are recommended to be utilized in breeding programme for pest resistance.

(Main Oilseed Research Station, JAU, Junagadh)

Forage Sorghum

In forage sorghum, plant damage by shoot fly was in the range of 3.3 per cent at 28 DAG to 5.0 per cent at 21 DAG. Whereas, due to stem borer plant damage was 12.90 per cent at 48 DAG, leaf damage score was 2.7 at 44 DAG and stem tunneling was 8.3 per cent at harvest time.

(Grassland Research Station, JAU, Dhari)

Year: 2005-06

Sesame

Avoidable yield loss in sesame due to infestation of leaf roller (*Antigastra catalaunalis*) ranged between 8 to 34 per cent with an average of 16 per cent.

(Dry farming Research Station, JAU, Targhadia)

Sesame

Yield loss in sesame (G. Til-2) due to pest complex i.e. leaf webber (*Antigastra catalaunalis)*, gall fly *(Asphondylia sesami)*, mite *(Polyphagotarsonemus latus)* and leaf eating beetle *(Pucneforus impressusa)* was 38.70 per cent.

(Agriculture Research Station, JAU, Amreli)

Sesame

Sesame genotypes/varieties, G.Til-10 and NG-2-177 were tolerant to leaf webber/capsule borer (*Antigastra catalaunalis)*. Entries G.Til-10, NG-2-177, AT-103 and AT-93 were tolerant to gall fly *(Asphondylia sesami)*. Entry AT-93 was tolerant to mite *(Polyphagotarsonemus latus)*.

(Agriculture Research Station, JAU, Amreli)

Cabbage & Cauliflower

The population of aphid (*Brevicoryne brassicae*) and whitefly (*Bemisia tabaci*) in cabbage and cauliflower were maximum during early January to early February under Junagadh condition. The diamond back moth (*Plutella xylostella*) infestation initiated in early January and reached at peak in early February. The population of aphid and whitefly were negatively correlated with maximum temperature in cabbage, while the DBM population in both the crops was positively correlated with wind speed.

(Department of Entomology, JAU, Junagadh)

Year: 2007-08

Pearl Millet

In pearl millet, incidence of shoot fly *Atherigona approximate* (Malloch) started at seedling stage and remained up to earhead stage. It was non-significantly and positively correlated with maximum and minimum temperatures and the difference of temperature, while negatively with remaining parameters. Incidence of stem borer *Chilo partellus* (Swinhoe) started from early crop stage. Comparatively higher dead heart per cent was noticed at pre flowering and earhead stages. Maximum temperature and the difference of temperature exhibited significantly negative correlation with stem borer incidence, while remaining weather parameters showed significant positive correlation. Incidence of *Helicoverpa armigera* (Hub.) (Earhead worm) started at earhead emergence was higher at 63 days after germination (DAG) and decreased towards maturity. Its correlation was found significantly positive with minimum temperature and negative with rainy days.

(Main Pearl Millet Research Station, JAU, Jamnagar)

Groundnut

The coccinellid *Menochilus sexmaculatus* (F.) was the major predator of aphid, *Aphis craccivora* Koch on groundnut crop. The predator commenced one week later than the aphid (Prey) which multiplied very fast and reached at peak in 31st standard week. There was highly significant and positive correlation between population of the predator and the aphid on groundnut crop. The pest to predator ratio was 33:1 (aphid/twig: coccinellid/plant).

(Main Dry farming Research Station, JAU, Targhadia)

Year: 2011-12

Testing bio efficacy of insecticides through seed treatment against sucking pests of summer groundnut

Seed treatment with imidacloprid 600 FS @ 2 ml/kg seed gave effective control of jassids and thrips in summer groundnut up to 35 day after sowing.

(Main Oil Seed Research Station, JAU, Junagadh)

Monitoring of fruit flies in mango orchard through methyl eugenol trap

In mango orchards of South Saurashtra Agro-climatic Zone, the population of fruit fly *(Bactocera dorsalis* Hendel*)* males was maximum during April to September (14th to 36th Met. Standard week). Its activity was related positively with high humidity (80 to 90%) and 24 to 26 °C minimum temperature.

(Department of Entomology, JAU, Junagadh)

Monitoring of fruit flies in mango orchard through methyl eugenol trap

In mango orchards of North Saurashtra Agro-climatic Zone, the population of fruit fly *(Bactocera dorsalis* Hendel*)* males was maximum during 1st week of April to last week of July (13th to 31th Met. Standard week). Its activity was related positively with maximum (32 to 42 °C) and minimum (21 to 27 °C) temperature and relative humidity (63 to 89%).

(Grassland Research Station, JAU, Dhari)

Monitoring of pod borer by pheromone trap in chickpea

The population of gram pod borer (*Helicoverpa armigera* Hub.) males was observed throughout the crop period except severe winter month, with maximum activity in 3rd Met. Standard week. Its activity was related negatively with maximum and minimum temperature and mean evaporation.

