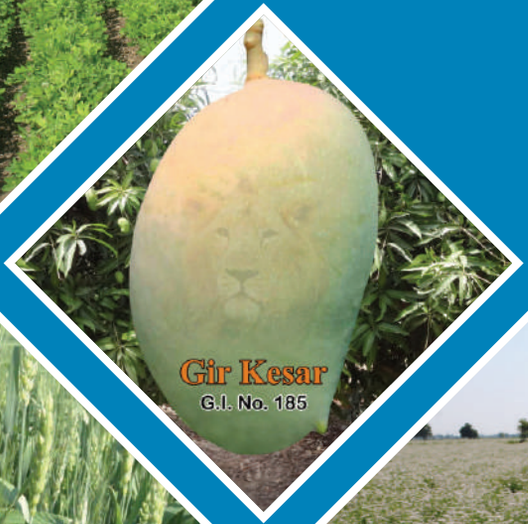
STATUS REPORT OF JUNAGADH AGRICULTURAL UNIVERSITY (2014-15 & 2015-16)

Prepared for
XXIV meeting of the ICAR
Regional Committee No. VI



DIRECTOR OF RESEARCH
JUNAGADH AGRICULTURAL UNIVERSITY
JUNAGADH-362001(GUJARAT)

September - 2016

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Status Report of Junagadh Agricultural University (2014-15 & 2015-16)

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FOREWORD

The ICAR Regional Committee provides an opportunity to discuss the status and future needs in the areas of research in agriculture and allied sciences, dissemination of research outcome for the end users and strategic plan for road map to achieve the targeted growth. The Regional Committee No. VI represents western most part of the country comprises of Gujarat, Rajasthan, Dadra & Nagar Haveli and Daman & Diu. The XXIV meeting of the Committee is going to be held at Central Arid Zone Research Institute, Jodhpur, Rajasthan during September 13-14, 2016. The status of research and development of Universities and ICAR Institutes will be presented and the burning issues related to climate change, seed production, soil health, plant protection, organic farming, water conservation, processing & value addition, marketing, agricultural machineries, trapping solar & wind energy, animal health & nutrition, aquaculture, etc. will be discussed.

Junagadh Agricultural University's jurisdiction is spread over the districts of Junagadh, Jamnagar, Rajkot, Porbandar, Surendranagar, Bhavnagar, Amreli, Devbhumi Dwarka, Gir Somnath and Morbi of the Gujarat state representing 32.74 % geographical area of Gujarat. The University through its eight constituent colleges offers higher education (UG & PG up to Ph.D.) in the faculties of Agriculture, Agricultural Engineering & Technology, Fisheries Science, Veterinary Science & Animal Husbandry, Horticulture and Agri-Business Management. University also offers Polytechnic/Diploma/Certificate Courses in the field of Agriculture, Horticulture, Agro Processing, Agricultural Engineering, Animal Husbandry and Home Science. The University is accredited by ICAR for five years with five constituent colleges for UG & PG.

The University has 31 research stations including multidisciplinary main research stations, sub centres on various crops and testing centres spread over in whole North Saurashtra & South Saurashtra Agro-climatic Zones and part of North-West and Bhal & Coastal Area Agro-climatic Zones of Gujarat. The research carried out on various issues related to different crops and disciplines including Wheat, Millet, Pulses, Oilseeds, Cotton, Sugarcane, Fruit Crops, Vegetables, Dry Farming, Grassland, Agricultural Engineering, Cattle Breeding and Fisheries. To strengthen the location specific research 21 AICRPs are functioning in the University.

The University is having six Krishi Vigyan Kendras (KVKs), Sardar Smruti Kendra (SSK), Centre of Communication (CoC), Agricultural Technology Information Centre (ATIC) etc. for extension activities; impart training to extension functionaries of the line departments, to transfer the agricultural technologies to the farmers and end users. Agro based ITI are also running in the university. Community FM Radio Station releasing extension progarmme on "Janvani 91.2". FLDs are being conducted on various crops and technologies at Farmers' fields through KVKs and Research Stations. A mega event Krushi Mahotsav is organized every year since 2005 for dissemination of latest technology at farmer's door step.

The activities and specific achievements in research, education and extension of JAU for the period of 2014-15 and 2015-16 are included in this Status Report.

Junagadh
September 03, 2016

(A. R. PATHAK)

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CHAPTER - I
INTRODUCTION

Junagadh Agricultural University came into existence under Gujarat Agricultural Universities Act 2004. The University is established specially with the regional mandate for strengthening the triple functions of agricultural education, research and extension education. The University represents ten districts viz., Amreli, Bhavnagar, Devbhumi Dwarka, Gir Somnath, Jamnagar, Junagadh, Morbi, Porbandar, Rajkot and Surendranagar. Historically known as Saurashtra, covering about 32.74 per cent area of the Gujarat State. There are eight colleges, six polytechnics and 31 research stations, which includes Multidisciplinary Main Research Stations, Sub Research Stations for various crops as well as Testing Centers spread over in whole North Saurashtra & South Saurashtra Agro-climatic Zones and part of North-West & Bhal-Coastal Area of Agro-climatic Zones in Gujarat.

In Saurashtra region of Gujarat state, there exists marked variation in agro-ecological situations and diversity in socio-economic & cultural habits. The total geographical area is 6.43 million hectares representing 32.74 per cent area of the state. As per 2011 census, the total population of Saurashtra region is 15.45 million with a density of 242 people per Km^2 living in 4,767 villages spread over in ten districts. The overall literacy percentage in the Saurashtra is 77.19.

Out of total geographical area (6.43 Mha) of Saurashtra, 3.70 million hectares (61%) is cropped area, while about 2.73 million hectares (39 %) accounted under cultivable waste land, other fallow, permanent pasture land, forest area, non-agricultural use & barren and uncultivable land account for 0.11, 0.32, 0.43, 0.39, 0.35 and 0.54 million hectare, respectively (Table 1.1 & Fig. 1.1 & 1.2).

Table- 1.1: Land use pattern

Type	Per cent Area	
	Gujarat	Saurashtra (JAU jurisdiction)
Net sown area	47.33	61.13
Double cropped	5.99	3.17
Total cropped area	53.32	64.30
Cultivable waste land	9.88	1.89
Area under forest	9.29	6.46
Nonagricultural use	5.68	5.78
Current and cultivable fellow	4.61	5.37
Permanent pasture & grazing	4.23	7.25
Barren & Uncultivable Land	12.97	8.95
Miscellaneous	0.02	0.00
Total geographical area of Gujarat		**195,98,000 ha.**

In Saurashtra region, the major field crops are groundnut, cotton, wheat, bajra, sesame & cumin, while mango, coconut, citrus, sapota, guava & ber are the major fruit crops. Onion, brinjal, okra, tomato & cluster bean are the major vegetable crops (Table-1.2). Recently pomegranate crop is introduces in Saurashtra region under cultivation. Among the major crops, cotton (46.70 %), followed by oilseeds (groundnut, sesame and castor) occupy 36.68 per cent, spices (6.82 %), vegetables (4.03 %), food grain (3.51 %) and fruits (2.26 %) of the net sown area. Saurashtra is the home of famous breed of cattle (Gir),

buffalo (Jafrabadi), goat (Zalawadi) and horse (Kathi). As per the 2007 census, there is 237.94 lakh total livestock population in Gujarat state. Whereas in Saurashtra region total livestock population is 63.56 lakh (26.71 %) in which cattle, buffalo, sheep, goat and other livestock with population of 23.22, 19.26, 10.23, 10.23 and 0.62 lakh, respectively. Gujarat has a long coastal-line of 1600 km. Some important ports like Veraval, Porbandar, Pipavav, Okha and Sikka are located in Saurashtra region. Important commercial varieties of fish, silver bar, shark, catfish, mullets etc. are caught in large quantities in sea cost areas of Saurashtra region.

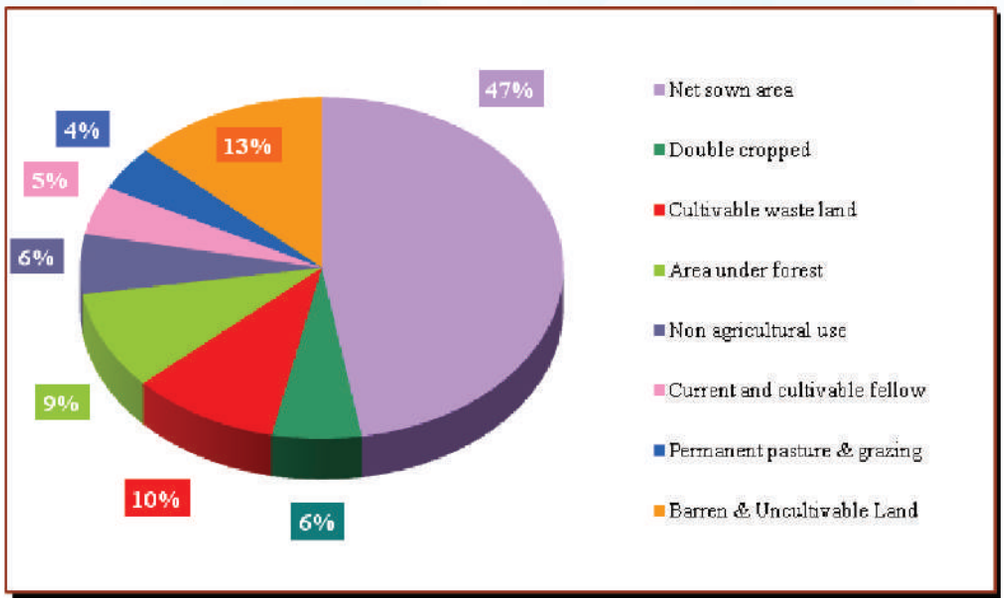


Fig. 1.1 Land Use Pattern in Gujarat (Area Percentage)

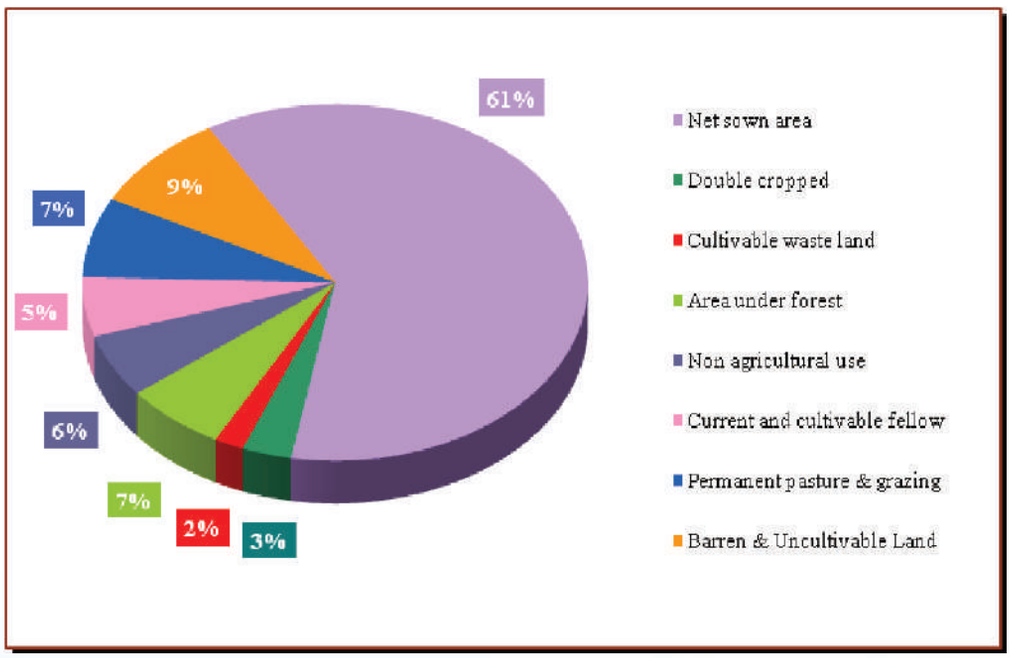


Fig. 1.2 Land Use Pattern in Saurashtra (Area Percentage)