(Grassland Research Station, JAU, Dhari)

Population dynamics of shoot fly and stem borer in forage sorghum in relation to abiotic factors

The sorghum shoot fly (*Atherigona soccata*) and stem borer (*Chilo partelus)* in *kharif* forage sorghum were active during 14 to 21 DAG and 45 DAG, respectively. Weather parameters did not show any effect on damage caused by both the pests; however, afternoon relative humidity caused negative effect on the damage caused by shoot fly.

(Grassland Research Station, JAU, Dhari)

Year: 2012-13

Evaluation of different chickpea varieties to bruchid (*Challosobruchus chinesis* L.) damage in storage

Varieties of chickpea *viz*., Chaffa, ICCL 86111, GG 4 and Dahod Yellow were found comparatively less susceptible and Phule G 0517 and PKV 4 as more susceptible to bruchid in stored chickpea.

White colour, smooth surface, large and very large seeded varieties (>22 g/100 seed weight) of chickpea were found more preferred for oviposition to bruchid, whereas white colour, large and very large seeded varieties (>22 g/100 seed weight) were found more preferred for development. Numbers of eggs and adult emergence have significant positive correlation with 100 seed weight and seed damage.

(Pulse Research Station, JAU, Junagadh)

Year: 2014-15

Management of sucking pests through insecticides in brinjal

Three sprays of bifenthrin 10 EC, 0.02 %, 20 ml /10 litre water or buprofezin 25 SC, 0.06 %, 24 ml/10 litre of water at 15 days interval starting from the pest infestation found effective for the control of brinjal whitefly.

The PHI for bifenthrin 10 EC, 0.02 % and buprofezin 25 SC, 0.06 % is 1 and 7 days, respectively.

(Dept. of Entomology, CoA, JAU, Junagadh)

Population dynamics of important pests of mango

The incidence of mango hopper, thrips and flower bug was found high during December to February while, leaf gall midge and shoot borer were found active during September to October.

(Dept. of Entomology, CoA, JAU, Junagadh)

Population dynamics of important pests of pomegranate

Anar butterfly was found high during November to May while, thrips was found active during August to November in pomegranate.

(Dept. of Entomology, CoA, JAU, Junagadh)

Testing of efficacy of different newer insecticides against shoot fly and stem borer in pearl millet

Seed treatment with imidacloprid 600 FS @ 8.75 ml/kg, 4.20 g a.i./kg at the time of sowing followed by spray with spinosad 45 SC, 0.009 % @ 2.0 ml/10 litre at 35 days after germination of the crop found effective for the management of shoot fly and stem borer. The PHI for these insecticides is 42 days.

(Pearl millet Research Station, JAU, Jamnagar)

Incidence of insect pests of chickpea through the cropping period and monitoring of pod borer moths using pheromone traps

Normal and late sowing of chickpea varieties showed sustainable population of *Helicoverpa armigera* at 60 days after sowing.

(Pulses Research Station, JAU, Junagadh)

Plant pathology

Year: 2005-06

Chickpea

The crop rotation of chickpea after sorghum OR chickpea after bajra and apply castor cake in furrow @ 500 kg/ha at the time of sowing with seed treatment of carbendazim 1 g + thiram 2 g/kg seed OR castor cake in furrow @ 500 kg/ha at the time of sowing with seed treatment of tebuconazole 3 g/kg seed gave the effective management of wilt in irrigated *rabi* chickpea under South Saurashtra Agro-climatic Zone.

(Pulse Research Station, JAU, Junagadh)

Year: 2006-07

Cotton

Seed treatment @ 10g/kg seed + soil application @ 2.5 kg/ha at the time of sowing with *Pseudomonas fluorescens* strain Pf 1 or *Pseudomonas fluorescens* strain Pf 2- CHAO strain was found effective for management of bacterial blight of cotton and seed treatment @ 10 g/kg seed + foliar spray @ 0.2% of the above strain at 30, 60 and 90 days after sowing significantly reduced the bacterial leaf blight of cotton variety G.Cot.Hy-10.

(Cotton Research Station, JAU, Junagadh)

Ber

The intensity of powdery mildew (*Oidium erysiphoides*) of ber increased with the decrease in maximum temperature below 35^{o} C, minimum temperature below 20^{o} C and morning relative humidity.

(Main Dry Farming Research Station, JAU, Targhadia)

Year: 2007-08

Groundnut

Pseudomonas fluorescens Pf-1 (ICBR 1:23.34) and *Trichoderma viride* - Local (ICBR 1:26.28) as seed treatment @ 10 g/kg seed are highly effective and economical in reducing collar rot, stem rot and tikka diseases of groundnut.

(Main Oilseed Research Station, JAU, Junagadh)

Year: 2014-15

Effect of fungicides application in cumin on *Trichoderma* applied in soil

Soil drenching of carbendazim 50 WP @ 2 kg in 2000 litre water/ha or foliar spray of mancozeb 75 WP @ 30 g/10 litre or hexaconazole 5 EC @ 10 ml/ 10 litre against soil borne diseases do not reduce the population of *Trichoderma harzianum* applied in soil.