Table – 1.2 Major crops

District	Major crops (Rank)				
	I	II	III	IV	V
Field crops					
Amreli	Cotton	Groundnut	Wheat	Sesame	Bajra
Bhavnagar	Cotton	Groundnut	Bajra	Sesame	Wheat
Jamnagar	Groundnut	Cotton	Wheat	Cumin	Sesame
Junagadh	Groundnut	Wheat	Cotton	Cumin	Sesame
Porbandar	Groundnut	Cumin	Wheat	Gram	Cotton
Rajkot	Cotton	Groundnut	Wheat	Sesame	Cumin
Surendranagar	Cotton	Wheat	Sesame	Bajra	Groundnut
Saurashtra	**Cotton**	**Groundnut**	**Wheat**	**Cumin**	**Sesame & Bajra**
Fruit crops					
Amreli	Mango	Sapota	Citrus	Guava	Ber
Bhavnagar	Citrus	Mango	Guava	Coconut	Sapota
Jamnagar	Papaya	Coconut	Mango	Ber	Sapota
Junagadh	Mango	Coconut	Sapota	Banana	Citrus
Porbandar	Coconut	Mango	Sapota	Papaya	Ber
Rajkot	Citrus	Mango	Ber	Sapota	Papaya
Surendranagar	Ber	Citrus	Mango	Papaya	Sapota
Saurashtra	**Mango**	**Coconut**	**Citrus**	**Sapota**	**Guava & Ber**
Vegetables					
Amreli	Onion	Brinjal	Tomato	Okra	Cowpea
Bhavnagar	Onion	Brinjal	Okra	Tomato	Cabbage
Jamnagar	Onion	Tomato	Okra	Brinjal	Cucurbit
Junagadh	Brinjal	Onion	Okra	Cluster bean	Cucurbit
Porbandar	Onion	Brinjal	Tomato	Okra	Cucurbit
Rajkot	Onion	Brinjal	Cucurbit	Okra	Cabbage
Surendranagar	Brinjal	Okra	Tomato	Cluster bean	Cucurbit
Saurashtra	**Onion**	**Brinjal**	**Okra**	**Tomato**	**Cluster bean & Cucurbit**

1.1. Geographical location

Saurashtra is located on the West Coast of India in Gujarat State (Fig. 1.3 & 1.4) and lies between $20^0 30'$ to 23^0 N latitude and 69^0 to 72^0 E longitude. It is flanked by Arabian Sea on the western side, the Gulf of Kutch in the north and Gulf of Khambhat in south-east.

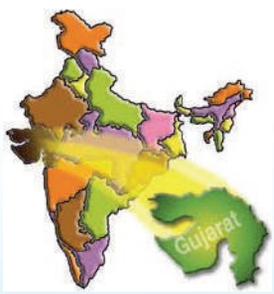


Fig. 1.3 Location of Gujarat in India

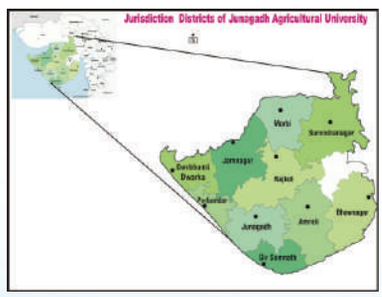


Fig. 1.4 Jurisdiction Districts of Junagadh Agricultural University

1.2 Geographical distribution

The Saurashtra region has an irregular high land core. The low coastal strip covered with sand and alluvium silt with the high land fringe by a 75 m contour. The altitude gradually rises to 300m and above to form different grades of surface. The region, in the extreme north comprising the district of Jamnagar and to the southern part, the district of Bhavnagar. The entire region is surrounded by sea on three sides, while it is connected with main land of Gujarat to its east. The Gulf of Kutch lies to its north, while the Gulf of Khambhat is located to its south east. The rivers that drain the area are Bhadar, Shetrunji, Shigvada, Raval, Ardak, Machhundri, Hiran and Bhogavo. Hills of Girnar, Palitana and Barda are noteworthy in the region. The natural eco-system include thorn- scrub forests, grassland *(Vidis)*, dry deciduous and riverine forests, mangroves, inter tidal region and coastal area including estuaries.

1.3 Climate

In terms of the standard climatic type, Saurashtra region comprises of arid and semi-arid types of climate. The principal weather parameters that build the climate of the region are rainfall and temperature, although others like humidity, cloudiness, dew and fog are also important from the agricultural point of view.

1.4 Rainfall

All parts of Saurashtra receive precipitation through the south west monsoon. The region being located at the peripheral boundary of the south west monsoon, the distribution of rainfall has been extremely uneven and irregular. The low pressure, depressions developing over the Bay of Bengal during monsoon months and moving north-to-north west also give rains to this part of the state. The average annual rainfall over different parts of the region varies widely from 400 mm in the northern part to 800 mm in the southern part of Junagadh district. The monsoon usually commences by the middle of June and withdraws by the middle of September. More than 95 per cent of the total annual rainfall is being received during June-September in most parts of the region. About 10-15 per cent of the annual rainfall is received in June, nearly 40 per cent in July, 30 per cent in August and 10-20 per cent in September. The maximum numbers of rainy days are in July and August. The rainy days range from 20 in Jamnagar to 37 in Junagadh district. The entire region falls under dry land and drought prone area. The co-efficient of variation of rainfall is more than 45 per cent.

1.5 Temperature

There is considerable variation in average temperature in different seasons in the region. During summer season, the maximum temperature goes beyond 42^{0}C and minimum temperature falls to 25^{0}C. In winter season, minimum temperature occasionally goes below 8^{0}C and maximum temperature up to 34^{0}C. The lowest temperature is recorded in the month of January and the highest temperature in the month of May. Temperatures are relatively low at places located in coastal region. The diurnal range of temperature is least in the months of July and August, while it is more in the winter. The range is higher for places like Rajkot, Amreli and Surendranagar.

1.6 Soils

The soils of Saurashtra region are low in nitrogen, sulpher and zinc, medium in phosphorus and iron, and high in potash. The soil of Saurashtra region (Fig. 1.5) is diverse in nature which can be broadly classified in to ten groups viz., 1) shallow black (Trap Basalt), (2) shallow medium black (Lime stone), (3) shallow to medium black (sand stone), (4) medium black (Trap Basalt), (5) mix red & black (Lime stone), (6) deep black (Trap Basalt), (7) marine deposits, (8) coastal shallow, (9) coastal deep, (10) stony (Trap Basalt).

While considering the major soil types, the pattern of rainfall and the temperature, the Gujarat State is divided into eight agro climatic zones viz. I-South Gujarat Heavy Rainfall, II-South Gujarat, III-Middle Gujarat, IV-North Gujarat, V-North West, VI-North Saurashtra, VII-South Saurashtra and VIII-Bhal & Coastal area. Out of which Junagadh Agricultural University is functioning in agro climatic zone No. VI, VII and part of zone V & VIII (Table-1.3 & Fig. 1.6). There are 31 research stations well spread over all four agro climatic zones (Table-1.4).

Table 1.3 Agro-climatic Zones under Junagadh Agricultural University

Zone No.	Name of zone	District	Rainfall (mm)	Climate	Soils
V	North West Agro - climatic Zone	Part of Surendranagar and Morbi	450	Arid	Sandy loam, saline
VI	North Saurashtra Agro-climatic Zone	Amreli, Bhavnagar, Rajkot, Jamnagar, Surendranagar, Devbhumi Dwarka and Morbi	537	Arid & Semi-arid	Medium black, calcareous
VII	South Saurashtra Agro-climatic Zone	Junagadh, Porbandar, Gir Somnath , part of Bhavnagar, Amreli and Rajkot	780	Semi-arid	Medium black, coastal alluvium
VIII	Bhal and Coastal Agro-climatic Zone	Part of Bhavnagar	650	Semi-arid, dry	Medium black, coastal saline