(Dept. of Plant Pathology, CoA, JAU, Junagadh)

Effect of foliar application of insecticides in cumin on *Trichoderma* applied in soil

Foliar spray of imidacloprid 17.8 SL @ 3 ml/10 litre or dimethoate 30 EC @ 10 ml/10 litre in cumin against sucking pests do not reduces the population of *Trichoderma harzianum* applied in soil.

(Dept. of Plant Pathology, CoA, JAU, Junagadh)

Effect of foliar application of herbicides in cumin on *Trichoderma* applied in soil

Herbicides used as pre-emergence or early post emergence in cumin *viz.,* pendimethalin 30 EC, 0.9 kg a.i./ha, 60 ml/10 litre at 2 DAS or glyphosate 41 SL, 0.75 kg a.i./ha, 37 ml/10 litre at 2 DAS reduces the soil population of *Trichoderma* up to one month after sowing but *Trichoderma* population was increased at later stage. While application of oxyfluorfen 23.5 EC, 0.240 kg a.i./ha, 20 ml/10 litre at 2 DAS do not reduce the population of *Trichoderma harzianum* applied in soil.

(Dept. of Plant Pathology, JAU, Junagadh)

Disease management through organic practices for organic groundnut cultivation

Blanket furrow application of FYM @ 7.5 tonne/ha followed by *Trichoderma viride* as seed treatment @ 10 g/kg seed, and *T. viride* @ 4.0 kg enriched in 250 kg FYM and as spray @ 2.5 kg/ha (5 g/litre of water) at 30 and 45 DAS found effective for the management of diseases of groundnut.

(Main Oilseed Research Station, JAU, Junagadh)

V. BASIC SCIENCE

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 Bajra 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.

MODEL NO.1: FOR DROUGHT STRESS CONDITION

EXPONENTIAL MODEL-1

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

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 RATIO (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								

MODEL NO.2: FOR POTENTIAL CONDITION (IRRIGATED)

EXPONENTIAL MODEL-2

$$Y = 0.472*(1.004^{X_1})*(0.997^{X_2})*(2.701^{X_3})*(0.568^{X_4})*(1.816^{X_5})*(0.238^{X_6})*(0.975^{X_7})*(1.497^{X_8})*(0.985^{X_9})*(1.007^{X_{10}})*(1.324^{X_{11}})*(4.413^{X_{12}})*(4.689^{X_{13}})*(4.088^{X_{14}})*(1.044^{X_{15}})*(0.441^{X_{16}})$$

WHERE, Y = Predicted yield under irrigated condition

PARAMETERS		REGRESSION COEFFICIENTS		STD. ERROR	T VALUES	F VALUE	R^2 VALUE	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 RATIO (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 DRT-2004-6, DRT-2004-17, INS-I-2003-2, INS-I-2003-4, ISK-II-2003-1, ISK-II-2003-19, 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.

(Professor & Head, Genetics & Plant Breeding, 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.

(Professor & Head, Genetics & Plant Breeding, 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, JAU, Junagadh)

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

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, greengram and cowpea crops.

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

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

Application of brassinolideas 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 Genetics & Plant Breeding, 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.

(Dry 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 percent acidity (2.16 %) and total phenol (7.64 mg%) as compared to the Junagadh, Vanthali and Dhari-Visavadar regions.

(Department of Biochemistry and Biotechnology, 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 and Biotechnology, 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.*

(Dept. of Biochemistry & Biotech., 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).

(Dept. of Biochemistry & Biotech., 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.

(Dept. of Biochemistry & Biotech., 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).

(Dept. of Biochemistry & Biotech., 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)

VI. SOCIAL SCIENCE

Year: 2005-06

Bajra (Optimum plot size)

A plot of 10.8 m^2 size having shape of 4.5 m (length) x 2.4 m (cross width) (4 rows) is optimum size (net) and shape for *bajra* experiment at Main Dry Farming Research Station, Junagadh Agricultural University, Targhadia.

(Department of Agricultural Statistics, JAU, Junagadh)

Sesame (Optimum plot size)

A plot of 9.45 m^2 size having shape of 5.25 m (length) x 1.80 m (cross width) (4 rows) is optimum size (net) and shape for sesame experiment at Dry Farming Research Station, Junagadh Agricultural University, Vallabhipur.

(Department of Agricultural Statistics, JAU, Junagadh)

Groundnut (Optimum plot size)

A plot of 10.8 m^2 size having shape of 4.0 m (length) x 2.7 m (cross width) (6 rows) is optimum size (net) and shape for groundnut experiment at Dry Farming Research Station, Junagadh Agricultural University, Nanakandhasar.

(Department of Agricultural Statistics, JAU, Junagadh)

Cotton (Optimum plot size)

A plot of 12.96 m^2 size having shape of 4.8 m (length) x 2.7 m (cross width) (3 rows) is optimum size (net) and shape for cotton experiment at Dry Farming Research Station, Junagadh Agricultural University, Nanakandhasar.

(Department of Agricultural Statistics, JAU, Junagadh)

Bajra (Optimum plot size)

A plot of 12.96 m^2 size having shape of 3.6 m (length) x 3.6 m (cross width) (6 rows) is optimum size (net) and shape for *bajra* experiment at Dry Farming Research Station, Junagadh Agricultural University, Jamkhambhalia.

(Department of Agricultural Statistics, JAU, Junagadh)

Castor (Optimum plot size)

A plot of 9.72 m^2 size having shape of 3.6 m (length) x 2.7 m (cross width) (3 rows) is optimum size (net) and shape for castor experiment at Dry Farming Research Station, Junagadh Agricultural University, Jamkhambhalia.

(Department of Agricultural Statistics, JAU, Junagadh)

Year: 2012-13

Optimum plot size in field experiment on wheat crop

It is recommended for the scientists to conduct the research on wheat keeping a plot of 10.80 sq.m. (4.0 m length x 2.7 m. width) as optimum plot size having 12 rows of wheat in South Saurashtra Agro climatic zone.

(Department of Agril. Statistics, JAU, Junagadh)

VII. FISHERIES SCIENCE

Year: 2005-06

Heavy metal Sea

The sea-water surrounding ship breaking yard of *Alang* in Bhavnagar district has been found contaminated with trace and heavy metals viz., Fe, Mn, Zn, Cu, Cd, Co, Ni, Cr and Pb due to ship breaking activities. The contamination of the seawater with all the heavy metals was above the permissible limits prescribed by BIS and NEERI.

(College of Fisheries, JAU, Veraval)

Year: 2007-08

Seasonal variations in population densities of important Diatoms on Zaleswar coast of Veraval

Study on seasonal abundance of prominent seven diatom species indicates that the species were highest in winter at Chorwad and Zaleshwar coasts. The density was higher at Chorwad coasts in all the seasons as compared to Zaleshwar.

(College of Fisheries, JAU, Veraval)

Year: 2009-10

Qualitative analysis of phytoplankton in freshwater culture pond

It is recommended to the scientific community that seven genera of phytoplankton *viz., Chlorella, Scenedesmus, Microcystis, Navicula, Volvox, Oedogonium* and *Spirogyra* are commonly observed in freshwater fish culture pond of the Saurashtra region.

(College of Fisheries, JAU, Veraval)

Year: 2010-11

Study on seasonal variation in iodine content of promising iodine yielding red sea-weeds of gulf of Kutch

Among the available red seaweed (Rhodophyceae) species of Gulf of Kutch, maximum iodine content is found in *Asperogopsis entestinalis* (555 mg/100gm DW) followed by *Rhodomenia australis* (151 mg/100gm DW).

(Fisheries Research Station, JAU, Okha)

Year: 2011-12

Preparation and evaluation of edible fish powder prepared from small sized croaker Otolithes ruber (Block & Schneider, 1801) landed at Veraval harbor

Fishery entrepreneurs and processors are advised to use small sized croaker Otolithes ruber along with their bones for the production of heat sterile protein and mineral rich edible fish powder having a shelf life of seven months.

(College of Fisheries, JAU, Veraval)

Qualitative studies of zooplankton in Meghal River at Chorwad

The Meghal River system, located in South Saurashtra region harbours Zooplanktons belonging to seven genera viz., Cyclops, Daphnia, Filinia, Brachionus, Bosmina, Moina and Keratella during monsoon and winter months.

(College of Fisheries, JAU, Veraval)

Identification and quantification of rotifer fauna of Okhamandal region

Thirteen species of rotifers are found in Okhamandal region. The rotifers are found in higher diversity and density in Surajkaradi pond and Gomati creek than seacoast areas in Okhamandal region in monsoon and post monsoon seasons. They are more abundant in lower salinity.

(Fisheries Research Station, JAU, Okha)

Cycle Evaluation for fish landing at Veraval of Veraval coast

The entrepreneurs and financial institutions are advised to consider an aggregate, profit making time span of seven years as the cycle period for fish landing centre, Veraval.

(College of Fisheries, JAU, Veraval)

Year: 2012-2013

Determination of suitable protein level for growth enhancement in *Labeo rohita*

In South Saurashtra agro-climatic zone better bio-mass can be obtained by providing fish feed containing 30 % protein to fish *Labeo rohita*.

(College of Fisheries, JAU, Veraval)

The effect of air and water transport on stress and survival of Rock oyster (*Saccostrea cucullata*)

The rock oyster (*Saccostrea cucullata*) can be transported by road for nine hours in wet gunny bag or water filled plastic bag (30 cm (W) x 38 cm (L)) at the density of 30 oyster per bag without any mortality.