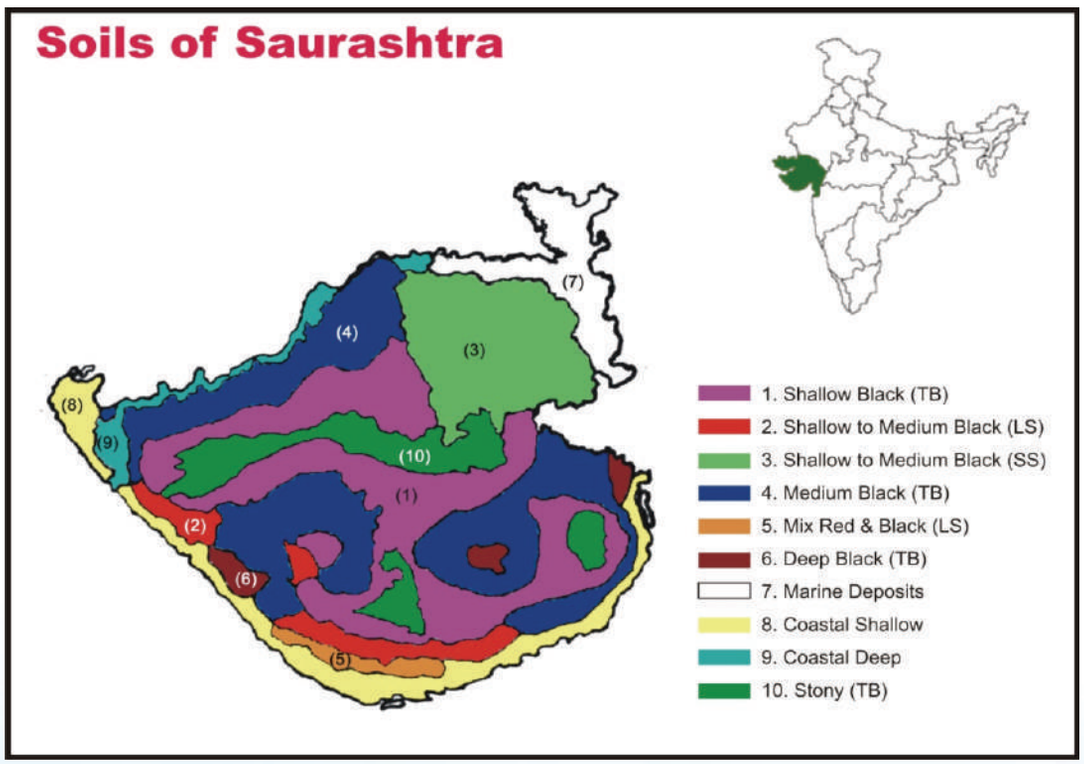


Fig. 1.5 Soils of Saurashtra

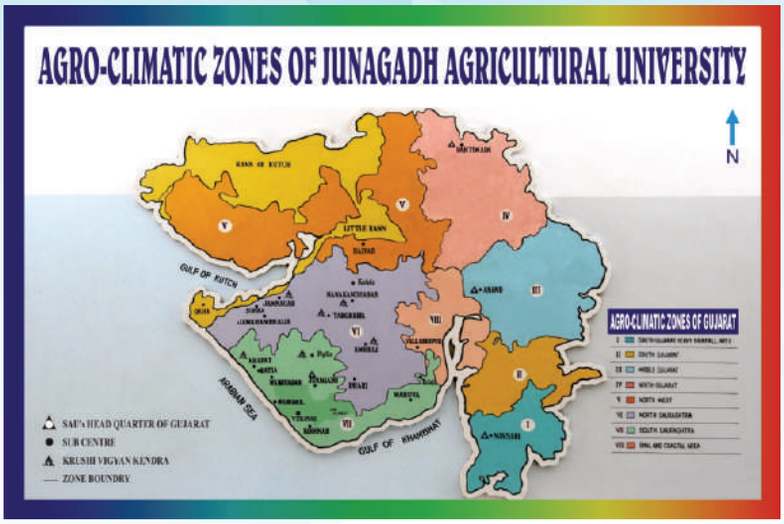


Fig. 1.6 Agro Climatic zones of Junagadh Agricultural University

Table 1.4 Research Stations in different Agro-climatic Zones of JAU

Zonal stations	Main/Special stations	Sub stations/testing centers
V. North West Agro -Climatic Zone		
		1. Agricultural Research Station, Halvad
VI. North Saurashtra Agro-Climatic Zone		
Targhadia	1. Main Dry Farming Research Station, Targhadia 2. Main Pearl Millet Research Station, Jamnagar 3. Agricultural Research Station, Amreli. 4. Grass land & Agricultural Research Station, Dhari	1. Dry Farming Research Station, Jamkhambhalia 2. Fisheries Research Station, Okha 3. Fisheries Research Station, Sikka 4. Cotton Research Station, Kukada 5. Bull Mother Farm, Amreli
VII South Saurashtra Agro-Climatic Zone		
Junagadh	1. Main Oilseeds Research Station, Junagadh 2. Wheat Research Station, Junagadh 3. Cotton Research Station, Junagadh 4. Castor Research Station, Junagadh 5. Agricultural Research Station (Fruit crops), Mahuva 6. Main Sugarcane Research Station, Kodinar 7. Pulse Research Station, Junagadh 8. Cattle Breeding Farm, Junagadh 9. Vegetable Research Station, Junagadh 10. Research Testing and Training Centre, Junagadh	1. Central Experimental Research Station, Sagadividi, Junagadh 2. Inland Fisheries Research Station, Junagadh 3. Oilseed Research Station, Manavadar 4. Cotton Research Station, Khapat 5. Fruit Research Station, Mangrol 6. Dry Farming Research Station, Ratia 7. Fisheries Research & Training Center, Mahuva 8. Agriculture Research Station, Talaja 9. Grassland Center, Jonpur 10. Spices Research Station, Junagadh
VIII Bhal & Coastal Agro-Climatic Zone		
-	-	1. Dry Farming Research Station, Vallabhipur

CHAPTER - II
THE UNIVERSITY

The Junagadh Agricultural University came into existence in May 1st, 2004 with the regional mandate for executing and strengthening the triple functions of agricultural education, research and frontline extension. The University represents ten districts of Saurashtra region i.e., Amreli, Bhavnagar, Devbhumi Dwarka, Gir Somnath, Jamnagar, Junagadh, Morbi, Porbandar, Rajkot and Surendranagar. The head quarter of this University is located at Junagadh.

THE MANDATE

- Endowing the quality education to produce globally competitive graduates and post graduates in different areas of agricultural and allied fields.
- Planning, execution, promotion, co-operation, monitoring and evaluation of problem solving research and its application in agriculture, horticulture, agricultural engineering, animal husbandry, dairy and fisheries sciences to deliver integrated solutions to the problems faced by the farmers in agriculture and allied field.
- To develop effective machineries to transfer knowledge and frontline technologies to farmers and agricultural organisations through extension services and imparting skills/training to rural youth through front line extension that develops progressive farmers with a global perspective and strong commitment to sustainable growth of agriculture.

AIM

The aim of Junagadh Agricultural University is to promote agricultural productivity in general and to improve the economic condition of rural community in particular through integration of teaching, research and extension education.

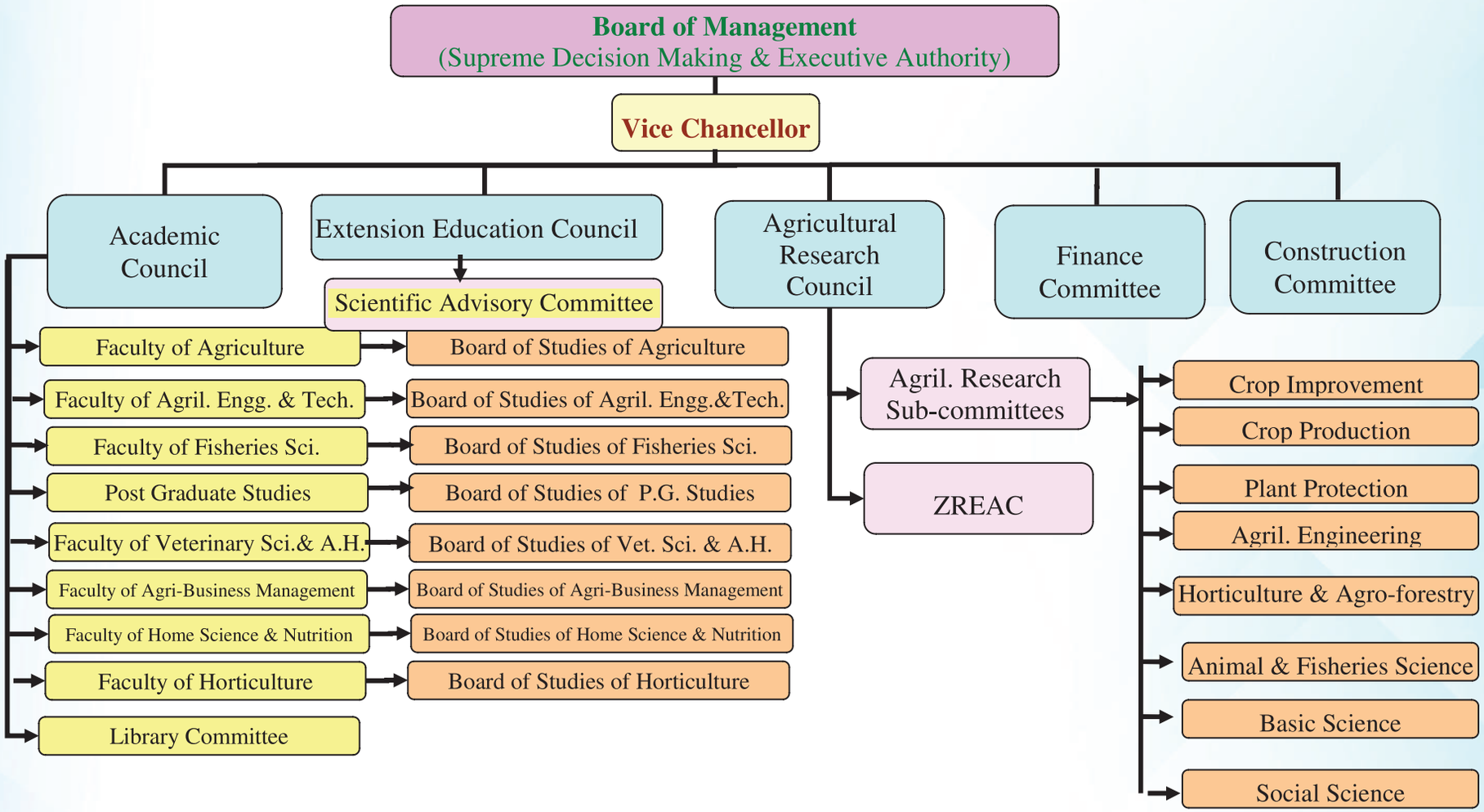
UNIVERSITY AUTHORITIES

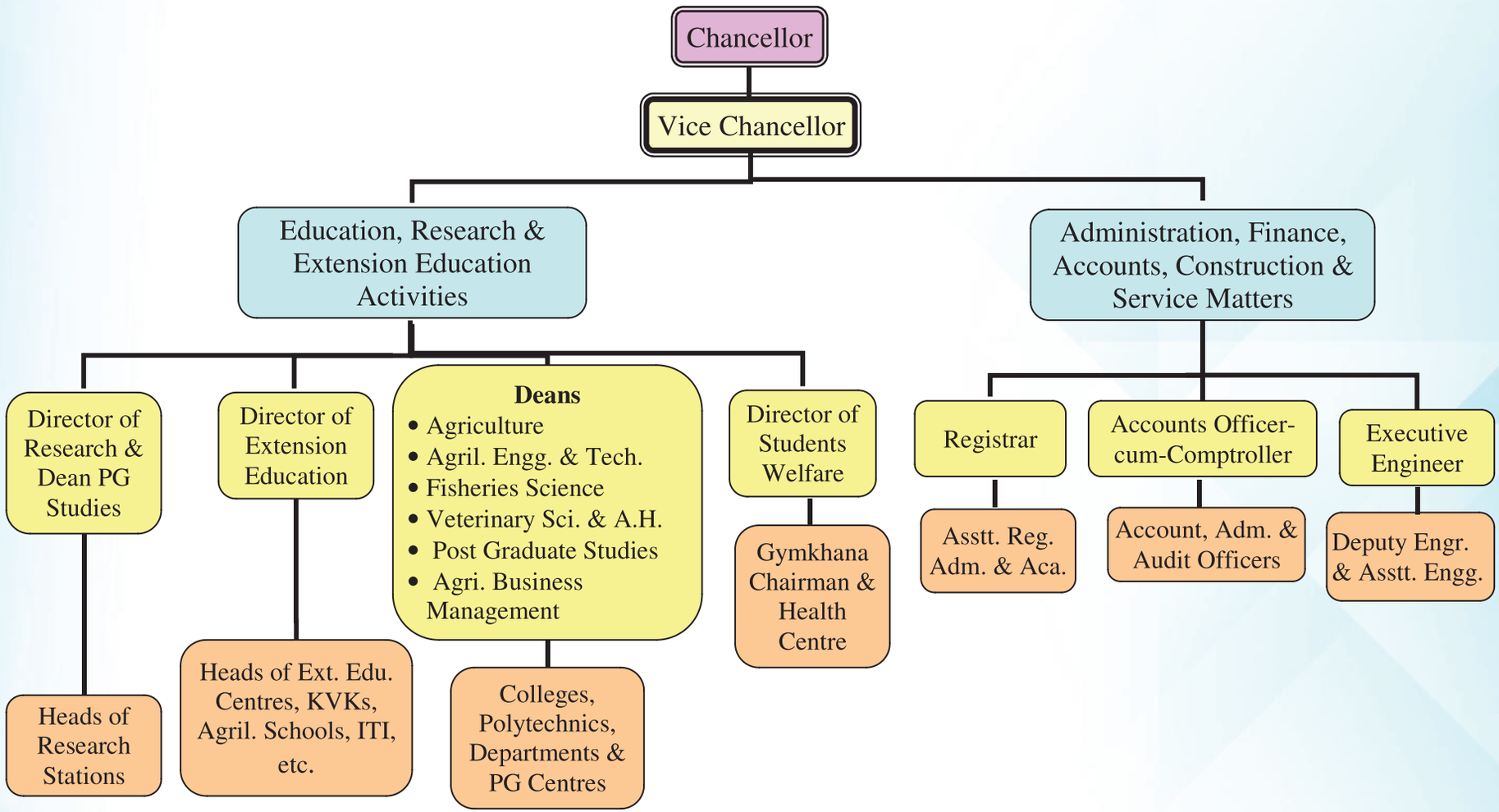
Following authorities were functioning under the provisions of Section-17 of the Gujarat Agricultural Universities Act 2004 during the year under report.