(College of Fisheries, JAU, Veraval)

Year: 2013-14

Qualitative and quantitative analysis of phytoplankton of Sikka region

The Sikka coast, located in Gulf of Kachchh, Gujarat harbours 36 genera/species of phytoplankton, among which, *Amphora* spp., *Bacillaria paradoxa*, *Biddulphia mobilensis*, *Chaetoceros calcitrans*, *Chaetoceros curvisetus*, *Coscinodiscus granii*, *Ditylum sol*, Gyrosigma spp., *Nitzschia closterium*, *Pluerosigma* spp. and *Rhizosolenia* spp. were found abundant. Hence, it is recommended to scientific community to target these species for further biodiversity studies.

(Fisheries Research Station, JAU, Sikka)

Diversity and distribution of brachyuran crab at off shore Sikka

The Sikka Coast, located in Gulf of Kachchh, Guajrat harbours 22 species of Brachyuran crab, among which, *Pilumnus vespertilio*, *Atergatis integerrimus*, *Scylla serrata*, *Charybdis acutifrons*, *Parasesarma pictum*, *Menippe rumphii*, *Ocypode ceratophthalmus* and

Portunus pelagicus were found abundant. Hence, it is recommended to scientific community to target these species for further biodiversity studies.

(Research Officer, Fisheries Research Station, JAU, Sikka)

Study of catch composition of trawl net operated along the Veraval coast, Gujarat

A total of 90 marine species (70 finfish and 20 shell fish) were recorded in the trawl net fishery. Ribbon fish, thread fin bream, squid, lizard fish and cuttle fish forms a major proportion of catch. Hence, it is recommended to scientific community to consider these species for further catch spectrum analysis.

(College of Fisheries, JAU, Veraval)

Analysis of plankton in brackish water shrimp culture pond

Ten genera of phytoplankton *viz., Chaetoceros, Skeletonema, Pleurosigma, Gyrosigma, Scenedesmus, Oscillatoria, Navicula, Nitzchia, Coscinodiscus* and *Chlamydomonas* and four genera of zooplankton viz., *Moina, Brachionus, Keratella* and *Pseudodiaptomus* are commonly observed in brackish water shrimp culture ponds of the Saurashtra region. Hence, it is recommended to scientific community to consider these species as feed in shrimp culture.

(College of Fisheries, JAU, Veraval)

Survey for cultivable sea water shrimps seed along Jafrabad and Mahuva coast

The fisheries scientists are recommended that cultivable shrimp seeds of *Metapenaeus kutchensis*, *Fenneropenaeus merguiensis*, *Fenneropenaeus indicus* and *Penaeus monodon* are available during month of September to January at Mahuva, while at Jafrabad coast during April to May for shrimp farming purpose.

(Agricultural Research Station (FC), JAU, Mahuva)

Year: 2014-2015

Record of marine finfishes commonly landed at Veraval fishing harbor

Seventy finfish species of different genera were recorded during the period of October 2010 to May 2014 at Veraval fish landing centre. The major groups of finfish available are sharks and rays, pomfrets, crockers, groupers, threadfins, ribbonfish, clupeids, lizard fish, sea catfishes, leather jackets, bull's eye. Fishes like *Rachycentron canadum, Mene maculate, Pomadasys maculates, Lethrinus ramark, Upenus sp., Cypselury obligolepis, Remora remora, Therapon jarbua, Therapon theraps, Harpodon nehereus, Plotosus conius, Coryphaena hippurus* are available in very less proportion at Veraval fish landing center.

(Dept. of Fisheries Resource Management, College of Fisheries Science, JAU, Veraval)

Antibacterial activity of some available seaweeds from Veraval coast

Seaweeds extract of *Gracilaria edulis, Sargassum weightii* and *Hypniamus ciformis* collected from Veraval coast contains antibacterial activity against *Aeromonas hydrophila, Pseudomonas aeruginosa* and *Vibrio alginolyticus*, respectively.

(Dept. of Aquaculture, College of Fisheries Science, JAU, Veraval)

Growth, mortality and stock assessment of Soldier catfish *Osteogeneiosus militaris* (Linnaeus, 1758) off Veraval coast

The present level of fishing on the Soldier catfish, *Osteogeneiosus militaris*, confirmed that the stock is being overexploited. Estimated growth parameters for *O. militaris* were 523 mm and 0.62 for L_∞ & K respectively. Estimated mortality parameters for *O. militaris* were 1.09, 3.67 and 2.58 for natural mortality, total mortality and fishing mortality respectively.

(Department of Fisheries Resource Management, College of Fisheries Science, JAU, Veraval)

Length–weight relationship and stomach content analysis of Japanese threadfin bream (Pink Perch), *Nemipterus japonicas*

The size and weight of Threadfin bream, *Nemipterus japonicus* available at Gujarat coast ranged from 6.5-24.1 cm and 20.5-277 g respectively with the length-weight relationship equation Log W = -2.2520 + 2.4669 Log L. The major food composition of *N. japonicus* constituted of crustaceans (54.35%), finfishes (30.24%), molluscs (7.80%), and unidentified and semi–digested materials (5.80%).

(Department of Fisheries Resource Management, College of Fisheries Science, JAU, Veraval)

Study on biodiversity of shellfishes in rocky intertidal zone of Veraval coast

The most abundant and year round species found at Veraval are *Patella radiate* followed by *Turbo intercostalis, Chiton granoradiatus*, *Rinoclavis sinensis* and Cerithium spp. of molluscs and *Balanus amphtrite* among the crutaceans.

(Department of Fisheries Resource Management, College of Fisheries Science, JAU, Veraval)

VIII. HORTICULTURAL & AGRO-FORESTRY

Year: 2008-2009

Extension of shelf life of mango cv. Kesar under pre-cooling and cold chamber treatments for local market

Scientist are advised to keep freshly harvested mature mango fruits cv. Kesar in a small cool chamber at 14 ^{0}C with 90 per cent RH to maintain the fruit quality up to 25 days.

(Department of Horticulture, JAU, Junagadh)

Year: 2010-2011

Characterization of different accessions of black jamun (*Syzyguim cuminii* Skeels*)* from Saurashtra region

The different accessions like VR-1, VM-1, JAU-6, VB-1 and VMA-1 of black jamun identified from Junagadh region were observed better in different characteristics.

(Department of Horticulture, JAU, Junagadh)

Year: 2011-2012

Response of different genotypes of custard apple to weather parameters

The climatic parameters like temperature, humidity and rainfall influenced the flowering, fruit setting, fruit retention percentage, fruit yield and disease-pests incidence. More humidity and off seasonal rain during March-April insist the first and second reproductive flush and adversely affects the third flush. Optimum temperature and rain leads to more fruit set. Heavy rain during fruit set also tends to more drop with less fruit retention percentage. Mealy bug population is decreasing with increasing rain, whereas, black spot decreases when wind speed is less. Custard apple requires 30-35ºC temperature during flowering and fruit setting, 75-90% humidity and 600-1400 mm even distributed rainfall. Off seasonal rain disturbs the flowering pattern and adversely affects the crop.

(Department of Horticulture, JAU, Junagadh)

Survey of coconut gardens in Gujarat state

From the survey of five districts of South Saurashtra and South Gujarat region, it was observed that only 14.29% farmers are growing hybrid coconut varieties (D x T and T x D) and 45.71% farmers preferred seedlings from nursery of university as well as horticulture departments of state government. While, 38.10% farmers are growing coconut as per

recommended spacing and 50% farmers follow recommended dose of fertilizers. It was also observed that only 10% farmers adopt the recommended irrigation practices and none of the farmers is using drip irrigation and plant protection measures in their orchards. Therefore, it is suggested that the extension functionaries are required to motivate the farmers to adopt recommended cultivation practices for coconut.

(Agricultural Research Station (Fruit Crops), JAU, Mahuva)

Year: 2013-14

Effect of time of ethephon application and trunk diameter on gum production from *Acacia senegal* (L.) Willd Gorad

It is recommended that application of 5 ml ethephon @ 100 ppm [0.25 ml Ethrel (40%) in 1 liter of water] to *Acacia senegal* (Gorad) above one meter ground level having 51-70 cm trunk girth during first fortnight of March resulted in higher gum production and higher net return.

(Grassland Research Station, JAU, Dhari)

IX. ANIMAL HEALTH & ANIMAL PRODUCTION

Year: 2011-2012

Impact of herd composition on herd performance traits in Gir cattle

Maintaining an established breeding herd of an average of 110 Gir cows in South Saurashtra region results in an average of 388 (i.e. 400) total heads, 260 total adult units and 72 % total female population with 85 (22 %) breedable heifers, 80 (21 %) growing females below 2 years of age and 63 (57 % total cows) milch cows with wet average of 6.8 lit., herd average of 3.8 lit. and return of 116 % over feed cost**.** Herd structure and performance vary significantly by year. Month significantly influences calving rate and herd average. Wet average (7.2 vs 6.1 lit), herd average (4.2 vs 3.4 lit) and % milch cows (57-60 vs 54-55 %) remain higher from March to May and lower during August-September months. Performance traits show negative trend with number of cows, total breedable females and total heads present in the herd. Hence, optimum herd structure should be maintained for higher performance and return.