The Board of Management

1. Academic Council
    1. Board of Studies of Post Graduate Studies
    2. Board of Studies of Agriculture
    3. Board of Studies of Agricultural Engineering & Technology
    4. Board of Studies of Fisheries Science
    5. Board of Studies of Veterinary Science and Animal Husbandry
    6. Board of Studies of Agri. Business Management
    7. Board of Studies of Home Science & Nutrition
    8. Board of Studies of Horticulture
2. Extension Education Council
    1. Scientific Advisory Committees (KVKs)
3. Research Council
    1. Zonal Research & Extension Advisory Committee (ZREAC)
    2. Agricultural Research Sub-committees (AGRESCO)
    3. Joint AGRESCO of JAU
    4. Combined Joint AGRESCO of SAUs of Gujarat
4. Finance Committee
5. Construction Committee

ORGANIZATIONAL SETUP




Chancellor
Vice Chancellor
Education, Research & Extension Education Activities
Administration, Finance, Accounts, Construction & Service Matters
Director of Research & Dean PG Studies
Director of Extension Education
Deans
• Agriculture
• Agril. Engg. & Tech.
• Fisheries Science
• Veterinary Sci. & A.H.
• Post Graduate Studies
• Agri. Business Management
Director of Students Welfare
Registrar
Accounts Officer-cum-Comptroller
Executive Engineer
Heads of Research Stations
Heads of Ext. Edu. Centres, KVKs, Agril. Schools, ITI, etc.
Colleges, Polytechnics, Departments & PG Centres
Gymkhana Chairman & Health Centre
Asstt. Reg. Adm. & Aca.
Account, Adm. & Audit Officers
Deputy Engr. & Asstt. Engg.

CHAPTER - III
CURRENT ISSUES/CONSTRAINS AND RESEARCH NEEDS

Issues

The major part of the Saurashtra region falls under semi-arid and arid types with varying climatic as well as soil conditions has been divided in to two Agro-climatic zones. The agro-ecological characteristic features and issues thereof have been:

- About 70 per cent of total area is rainfed and there is a wide variability in crop yields due to erratic and scanty rainfall.
- Low soil organic carbon status due to low rainfall and high temperature with minimum recycling of organic residues.
- The economy is mainly based on the activities related to cotton and groundnut in crop sector and livestock and fisheries in the non-crop sector.
- The area and production of cereals and pulses is limited.
- In Saurashtra, irrigated area is quite low and most of the irrigation is through open well/tube well which largely depend on monsoon performance. However, due to use of water conservation technologies viz., check dam, bori-bandh, khet-talavdi etc. has reduced the ground water depletion and increase irrigated rabi area. Besides availability of Narmada canal water has also increased irrigated area.
- Cotton and groundnut are the major crops grown in Saurashtra in kharif season.
- In the adjoining areas of 788 kms long coastal belt, sea water ingress and inland salinity cause soil health/fertility problems.
- Due to industrial establishments in Saurashtra, the deposition of effluent water and heavy metal contaminants as well as mining near coastal region paused socio economic and ecological problems. The heavily affected areas have been the part of Jamnagar, Porbandar, Junagadh, Devbhumi Dwarka, Gir Somnath and Bhavnagar districts.
- As the water requirement of the crops is very high, scanty rainfall and the less number of rainy days are the hurdles for crop production in the region.
- Suitable agricultural machinery required to be developed and popularized for timeliness and reducing human drudgery in operation for major crops of the region.
- The cost of cultivation is relatively higher in the region that may be due to limited use of power sources. To increase the use of improved machinery custom hiring required to be promoted.
- The area under horticulture is increased but limited fruit processing units are available in this region.
- Protected cultivation using net/poly house for cash crops vegetable, floriculture and medicinal plant.

CONSTRAINTS/ THRUST AREAS

Agriculture

- Low seed replacement rate in groundnut.
- Low and instability of crop productivity due to abiotic stress particular seasonal climate variation.

- Sea water ingress and soil salinity/sodicity.
- Low soil organic carbon status.
- Soil health deterioration due to injudicious use of fertilizer, poor quality underground water, pesticides, fungicides and weedicides.
- Development of groundnut varieties for confectionaries and value added products.
- Less processing units for fruits crops particularly in mango and sapota.
- Bio-remediation of salt affected soil of coastal region.
- Development of bio-fortified varieties in cereal crops.
- Limited protective cultivation and use of MIS system.
- Low use of biofertilizer, bioagent and bio-control appliances.
- Technologies for protected cultivation need holistic research.
- Pink ball worm serious problem in cotton crop.
- White grub infestation is also increasing groundnut.
- Wild and real animal damage in agricultural crops.

Livestock & Fisheries

- Impurity of breeds leads to low productivity.
- Inadequate fodder and balanced nutrients.
- Lack of technologies for rapid diagnosis of diseases and nutrient deficiency.
- Water pollution and cattle health problems.
- Poor R & D facilities for marine and inland fisheries.
- Less use of bullocks in farm operation due to mechanization.

The major emphasis would be on the improvement of the productivity through

Agriculture

- Increase in genetic potential by developing high yielding varieties, hybrids and transgenic of major crops through marker assisted selection.
- Incorporation of desired genes for biotic-abiotic resistance and quality.
- Development of varieties suitable for processing and value addition.
- Development of climate resilient varieties and input-agro technology for the mitigation climate changes.
- Development of genetically engineered strains of microbes for bio control/ bio fertilizer.
- Development of water harvesting and recharging technologies/integrated water management.
- For ensuring quality and higher production, the use of protected cultivation should be promoted.
- The research on horticultural crops will be intensified.
- Research on protected cultivation will be give special attention.
- Crop-weather modeling and weather forecasting.
- Conservation of biodiversity and developing technologies for medicinal plants.
- Technology development for cultivation, processing and value addition of medicinal plants.
- Integrated soil nutrient management through crop residues recycling.

- Research on organic farming in mandate crops of Saurashtra region.
- Crop quality assessment.
- Development of processing technology for mango, sapota, tomato and other fruits.
- To evolve location specific cropping/farming system coupled with allied occupation.
- Research on new crops of economic importance.
- Development of weather forecasting and climate change models.
- Adaptive research on precision farming.
- Research on renewable energy production and management.
- Isolation and production of bioagents for biocontrol of pest and diseases.
- Development of research technology in seed spices.
- Emphasis on seed production of developed variety of mandate crops.
- Research needs for Integrated farming system model.
- Seed bank for conservation of seed materials of the developed/local cultivated type variety.
- Comprehensive strategies for control of pink boll worm in cotton and white grub in groundnut.

Livestock & Fisheries

- Genetically improvement for higher productivity in indigenous breeds of cattle and buffaloes.
- Availability of pure breeds animals of Gir cow and Jafrabadi buffalo.
- Production technologies for forage crops.
- Production of proven sires in Gir cattle and Jafrabadi buffalo through field progeny testing programme.
- Dissemination of superior genetic material in the fields through artificial insemination.
- Sexing of semen to maximize the female birth ratio in Gir cow and Jafrabadi buffalo.
- Development of cattle management practices against climate change.
- Fish production technologies of inland fisheries by use of brackish water in coastal region.

Human Resource Development

- To develop trained manpower for frontier areas.
- Biotechnology and genetic engineering.
- Applied remote sensing and GIS.
- Product processing.
- Non-conventional energy sources.
- Strengthening of IPR in JAU.

Extension education

- Distance education in agriculture.

  Distance education satisfied the interest of the young farmers who could not go to the school. Therefore, prime need is to be given to Distance education. This also provides the latest information of agriculture to the youth of village area.

- Development of multi-media, audio-visuals and self-learning modules.

  Most of the farmers of village area are illiterate. Therefore, instead of one way lecture system, a

teacher should use multi- media and audio- visual aids, while delivering lecture.

- Development of aqua-based production system modules for coastal areas.

  Meager works has been done for the development of fishermen. Fishing is the main business of our fishermen. Therefore, they must be aware about the scientific fishing system.

- Adaptive research trials

  Adaptive research trials are to be organized at farmers' field for better understanding the new technologies developing by scientists. Farmers always follow the neighboring farming community. They have more trust on farmers.

- Technology transfer through Krishi Mahotsav, Krishi Mela and graffiti.

  The celebration of Krishi Mahotsav is the most useful system of extension education. More than one lakh farmers visit the Krishi Mela which is organized during the one month of celebration of Krishi Mahotsav. Thus, the agriculture scientists are playing a key role for transfer of technology. Previously, we have launched the programme named "Scientist at the door step of the farmers". Now, this has been included as one of the most useful campaign to transfer the new agriculture system to the farming community.

- Need based training to the extension functionaries.

  Since many years, we are organizing various programmes keeping in view the needs of the farmers about the agriculture and its allied science.

- Establishment the Gram Kisan Samiti in the rural areas through Centre of Communication (COC) scheme.

  This is also a new approach for Transfer of Technology (TOT). The Gram Kisan Samities are formed in village. We are organizing various programmes at their village as they are the member of COC. We are also give priority to transfer the latest agricultural knowledge to the members of COC, also giving feel some status which help us to coordinate various programmes at village as well as the research centres.

- Agricultural Technology Information Centre (ATIC) and Transfer of Technology Centre provide technical assistance to the farmers.

  ATIC is also one another useful method for TOT in which the scientists are not simply giving lecture but interaction is being arranged where the demonstration is organized. One another main activity of ATIC is to provide seeds and sapling to the farming community. This is also one of the important motto is of ATIC.

- Strengthening of Farm & Radio Advisory Centers.

  This is also an electronic era. Radio and television are the main source of new information with help of this electronic system. We can send the message to the hundreds of farmers living at a distance places.

- Electronic era

  E-communication and e-extension are the latest systems to send the latest information to the farmers. With the help of this new electronic system, we can send the message within a very short time to the farmers living at a far distance places.

CHAPTER - IV
PERSPECTIVE

Junagadh Agricultural University is functioning in Saurashtra region of Gujarat State. Saurashtra is erstwhile *Kathiawad* state, an area once ruled by 202 princes. In November 1956, the states were recognized and the bigger bilingual State of Bombay was formed. Again with the bifurcation of the Bombay State into Maharashtra and Gujarat on May 1st, 1960, it became a part of Gujarat State. The Saurashtra, on the western coast of India is situated in the peninsular part of the Gujarat State. It comprises ten districts *viz.,* Amreli, Bhavnagar, Devbhumi Dwarka, Gir Somnath, Jamnagar, Junagadh, Morbi, Porbandar, Rajkot and Surendranagar. The region is endowed with 788 kms sea coast stretching all along from Gulf of kutch in the north west through the Arabian sea in the south up to the Gulf of Cambay in the east.

The region accounts for 27 per cent of the total population and about 1/3 of the total geographical area of the state. It has undulating topography. It has recorded spectacular growth in agricultural production primarily due to the outcome of the planned development. The important strategies to enhance productivity of crop and diversification of enterprises were capital formation on the one hand and, supply of various inputs and ensuring remunerative prices on the other. It was found that no sooner did the balance budgetary allocation shift from capital formation to subsidies and services, the growth in agricultural sectors started declining. The livestock sector on the contrary, bypassed the ill-effects of this shift as was reflected by the consistent higher growth rate indicating greater resilience on animal based farming system. On the other hand, marine fish production is likely to reach a level of maximum sustainable yield.

This issue needs attention of the policy planners for the livelihood of large number of fisher fork in the region. The fisherman can be encouraged for inland fisheries as well as mariculture.

Since, country has become a signatory to the WTO and quantitative restrictions have been lifted, the farmers have no easy to go but to be competitive internationally for their farm produces. To face the challenges posed due to globalization, it is highly essential to redesign the existing development model or develop, a new model which can pave the way for strong and vibrant agricultural sector. Rapid and efficient dissemination of new technologies, establishing knowledge centers at village level for quick and down massages, training to development functionaries and finally the training to farmers about Sanitary and Phytosanitary measures to be followed for maintaining quality of farm produces at par with the global standards, etc. are the prime need of the time.

4.1 Education

To begin with, the University had five UG degree programmes covering broadly Agriculture, Horticulture, Veterinary Science & Animal Husbandry, Agricultural Engineering & Technology and Fisheries Science. Over the years, attempts have been made to diversify agricultural education by starting specialized under graduate and post graduate degree programmes in various branches of agricultural sciences. The JAU has started PG programme in Fisheries Science, UG & PG programmes in Veterinary Science and MBA in Agri-business. Moreover, six polytechnic programmes have been started. Presently the University offers five Bachelors' degree programmes covering Agriculture, Horticulture, Agricultural Engineering & Technology, Fisheries Science and Veterinary Science & Animal Husbandry and six Masters' degree programmes in 35 disciplines, among them the faculty of Agriculture (Agril. Economics, Agril. Extension, Entomology, Agril. Meteorology, Agronomy, Crop Physiology, Genetics & Plant

Breeding, Plant Pathology, Seed Science & Technology, Soil Science, Plant Molecular Biology & Biotechnology, Biochemistry and Agril. Statistics), faculty of Horticulture (Floriculture & Land Scape Architecture and Fruit Science) faculty of Agril. Engineering & Technology (Processing & Food Engg., Farm Machinery & Power Engg., Soil & Water Engg., Renewable Energy Engg.), faculty of Fisheries Science (Fisheries Resources Management, Fish Processing Technology and Aquaculture) faculty of Veterinary Science & Animal Husbandry (Animal Genetics & Breeding, Animal Nutrition, Live Stock Production & Management, Animal Biotechnology, Vet. Pharmacology & Toxicology, Vet. Animal Husbandry Extension, Vet. Microbiology, Vet. Physiology, Vet. Biochemistry, Vet. Epidemiology & Preventive Medicine, Vet. Clinical Medicine, Ethics & Jurisprudence, Vet. Surgery & Radiology) and Agri-business Management (MBA in Agri-Business) and Doctoral degree programmes in various disciplines.

To keep pace with developed world, steps are proposed to be taken for improving the standard of education in agriculture and allied sector.

Table 4.1 Thrust areas identified and proposed perspective plan for Agril. Education

SN	Thrust Areas	Perspective Plan
General aids in education		
1	Raising the intake capacity of the existing colleges	• Proportional expansion of infrastructure facilities.
2	Improving the educational standards	• Faculty improvement. • Modernization of education system. • Introduction of new courses. • Modernization of laboratories, class rooms and instructional farms. • Introduction of teachers' assessment and evaluation. • Revision of PG curricula. • Developing the system of accreditation. • Instituting associateship for meritorious PG students. • Effective co-ordination of multi-disciplinary education & research. • Use of information technology in teaching and examination system.
3	Developing linkages with foreign Universities/institutes	• Exploring possibilities of collaboration with foreign universities in frontier areas.
Agriculture & Horticulture		
4	Diversification of education	• Establishment of faculty of basic science and humanities, information technology, food processing and biotechnology. • Starting post graduate diploma in agri-business management, agri-information technology, biotechnology, horticulture, water management, in agriculture and food processing in engineering. • Establishment of new departments viz., microbiology, virology, toxicology & nematology.

		• Starting of PG degree in vegetable science, plantation, aromatic and medicinal crops. • UG & PG programme in nano-biotechnology and Agricultural Information Technology. • New post-doctoral programmes in water management, biological control, virology, organic farming, biotechnology etc.
Agricultural Engineering & Technology		
5	Strengthening of UG, and PG Education in the Engineering	• Establishment of new laboratories and modernization of present laboratories. • Establishment of Basic Engineering Department. • Department of Irrigation & Drainage Engineering. • Degree programme in Energy & Environmental Engineering at UG level. • Master and Ph.D. research program in Solar Energy, Wind Energy and Bio Energy. • Development of CAD/CAM computerized laboratory. • Upgradation of Agril. Engg. College with inclusion of Multi Engineering Disciplines. • International collaboration in PG research.
Fisheries		
6	Enhancing the skill development and output of degree holders and diversification of fisheries education	• Raising the intake capacity. • Improving and updating laboratory and classroom facilities. • Establishing new departments (information technology, food processing, biotechnology, fishery economics & statistics, fishery management). • Introducing new disciplines (fish nutrition & biotech., fishery pathology and microbiology, fishery genetics & biotechnology, aquatic environment, fisheries management). • Faculty exchange and training programmes.
Veterinary Science & Animal Husbandry		
7	Strengthening institutional capacities in veterinary science	• Increase the intake capacity. • Up gradation of students' amenities. • Modernization of laboratories, instructional farm and teaching veterinary clinical complex.

4.2 Extension Education

Technological change is the key to agricultural development. Despite the widespread diffusion of new production technologies, the farmers do not adopt many new technologies because do not fit well with the circumstances of technologies the farmers for whom they are intended. The efficacy of adoption of technologies largely depends on appropriate assessment of need and impact of technologies.

Developing information based technology, assessment of developed technologies and forecasting of technological requirements are essential in changing times.

The university has planned to develop a system for assessment and refinement of technologies to make them location specific. Farmer led extension approach can further accelerates the flow of such technologies to the farmers as well as feedback to the research/extension system.

Diversification in vocational education on rain fed farming, biotechnology, poultry, fisheries, processing of fruits and vegetable, etc. will help in motivating rural youth to take up agricultural occupation. Farm women, tribal farmers/farm women/ youth, input dealers, etc also be encouraged to participate more in training programmes. Efforts will be made to provide specialized training in prime areas like nursery management, seed production technology, agro processing & post-harvest technology, dairy management, agricultural business management, hi-tech agriculture, greenhouse construction & systems management, use of micro-irrigation systems, its operation and management etc. to the rural youth so as to equip them technologically, for self-employment.

At present, Agriculture Diploma School, four centres offering certificate courses, Training & Visit Scheme, *Sardar Smruti Kendra,* Farm Advisory Service Centre, six Krishi Vigyan Kendras, Extension Programme for Fisheries, Agricultural Technology Information Centre (ATIC), Centre of Communication (CoC), Information & Reception Centre (IRC) and Community Radio Station are functioning in the University. Of which, all the six KVKs, Extension Programme for Fisheries, ATIC, CoC, IRC and Community Radio Station are recent addition after establishment of the University.

Table 4.2 Thrust areas identified and proposed perspective plan of Agril. Extension Education

SN	Thrust Areas	Perspective Plan
1	Distance Extension Education through Cyber Extension	• Developing Multimedia and Self Learning Modules. • On-line Transfer of Farm Information. • Distance learning courses through satellite communication; correspondence and more effective communication system through electronic media, audio visual aids computer network.
2	Frontline Transfer of Technology	• Establishment of Transfer of Technology center for assessment, refinement and exploration of farm technologies; and validation of local technologies in view of Agro-eco situations of the zone. • Six Agricultural Technology Information Centers are working to facilitate direct access to technological products, information about new technologies and diagnostic services to the farmers. • Mobile Transfer of Technology Project is planned to reach the remote un-reached peasants.
3	Diversification of Vocational Educational Programmes	• The Vocational Educational Programmes are in operation in the areas like Greenhouse Construction & Systems Management, Use of Micro-irrigation Systems, its Operation and Management and Seed Production technology, Agri-business Management, High-tech Agriculture, etc.

		• New frontiers like value addition in fruits and vegetables; inland fish, poultry and agro-processing will be covered under new projects.
4	Improving Research Extension Linkage	• Organize training at State level with functionaries of line Departments of the State and other agencies; Village adoption programme to demonstrate advanced technology. • To establish Centre for Communication Network to improve linkages between farmers, extension functionaries and scientist.
5	Diagnostic services	• Plant Clinic for Diagnosis and Management of crop diseases/pest disorders will be established. Similar component can be added to the existing frontline transfer of technology centers.
6	Certificate courses in Agro base ITI	• Different four courses are offering in Agro base ITI in Six month • Formulation of course curricula.
7	Establishment of veterinary clinical complex	• Strengthening treatment facility for outdoor and indoor sick animals. • Need-based institutional training in A. H. field for farmers, farm women and rural youth.
8	Transfer of fishery technologies	• Establishment of ToT centre for fisheries. • Establishment of demonstration-cum-training centre in freshwater aquaculture. • Vocational programmes in museology, feed formulation, ornamental fish culture, net fabrication, fishery product development, quality assessment of fishery products, etc. • Imparting trainings to personnel from different departments and organizations. • Establishing linkages with state fisheries department, fishermen, NGOs and entrepreneurs and also strengthening/creating alliances and partnerships. • Online fishery information.

4.3 Research

Since technologies going to be main tool for enhancing growth rate of agriculture, the maximum thrust in research would be on genetic engineering, integrated pest and disease management, integrated plant nutrient management, development of integrated, ecologically sound and viable farming systems, post-harvest technology, biodiversity conservation, natural resources management and significance of climate change in agriculture and allied sciences.

Among the crops, the priority in research will go to those crops in which Saurashtra region is competitive at the National and International level, for example, groundnut, cotton, wheat, pearl millet, sesamum, castor, onion, garlic, cumin, mango, coconut, citrus, sapota, guava, ber, papaya, brinjal, okra, and tomato. Pulses have also been identified as key crops owing to their importance for food nutrition of people.