(Cattle Breeding Farm, JAU, Junagadh)

Breeding and lactation efficiencies of Gir cows

In organized large dairy herd of Gir cattle in South Saurashtra region-i) Over all breeding efficiency, lactation efficiency, age at first calving, calving interval and lactation period of Gir cows were 86.9±0.5 %, 61.1±1.1%, 1527.8 ± 14.2 (50.1 mo.), 481.2 ± 4.9 (15.8 month) and 281.0 ± 4.6 days, respectively. About 29 % of heifers calved for the first time below the average age of 44 months and 38 % of cows calved at an average calving interval of 14 months. ii) Average milk production of Gir cows increased with increase in parity and reached peak of 2300 lit. of 300-d milk yield in 5^{th} lactation. In subsequent lactations also, 300-d lactation milk yield remained between 1950 and 2100 lit. up to 8th lactation which indicated high persistency of production over parity. Productive life of cows averaged 8.5 years (i.e., 3108 days) with 10,000 lit. life time milk production with an average of 4.3 calvings during lifetime. iii) About 19 % Gir cows remained in the herd for more than 12 years of age (on an average 14.6 years) and more than 25 % of cows performed in the herd

for more than 6 lactations. Hence, breeding goals of less than 44 months of age at first calving and 14 months of calving interval may be set for Gir cattle.

(Cattle Breeding Farm, JAU, Junagadh)

Breeding and lactation efficiencies of Jaffrabadi buffaloes

In organized large dairy herd of Jaffrabadi buffaloes in South Saurashtra region-i) Over all breeding efficiency, lactation efficiency, age at first calving, calving interval and lactation period of Jaffrabadi buffaloes averaged 79.0 ± 1.5 %, 58.2 ± 1.6 %, 1656.7 ± 28.6 (54.3 month), 541.9 ± 7.9 (17.8 month) and 291.9 ± 5.0 days, respectively. About 28 % of heifers calved for the first time below the average age of 47 month and 31 % of buffaloes calved at an average calving interval of 15 months**.** ii) Average milk production of Jaffrabadi buffaloes increased with increase in parity and reached peak of 1900 lit. of 300-d milk yield in 4^{th} lactation. In subsequent lactations also, 300-d lactation milk yield remained between 1700 and 1800 lit. upto 6^{th} lactation which indicated high persistency of production over parity. Productive life of buffaloes averaged 10.1 years (i.e., 3701 days) with 8500 lit. life time milk production with an average of 4.7 calvings during life time. iii) About 20 % Jaffrabadi buffaloes remained in the herd for more than 12 years of age (on an average 16.6 years) and more than 38 % of these animals performed in the herd for more than 6 lactations. Hence, breeding goals of less than 47 months of age at first calving and 15 months of calving interval may be set for Jaffrabadi buffaloes.

(Cattle Breeding Farm, JAU, Junagadh)

Year: 2012-2013

Management of sub-estrus condition in post partum buffaloes through hormonal therapy

The field veterinarians are informed that synthetic analogue of Prostaglandin ($PGF_2\alpha$) when injected @ 2 ml i/m in post partum subestrus Jaffarabadi buffaloes helps in the regression of corpus luteum within an average period of 2 to 3 days.

(Cattle Breeding Farm, JAU, Junagadh)

Year: 2013-14

Estimation of Bulk milk Somatic Cell Count (SCC) from the raw milk of Gir cattle and Jaffrabadi buffalo

The scientific community is informed that average bulk tank milk somatic cell count - BTMSCC/ml milk of Gir cows (720,278 SCC/ml) and Jaffrabadi Buffaloes (623,625 SCC/ml) were lower than the US standards for “Grade A” milk (750,000 SCC /ml) without significant effect of season and time of milking in organized dairy farm.

(Cattle Breeding Farm, JAU, Junagadh)

Incidence of parasitic infections in bovines in and around Junagadh city

The veterinary professionals are informed that cattle and buffalo in and around Junagadh region were found predominately infected with *Toxocara vitulorum*, *Fasciola* spp., strongyles, *Strongyloides papillosus*, amphistomes, coccidia (*Eimeria* spp. and *Cryptosporidium* spp.) and *Buxtonella sulcata* (ciliates) parasites.

(Dept. of Vet. Parasitology, College of Vet. Science & A. H., JAU, Junagadh**)**

Abattoir survey of reproductive abnormalities in Jaffrabadi buffaloes (Bubalus bubalis)

It is informed to scientific community that about half of the culled Jaffrabadi buffaloes have acquired cervical affections, which include kinked cervix (72.6%) and cervical ectropion (25.8%) as major abnormalities which should be noted as a point of concern by scientific community.

(Dept. Vet. Gyn. & Obst., College of Vet. Science & A. H., JAU, Junagadh**)**

Year: 2014-15

Survey on ethno-veterinary practices and preliminary evaluation of antibacterial activity of commonly used plants for animal health in Junagadh district

Methanol extract of *Prosopis juliflora* (Gando Baval) leaves at the concentration of 200 mg/ml has good *in vitro* antibacterial activity against bacterial isolates from animals, viz., *Escherichia coli*, *Streptococcus agalactiae* and *Staphylococcus aureus*.

(Department of Veterinary Pharmacology & Toxicology, College of Veterinary Science & A. H., JAU, Junagadh)

Radio-anatomy of heart size in Mongrel dogs using Vertebral heart score system

The normal VHS for mongrel dogs is 8.0 to 11.1 V. The deviation from this range may indicate cardiac abnormalities.