In the animal sciences, enhancing animal productivity through population improvement, better health care and improved nutrition would receive the greater attention in XII plan.

Table 4.3 Thrust areas identified and proposed perspective plan of Agril. Research

SN	Thrust Areas	Perspective Plan
Crop Improvement		
1	Genetic up-gradation through hybridization	**Short term** • Genetic enhancement and population improvement in diploid and tetraploid cotton. • Development of CMS based hybrids and diversification of cyto-source in cotton. • Development of long linted G. hirsutum with high yield potential. • Development of genotypes for early and late heat tolerance in wheat for climate change. • Development of short duration varieties suitable for Saurashtra condition in wheat and chickpea. • Development of early and inputs responsive hybrids for good quality summer bajra cultivation. • Identification and utilization of open pollinated varieties/hybrids for average input condition in pearl millet. • Development of bold seeded & confectionary type of groundnut varieties. • Development of early or medium late maturing MS lines in pearl millet. • Development of high yielding medium late maturing pigeon pea varieties. **Long term** • Generation of genetic variability for resistance to biotic and abiotic stresses through use of wild relatives in cotton, wheat, bajra, groundnut, vegetables etc. • Development of CGMS system and hybrid development in sesame, chillies, pigeon pea and onion. • Development of multi-adversity resistant (MAR) genotypes in cotton. • Use of synthetic germplasm for the development of new plant type in wheat. • Gene pyramiding for the development of disease resistant varieties in mandate crops. • Marker assisted selection for biotic, abiotic and quality traits in mandate crops. • Diversification of male sterile lines through development of downy mildew resistant CMS lines in A5 and A4 sources in pearl millet.

		• Establishment of long term population improvement programmes of pearl millet to extract downy mildew resistant CMS & 'R' lines. • Development of physiologically efficient plant types in mandate crops.
2	Germplasm maintenance and utilization	**Short term** • Collection, conservation, characterization and evaluation of available genetic resources. • Identification and utilization of resistance sources against major biotic and abiotic stresses in mandate crops. • Cataloguing of accessions based on morphological, phenotypic and genetic characteristics in crop plants. **Long term** • Exploration of germplasm of minor vegetables, pulses and seed spices. • Collection, conservation and evaluation of germplasm of crop plants. • Identification, characterization and conversion of photo-period sensitive germplasm accessions to make them suitable for the region. • Pre-breeding/conversion of unabated germplasm of cultivated species of cotton into usable and value added varieties.
3	Breeding for yield and quality improvement	**Short term** • Development of high yielding cultivars amenable to machine harvesting in the mandate crops of Saurashtra region. • Development of highly nutritive pearl millet hybrids containing high Fe & Zn content. • Exploitation of genetic variability for milling characteristics and resistance to stored grain pests. • Development of high yielding onion varieties with high TSS for processing & export and big cloved garlic varieties. • Development of high oil and high O/L ratio containing groundnut varieties. • Breeding for resistance to specific diseases in the crops of the region. **Long term** • Development of efficient criteria for selection, breeding methodologies for simultaneous improvement of yield and quality parameters. • Development of crop varieties/hybrids suitable for processing, export and confectionery purposes in important crops.

		• Use of biochemical tools to improve resistance / tolerance to biotic and abiotic stresses in mandate crops. • Development of varieties with early and synchronized maturity suitable for machine picking in arboreum cotton. • QTL mapping for economically important traits inclusive quality traits in mandate crops. • Development of transgenic varieties for various purposes. • Application of biotechnology and tissue culture for development of inbreds and in vitro selection for disease and drought resistance. • Pyramiding resistant genes for various races of important diseases of mandate crops. • Development of vegetable varieties/hybrids suitable for off season and greenhouse cultivation in important vegetables for processing, export and dehydration purposes.
Biotechnology		
4	Upgrading and strengthening of biotech research	**Short term** • Understanding the physiological, genetic and molecular mechanisms underlying abiotic & biotic stress tolerance. • Molecular basis of male sterility and fertility restoration. • Cloning and characterization of novel genes of agronomic importance. • DNA fingerprinting of varieties released by JAU. **Long term** • Molecular analysis of important plant pathogens, pathotyping and host pathogen interaction. • Molecular breeding for stress tolerance. • Map based gene cloning and markers for MAS. • Genetic engineering for resistance to pathogens. • Genome sequencing of crop plants and microorganisms.
Basic Science		
5	Production of elite planting materials	**Short term** • Development of tissue culture protocols for important field crops, vegetables, fruits, medicinal & aromatic crops. • Endow the farmers with quality planting materials. **Long term** • Development of protocol for anther culture and multiplication of highly recalcitrant crops. • Standardization of protocol for embryo rescue technique.
6	Development of biodiversity park and encouraging production of quality planting material of	**Short term** • Introduction of germplasm of medicinal & aromatic plants.

	medicinal and aromatic plants	• Establishment of short term storage seed bank. **Long term** • Development of facilities for long term storage of seed through cryopreservation. • Fingerprinting of medicinal and aromatic plants germplasm.
7	Understanding the basic physiological mechanisms contributing to differential yield response of mandatory crops of the region	**Short term** • Identification of morphological, physiological and biochemical parameters for rapid screening of drought and salinity resistant crop genotypes. • Use of different salts/ PGR'S and biomolecules for seed treatment/ foliar spray. • Research on basic and applied aspects of plant growth and development, plant metabolism, micronutrients, growth regulators and abiotic stresses. **Long term** • Study on molecular aspects of plant physiological processes particularly under changing environmental conditions.
8	Improvement of seed germination and storage capacity of seeds	**Short term** • Establishment of functional seed testing laboratory and model of small scale seed processing plant. • Studies on seed dormancy and cultivar purity.. **Long term** • Development of protocol for seed coating and pelleting for small seeded crops.
Plant Protection		
9	Bio-control of insects, pests and diseases	**Short term** • Research on beneficial microbes and insects for control of pests and diseases. • Screening of promising micro-organisms and insects in vitro. • Testing of field performance of bio-control agents. **Long term** • Acclimatization and sustainability of bio-control agents in ecosystem • Standardization and quality production of bio-control agents.
10	Integrated pest management	**Short term** • Development of guideline for incorporation of non-chemical methods and integrated pest and disease management. • Evaluation of new micro-molecules and optimization of dose of pesticides with reference to pest ecology.

		Long term • Quantification of pesticides residue in agricultural produces. • Development of IPM modules.
Natural Resource Management		
11	Technology for organic farming including bio-fertilizer & integrated plant nutrient management	**Short term** • Research on farm residue recycling. • Development of enriched organic manure. **Long term** • Testing of efficient strains of N-fixing and P-solubilizing microbes. • Quality standards of organically raised farm produce. • Carbon sequestration.
12	Development of dry farming and water management technologies	**Short term** • Water management in cropping systems based on water availability. • Fine tuning of the recommendations on irrigation for different farming situations. • Increasing water use efficiency through adoption of micro-irrigation system. • Use of sewage water, recycling of waste waters in agriculture. • Developing low cost technologies for in situ moisture conservation. • Utilization of saline water for farming. • Contingent crop planning. **Long term** • Evaluation of microbial techniques for justification of sewage water/saline water. • Introduction and evaluation of high value specialty crops for increasing system productivity and sustainability. • Integrated farming systems for small and marginal farmers.
13	Integrated weed management	**Short term** • Development of guidelines for incorporating the non-chemical (cultural/ mechanical and agronomic manipulation) with chemical methods. • Evaluation of new herbicides and optimizing their time and dose of application and elucidating factors affecting their efficiency. **Long term** • Dynamics of weed seed bank in soil. • Quantification of herbicide residues in soil, water and plant parts and their consequent entry in the food chain.

		• Development of management techniques to mitigate the negative impact of herbicide residues.
14	Technologies for improvement/ restoration of soil health	**Short term** • Development of low cost technologies for the reclamation of salt affected soils. • Developing sustainable and stable cropping systems. • Diversification and intensification of agriculture. **Long term** • Evolving alternate land use planning based on land capability classification. • Working out techniques of conservation agriculture, carbon sequestration and watershed management for rejuvenation of waste lands. • Developing technologies for arresting sea water ingress in coastal areas. • Real-time N application.
15	Stability in production system under the changing climate	**Short term** • Weather characterization. • Medium range weather forecasting models. • Development of crop contingency plans for mitigating climate change. **Long term** • Risk management in agriculture and crop assessment.
Horticulture		
16	Centre of excellence in mango	**Short term** • Production of quality planting material. • Training and demonstration to farmers about Good Agricultural Practices (GAP) right from field preparation to the marketing. • Research on cultivation of organic mango. • Standardization of rootstock and grafting technique. **Long term** • Research on effect of climatic changes in mango. • Research in different varieties for higher production and introduction in new area. • Standardization of different post-harvest techniques and value addition. • Standardization of geometric architecture and canopy management.
17	High-technology research in banana, papaya, guava, sapota and custard apple	**Short term** • Production of quality planting materials for commercial planting. • Standardization of efficient de-suckering in banana for commercial planting. • Studies on sex expression in papaya.

		• Standardization of root stock and grafting technique in sapota. • Studies on blackening of fruits in custard apple. • Integrated nutrient management of different cultivars. **Long term** • Use of PGRs for higher yield and export quality. • Research in different varieties for higher production and introduction in new area. • Standardization of different post-harvest techniques and value addition in sapota.
18	Efficient technologies for protected cultivation	**Short term** • Development of production technologies for flowers and vegetables under protected condition.
19	Strengthening of post-harvest technology and value addition	**Short term** • Post-harvest handling, processing and storage studies for different horticultural produces. • Market studies with respect to fruits, vegetables and flower crops.
Agricultural Engineering		
20	Development of Renewable Energy technologies and efficient utilization	**Short term** • Research on solar drying, solar distillations, greenhouse technology, solar water heating, cooking, advance solar collector, PV pumping, LED based PV lighting etc. • Development of new technologies on biomass gasification and biogas production. **Long term** • Development of advanced solar systems for cooling, test set-ups for solar, thermal and PV system. • Designing of solar thermal and PV power projects. • Solar-wind hybrid system, wind turbine and high performance wind pumping systems.
21	Reduction in cost of cultivation and drudgery through farm mechanization	**Short term** • Development and modification of improved farm equipments with better timeliness of operation, higher input use efficiency comfort to operators. • Performance evaluation of developed technology. **Long term** • Establishment of centre of farm mechanization, precision farming and ergonomics • Establishment of custom hiring services for improved machines.
22	Centre for Remote Sensing and Geo-informatics in Agriculture	**Short term** • Assessment of the land, water and vegetation resources of the region.

23	Water management	**Short term** • Watershed development and management: rainwater harvesting in different agro-climatic zones. • Assessment of groundwater development and energy use patterns for optimization of groundwater use. • Crop diversification and improvement of water use efficiency. • Strategies for mitigation of natural calamities, global warming and its effect on crop production system; modelling weather variability for crop planning. **Long term** • Conjunctive use of harvested rain water with groundwater through Micro Irrigation Systems. Participatory irrigation management. • Development of strategies for groundwater recharging in the coastal and semi-arid watersheds, standardization of methodology of extraction of groundwater. • Evaluation of performance features of canal irrigation system, and developing strategies for performance improvement to synchronize canal water supplies with crop water demand.
24	Management of coastal sodic and saline area programme	**Short term** • Reclamation of waterlogged and coastal saline lands with physical as well as biological drainage measures • Multiple use of village ponds/talavadi etc. through integration of pisciculture, duckery and cultivation of aquatic crops viz., makhana (Euryale ferox), water chestnut (Trapa bispinosa) and swamp taro (Colocasia esculenta).
25	Development of post-harvest technology for cereals, oilseeds and pulses.	**Short term** • Development of post-harvest practices / equipment for cereals, pulses and oilseeds. • Development of technology for groundnut– cereal-millets based extruded food products. • Isolation of protein from defatted groundnut cake. **Long term** • Application of bio-technology in food processing. • Technology and equipment suitable at rural level for processing. • Technology for utilization of by-products.
Fisheries		
26	Enhancement of fish production and productivity.	**Short term** • Development of indigenous feeds/ rations and feed additives for cultured fishes.

	Maintaining the sustainability of aquatic system and developing new value added products.	• Developing technology for brackish water fish. • Developing new products from trash fish. • Research on prevention and control of disease and parasites of fishes. • In vitro technology for the production of prawn seed. **Long term** • Genetic improvement of cultivable fish with respect to growth and disease resistance. • Novel seafood and marine product development. • Improvement in processing and packing of traditional cured fish products. • Research on marine proteins and marine oils. • Designing fish gears and their impact assessment. • Fish population genetics.
Veterinary Science & Animal Husbandry		
27	Livestock improvement	**Short term** • Development of low-cost methods for storage and value addition in crop residues. • Identification and nutrition enhancement of unconventional feed resources. • Clean milk production under Indian conditions. • Conservation and improvement of animal genetic resources viz., Gir cattle, Jaffrabadi buffalos, Kathiawadi horse and Zalawadi and Gohilwadi breeds of goats. • Experiments on nutritional manipulations for increasing bio-active peptides and omega-3 fatty acids of milk. **Long term** • Generation of animal behavioural information for sustaining with environment/climate change and its effects on various performance traits. • Identification and characterization of animals for registration /patents.
28	Animal biotechnology research	**Short term** • Research for increasing yield and minimizing production risks through application of available biotechnologies viz., cryo-preservation of sperm and ova, embryo-transfer technology. **Long term** • Facilities for gene-mapping and genetic manipulation for improving the quality and quantitative traits. • Research for improving efficiency of rumen microbes. • Initiation of research in immunogenetics.
29	Regional Animal Disease Diagnostic	**Short term** • Clinical diagnosis of diseases of livestock and wild animals. • Use of ITK in prevention and control of diseases and parasites.

Social Science		
30	Research on sustainable indigenous technological knowledge (ITK) of agriculture & allied fields.	**Short term** • Documentation and testing of ITK in Agriculture. • Selection of reliable ITKs. **Long term** • Standardization of ITKs for forecasting of monsoon.
31	Export potential for major horticultural commodities from Gujarat	**Short term** • Examine the growth and stability in area, production and yield of fruit crops in Gujarat state. • Workout the export competitiveness of fruits.
32	Cost of cultivation/ production of major horticultural crops	**Short term** • Work-out the cost of cultivation, production, returns, input-output ratios and payback period for important horticultural crops.
33	Economic evaluation of irrigation project	**Short term** • Cropping pattern of command area, estimation of profitability of different crops and economic feasibility of the project.
34	Improvement in the efficiency of field experiments	**Short term** • Study the distribution of variability in field experiments on groundnut, sesame, cotton, bajra, etc. • Develop statistical methods/ approaches to minimize error.

Short Term: 5 Years
Long Term: 10 Years

CHAPTER - V
PROGRESS OF RESEARCH

Junagadh Agricultural University in its endeavor to achieve excellence in mission of developing trained man power, evolve high yielding cost effective and eco-friendly technologies and disseminate the knowledge and technologies for bringing prosperity in rural areas laid emphasis on qualitative and quantitative improvement in education, research, extension and vocational education through various new initiatives *viz.,* man power planning & management, signing of MoUs with national & international universities/institutes/corporate, agriculture human resource development, up-gradation of educational standards, initiation of new post-graduate programmes, establishment of IT network, imparting interactive audio-video based training, re-orientation of research priorities and programmes, strengthening of research in bio-technology, meteorology, organic farming, integrated pests & diseases management, environment moderation, water conservation & management and post-harvest management. A detailed account for steps taken to improve each activity and their outcomes/results are described here under.

The research agenda for XII Five Year Plan was drawn in consonance with national priorities laid down by Government of India and perspective plans of Departments of Agriculture, Horticulture, Forestry, Animal Husbandry and Fisheries of Government of Gujarat and mainly focused on the genetic improvement of crops/animal and their production & management technologies in order to meet the growing demand of human and animal population in respect of food, fodder, fiber and fuel.

Considering that Gujarat is primarily a rainfed state with only 35 per cent area under irrigation and is going to remain so even after commissioning of Narmada project, the rainfed agriculture was accorded second highest importance in the order of priority and therefore the research on in-situ moisture conservation, rain water harvesting, aquifer recharging, efficient use of water and environmental moderation was initiated so as to insulate the arid and semi-arid farming systems against the risk of failures caused by aberrant weather i.e. late onset or early withdrawal of monsoon, mid-season prolonged droughts and low rainfall.

High incidence of pests and diseases owing to the fact that it is a coastal state poses a great loss to farming occupation. It raises the cost of cultivation and cause economic damage to farmer's profit. Environmental pollution is a serious hazard caused by the high use of pesticides and fungicides. Keeping these in view, work on alternative pest management technologies viz., biological, agronomical and physical was strengthened and those found good were integrated and fine-tuned through large scale adaptive trials/demonstrations to suit diversified agro-climatic socio-economic conditions.

To deal with the issue of sustainability, which has of late invited wider attention, a project on organic farming was sanctioned at all the four universities of Gujarat (including Junagadh Agricultural University). The objectives envisaged are: development of enriched FYM, evolving integrated nutrient management packages with emphasis on use of organics, quality improvement in agricultural produce, improvement in soil health and productivity *etc.*

Besides here, the research agenda included, fertilizer, use of plastic in agriculture, green house technology, food testing facility, water & energy saving technology/devices, diversification to high value crop, micro propagation, value addition through shelf life elongation, quality improvement, grading, embryo transfer technology, feed testing laboratory, medicinal and aromatic plants.

In order to keep pace with the western world in future technologies, basic infrastructure facilities for research in genetic engineering, microbiology and medium term weather forecasting were proposed to be developed.

5.1. Accomplishments

The research undertaken during last two years by different research stations of Junagadh Agricultural University has enabled to develop and release several yield enhancing cost saving, environmentally safe and scale neutral technologies for farmers' adoption. The major achievements made in different areas are described herein.

5.2. New technologies

Table 5.1: New varieties/Recommendations developed in the different disciplines

Sr. No	Sub-committee	No. of Recommendations finalized for farmers		Total
		2014-15	2015-16	
1	Crop Improvement	08*	03*	11*
2	Crop Production	13	10	23
3	Plant Protection	16	03	19
4	Horticulture & Agro-forestry	04	02	06
5	Agricultural Engineering	05	04	09
6	Fisheries Science	03	02	05
7	Basic Science	04	03	07
	Total	**8*+45**	**3*+24**	**11*+69**

* Varieties released.

I. Crop Improvement

The following eleven new varieties were recommended for the farmers.

Year 2014-15

Gram: Gujarat Junagadh Gram 6 (GJG 6)

This variety has produced (1867 kg/ha) 13.6, 21.9 and 5.2 per cent higher seed yield over check varieties Gujarat Gram 1 (1643 kg/ha), Gujarat Gram 2 (1531 kg/ha) and Gujarat Junagadh Gram 3 (1775 kg/ha), respectively. Seeds of this variety are of medium size and dark brown in colour with 19.9 per cent protein. This variety is resistant to wilt (8.7 % in wilt sick plot) and stunt (5.0 %) diseases. It is recommended for release in Gujarat under rainfed condition.

Pigeon pea: Gujarat Junagadh Pigeon pea 1 (GJP 1)

This variety has produced (2115, 2045 & 1987 kg/ha) 38.8, 10.1 and 27.6 per cent higher seed yield over check varieties, BDN 2 (1524 kg/ha), ICPL 87119 (1858 kg/ha) and Vaishali (1557 kg/ha), respectively. This variety is medium late (176 days) in maturity. Gujarat Junagadh Pigeon pea 1 (GJP 1) is also found moderately resistant to wilt (13.89 %) and SMD (13.89 %) disease. The seeds of this variety are bold in size with white colour. This variety is recommended for Gujarat state.

Sesame: Gujarat Junagadh Til 5 (GJ Til 5)

This variety recorded the seed yield of 1241 kg/ha which was 22.4 per cent higher than the check variety Gujarat Til 3 (1014 kg/ha). Oil yield of

proposed variety was 22.2 per cent higher than Gujarat Til 3. Proposed variety matured in 91 days and contains 46.98 per cent oil in its seeds, which are white in colour and bolder in size. This variety was approved by the house for cultivation in summer season.

Brinjal: Gujarat Junagadh Long Brinjal 4 (GJLB 4)

This variety had recorded a mean fruit yield of 396 q/ha which was 30.8 and 25.8 per cent higher over check varieties GOB 1 (302.7q/ha) and GBL 1 (314.7 q/ha), respectively. The little leaf disease (5.08 %) was less as compared to check variety GOB 1 (6.15%). Jassid (3.04/leaf), whitefly (4.70/leaf) and fruit borer (11.05 %) were less as compared to check variety GOB 1. The protein (1.51 %) and total soluble sugar (3.36 %) were also more than check varieties. The fruits of GJB 4 are medium in size with long shape and light purple colour with good shining. It is recommended for release in Gujarat state.

Brinjal: Gujarat Junagadh Brinjal Hybrid 4 (GJBH 4)

This hybrid gave a mean fruit yield of 428 q/ha which was 14.1 and 25.7 per cent higher over hybrid checks GBH 2 (375.08 q/ha) and ABH 1 (340.57 q/ha), respectively. It has also recorded 6.6 and 7.7 per cent higher fruit yield than the private hybrids Navina (VNR Seeds) and ARBH 201 (Ankur Seeds), respectively. The little leaf disease (4.42%) was less as compared to check variety GBH 2 (4.98%). The damage due to jassid (2.84/leaf), white fly (3.93/leaf) and fruit borer (4.93 %) were less as compared to hybrid checks. The protein (1.48 %) and total soluble sugar (3.33 %) were more as compared to hybrid checks. The fruits of this hybrid are medium in size with oblong shape and pink purple colour with good shine. It is recommended for release in Saurashtra and Middle Gujarat.

Sponge gourd: Gujarat Junagadh Sponge Gourd 2 (GJSG 2)

This variety had recorded a mean fruit yield of 114.04 q/ha, which was 18 and 19.2 per cent higher than state check variety GSG 1 (96.60 q/ha) and National check variety Pusa Chikni (95.69 q/ha). Further, mosaic (18.25 %), downy mildew score (2.35), fruit fly damage (12.86 %) and leaf miner larvae (5.61/leaf) were less as compared to check varieties. The pulp/skin ratio (12.393), total soluble solids (6.25 %), total soluble sugar (1.67 %), protein (0.218 %) and chlorophyll total (1.53 mg/g) were more as compared to check varieties. The fruits of GJSG 2 are long in size, green colour with good shine. It is recommended for release in Gujarat.