(Department of Veterinary Surgery & Radiology, College of Veterinary Science & A. H., JAU, Junagadh)

Histomorphometry & Histochemical observations on the ovaries of Jaffrabadi buffaloes in different season of year

In Jaffrabadi buffaloes, based on biometrical and micrometrical observations, higher functional activities of ovaries are observed in winter season.

(Department of Veterinary Anatomy, College of Veterinary Science & A. H., JAU, Junagadh)

Molecular characterization of Interleukin-8 (IL-8) gene in Jaffrabadi Buffalo (*Bubalus bubalis*)

It is recommended to use following primers for the study of IL-8 gene involved in mastitis resistance.

List of Primers

Sr. No.	**Primer Sequence 5'-3'**	**Primer length (bp)**
Primer 1	Forward 5'-GGGCGGAGGTTGCGTATT-3' Reverse 5'-TAAGAGGGATCCCAGTAAGGTTT-3'	18 23
Primer 2	Forward 5'-GACGAGCTTCAGGCAACTATCA-3' Reverse 5'-ATATTAAATGCCATGGAGACAAA-3'	22 23
Primer 3	Forward 5'-TGGAAGAATCCAGCAAAGTTC-3' Reverse 5'-TGACAGAAGGCACAGGCATA-3'	21 20
Primer 4	Forward 5'-CCAATCGATCTGGAAATCCT-3' Reverse 5'-TGACTAAGAGGTCTTTCTGTTTGTG-3'	20 25
Primer 5	Forward 5'-ACAAACAGAAAGACCTCTTAGTCA-3' Reverse 5'-CAAACTCCTGATGACTCTGACA-3'	25 22

(Department of Animal Genetics & Breeding, College of Veterinary Science & A.H., JAU, Junagadh)

Molecular characterization of Toll Like Receptor 4 (TLR-4) gene in Jaffrabadi Buffalo (*Bubalus bubalis*)

Allele B is more frequent than allele A for *TLR-4/ALU I* gene and use of following primers is recommended in Jaffarabadi buffaloes.

Exon(s)	**Sr. No.**	**Primer Sequence 5'- 3'**	**Amplicon Size (bp)**
Exon 1	Primer-1	Forward 5'-CACAGAGCCACTTCTGGTCA-3' Reverse 5'- TTTTCAGAAGCAAGGCCAAG-3'	180
Exon 2	Primer-2	Forward 5'- ACCTGAGCTTTAACTACCT-3'	280

		Reverse 5’-AATATTTCTGCTGAATAGGA-3’	
Exon 3	Primer-3	Forward 5’-CTGGGCTCTCAAGTTTACGG-3’ Reverse 5’-AACCAGCCGGTTGATTTTTA-3’	410
	Primer-4	Forward 5’-GGCTGGTTTTGGGAGAATTT-3’ Reverse 5’-TGTGAGAACAGCAACCCTTG-3’	420
	Primer-5	Forward 5’-CAAGGGTTGCTGTTCTCACA-3’ Reverse 5’-GAGCGAGTGGAGTGGTTCAT-3’	478
	Primer-6	Forward 5’-TGCTCCCTGACATCTTCACA -3’ Reverse 5’-TCTGACAAGTGGCATTCCTG-3’	440
	Primer-7	Forward 5’-TCAGGAATGCCACTTGTCAG-3’ Reverse 5’-CAGGTCTGGGCAATCTCATA-3’	406
	Primer-8	Forward 5’-CCAGAGCCGATGGTGTATCT-3’ Reverse 5’-CACTGAATCACCGGGCTTT-3’	410
	Primer-9	Forward 5’-GGTAAACCCACGAGTCCAGA-3’ Reverse 5’-CCCCCGGGAAGTTCTATATT-3’	286

(Department of Animal Genetics & Breeding, College of Veterinary Science & A.H., JAU, Junagadh)

To study the retrieval rate and grading of oocytes from ovary of culled Jaffrabadi buffaloes

Higher recovery rate and good quality oocytes can be obtained from ovaries without CL (Corpus Luteum) in Jaffrabadi buffalo using slicing method.

(Department of Veterinary Gynecology & Obstetrics, College of Veterinary Science & A. H., JAU, Junagadh)

Comparative study on Efficacy of different medicaments for induction of estrus in true anestrous Jaffrabadi heifers (*Bubalus bubalis*)

The true anoestrus Jaffrabadi buffalo heifers of 3 to 3.5 body condition score responded well to CIDR or ovosynch-protocol in terms of estrus induction and conception rate.

(Department of Veterinary Gynaecology & Obstetrics, College of Veterinary Science & A. H., JAU, Junagadh)

Association of milk components with Intra-mammary infection in Jaffrabadi Buffaloes

The milk lactose and milk urea nitrogen are found to be decreased in Jaffrabadi buffaloes with mastitis.

(Department of Livestock Production management, College of Veterinary Science & A. H., JAU, Junagadh)