Okra: Gujarat Junagadh Okra Hybrid 4 (GJOH 4)

This hybrid recorded a mean fruit yield of 135.94 q/ha, which was 46.9 per cent higher over check variety Pusa Sawani (92.50 q/ha) while with hybrid check the GJOH 4 recorded 145.74 q/ha fruit yield which was 23.9 per cent higher than GJOH 3 (117.67q/ha). It also yielded 17.1, 28 and 30.7 per cent higher yield over one private check HOK 152 and two public sector checks Arka Anamika and Pusa Sawani, respectively. The yellow vain mosaic (36.71%) was found less as compared to check variety Gujarat Okra Hybrid 2 (46.15 %). The jassid (5.26), thrips (4.79), white fly (4.76) and fruit borer (4.66 %) damage were less than check varieties. The pods of this hybrid are medium dark green, tender, long and attractive. It is recommended for release in Gujarat.

Onion: Gujarat Junagadh Red Onion 11 (GJRO 11)

This variety had recorded a mean bulb yield of 323.55 q/ha which was 21.6, 18.7 and 15.4 per cent higher over check varieties AGFL-Red (266.15 q/ha), Pilli Patti (272.55 q/ha) and Talaja-Red (280.34 q/ha), respectively. The purple bloch (12.67 %) was less as compared to check varieties AGFL-Red (20.30 %), Pilli Patti (23.56 %) and Talaja-Red (24.28 %). Population of thrips (5.7/leaf) was found less as compared to check varieties. It was found less pungent (Pyruvic acid: 1.22 %) as compared to check varieties AGFL-Red and Talaja-Red. In this variety, 12.94 per cent total soluble solids were recorded. The bulbs of GJRO 11 are medium in size with flat globe shape and red in colour.

Year 2015-16

Wheat: Gujarat Junagadh Wheat 463 (GJW 463)

The wheat variety Gujarat Junagadh Wheat 463 has recorded 5575 kg/ha grain yield under early sown condition which was 28.1, 30.0, 21.7 and 12.9 per cent higher over check varieties GW 496 (3338 kg/ha), LOK 1 (4287 kg/ha), GW 366 (4565 kg/ha) and GW 190 (4938 kg/ha), respectively. Whereas, the proposed variety has recorded 5091 kg/ha grain yield under timely sown condition which was 13.4, 6.9, 1.1 and 6.2 per cent higher grain yield over check varieties GW 496 (4479 kg/ha), LOK 1 (4763 kg/ha), GW 322 (5037 kg/ha) and GW 366 (4792 kg/ha), respectively. It possesses amber seed like GW 496. This variety is tolerant against rust disease. The Gujarat Junagadh Wheat 463 variety was approved for wheat growing area of the state.

Onion: Gujarat Junagadh White Onion 3 (GJWO 3)

The white onion variety recorded bulb yield of 398.06 q/ha, which was 20.8, 11.3 and 7.8 per cent higher over check varieties, PWF-131 (329.54 q/ha), GWO-1 (357.75 q/ha) and qualifying variety GAWO-2 (369.26 q/ha), respectively. The proposed variety bulbs contain higher total soluble solid (13.15%) as compared to check varieties *viz.,* PWF-131 (12.80%), GWO-1 (12.88%) and GAWO-2 (12.18%). Bolting per cent and jointed bulb per cent were less as compared to check varieties and the bulbs of this variety were medium in size with flat globe shape and white in colour preferred by industry. The variety was approved for whole Gujarat.

Onion: Gujarat Junagadh Red Onion 11 (GJRO 11)

The variety recorded bulb yield of 336.29 q/ha, which was 16.0, 27.3 and 21.3 per cent higher over check varieties, AGFL Red (289.9 q/ha), Pilli Patti (264.2 q/ha) and Talaja Red (277.3 q/ha), respectively. This variety was found less pungent (pyruvic acid, 1.22 µM/g) as compared to check varieties AGFL-Red and Talaja-Red and the bulbs of this variety were medium in size with flat globe shape and red in colour. The proposed variety was found good as compared to check varieties against diseases and insect-pest reactions. The proposal was approved by the house for South Gujarat too.

Recommendations for the farmers

II. Crop Production

Nutrient Management

Year 2014-15

Studies on the effect of water soluble foliar grade fertilizers on the growth and yield of summer groundnut

The farmers of South Saurashtra Agro-climatic Zone growing summer groundnut are recommended to fertilize the crop with FYM 7.5 t/ha + 60 % RDF (i.e. 15-30 kg N-P_2O_5/ha) for obtaining higher yield and net realization.

Effect of bio-phos on the performance of castor

The farmers of South Saurashtra Agro-climatic Zone growing irrigated castor are recommended to apply 40 kg P_2O_5/ha and treat the seeds with phosphate solubilizing microorganism *(Chaetomium globosum)* @ 30 g/50 g seed along with recommended dose of nitrogen (120 kg/ha) for obtaining higher seed yield and net return.

Nutrient management in groundnut-Bt. cotton intercropping system

The farmers of South Saurashtra Agro-climatic Zone adopting groundnut-Bt. cotton inter-cropping system (in 3:1 ratio) are recommended to apply 50 per cent RDF (i.e. 6.25-12.5-0 kg N-P_2O_5-K_2O/ha) to the groundnut crop and 100 per cent recommended dose of fertilizer (i.e. 160 kg N/ha) to the cotton crop for obtaining higher yield and net realization.

Effect of integrated nutrient management on yield, quality and nutrient uptake by garlic under salt affected soil

The farmers of South Saurashtra Agro-climatic Zone growing garlic in salt affected soil are recommended to apply 50 % RDF (i.e. 25:25:25 kg N:P_2O_5:K_2O/ha) along with FYM @ 10 t/ha for obtaining higher bulb yield and net return.

Year 2015-16

Effect of potassium fertilizer on castor hybrid

The farmers of South Saurashtra Agro-climatic Zone growing irrigated castor are recommended to apply potash @ 50 kg K_2O/ha (25 kg/ha as basal and 25 kg/ha at 45 days after sowing) along with recommended dose of nitrogen and phosphorus (120-50 N-P_2O_5 kg/ha) for obtaining higher seed yield and net return.

Nutrient management in Bt cotton under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone (AES-10) growing Bt cotton are recommended to apply 20 kg P_2O_5, 40 kg K_2O and 20 kg sulphur (150 kg gypsum/ha) along with recommended dose of nitrogen (80 kg N/ha) for obtaining higher yield and net return as well as maintaining soil fertility under rainfed condition.

Effect of potassium and sulphur on growth and yield of wheat crop

The farmers of South Saurashtra Agro-climatic Zone growing wheat are recommended to apply 60 kg

potash and 40 kg sulphur (through gypsum) per hectare as basal in addition to recommended dose of N and P (120-60 N-P_2O_5 kg/ha) to wheat crop for getting higher yield and net return.

Effect of multi-micronutrient formulations on okra

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* okra in medium black calcareous soil are recommended to apply micronutrients as per soil test value as basal in addition to recommended dose of fertilizers (150-50-50 N-P_2O_5-K_2O kg/ha) to okra for getting higher yield and net return.

Efficacy of multi-micronutrient formulations in improving crop production in Bt cotton

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton in medium black calcareous soil are recommended to apply micronutrients as per soil test value as basal in addition to recommended dose of fertilizers (240-50-150 N-P_2O_5-K_2O kg/ha) to Bt cotton for getting higher yield and net return.

Alternatively, foliar spraying of multi-micronutrient formulation Grade IV (Fe-Mn-Zn-Cu-B, 4.0-1.0-6.0-0.5-0.5 %) @ 1% at 45, 60, 75 and 90 DAS in addition to recommended dose of fertilizers (240-50-150 N-P_2O_5-K_2O kg/ha) is recommended to Bt cotton for getting higher yield and net return.

Package of Practices

Year 2014-15

Evaluation of preparatory and secondary tillage practices in rainfed groundnut

The farmers of South Saurashtra Agro-climatic Zone growing rainfed groundnut are recommended to adopt in-row subsoiling (20 cm depth) before sowing, interculturing at 15, 30, 45 and 60 days after sowing (DAS) and apply pendimethalin@ 900 g/ha (30 EC 60 ml/10 lit) as pre-emergence with hand weeding at 30 and 45 DAS for achieving higher yield and net realization as well as effective moisture conservation and weed management.

Studies of possibilities of organic farming in pearl millet–gram crop sequence

The farmers of North Saurashtra Agro-climatic Zone adopting pearl millet-gram crop sequence and interested in organic farming are recommended to apply FYM 7.5 t/ha every year to pearl millet only for securing higher net realization and to maintain soil fertility.

Optimization of nutrients for pearl millet production in kharif season

The farmers of North Saurashtra Agro-climatic Zone growing hybrid pearl millet during *kharif* season are recommended to apply 100 kg N and 30 kg P_2O_5/ha for obtaining higher yield and net return.

Nutrient management through organic and inorganic sources for major and trace elements in rainfed pearl millet

The farmers of North Saurashtra Agro-climatic Zone growing hybrid pearl millet during *kharif* season are recommended to apply $ZnSO_4$ and $FeSO_4$ @ 20 kg/ha each, along with recommended dose of fertilizers (80-40-0 kg N-P_2O_5-K_2O/ha) and FYM 5 t/ha for obtaining higher yield and net return as well as for improving grain quality.

Year 2015-16

Effect of sowing time and spacing on summer cluster bean

The farmers of South Saurashtra Agro-climatic Zone growing summer cluster bean are recommended to sow the crop in second week of February at 45 cm x 15 cm spacing for obtaining higher yield and net realization.

Evaluation of potentiality of organic farming for groundnut (*kharif*) - chickpea (*rabi*) cropping sequence

The farmers of South Saurashtra Agro-climatic Zone adopting groundnut (*kharif*) - chickpea (*rabi*) cropping sequence under organic farming are recommended to apply FYM (1.25 t/ha) + castor cake (139 kg/ha) to groundnut and vermin-compost (667 kg/ha) + castor cake (222 kg/ha) to chickpea in furrow before sowing for securing higher net realization and maintaining soil fertility.

Development of organic farming packages for system based high value crops (Groundnut-Onion)

The farmers of South Saurashtra Agro-climatic Zone adopting Groundnut (*kharif*) - Onion (*rabi*) cropping sequence are recommended to apply 50% RDF (6.25-25 N-P_2O_5 kg/ha) for groundnut and 37.5-60-50 N-P_2O_5-K_2O kg/ha for onion + 50% RDN as FYM to groundnut (1250 kg/ha) and onion (7500 kg/ha) for securing higher groundnut equivalent yield and net realization along with maintenance of soil fertility.

Farmers interested in adopting Groundnut (*kharif*) - Onion (*rabi*) cropping sequence under organic farming are recommended to follow nutrient management system as 50% RDN as FYM (1250 and 7500 kg FYM/ha for groundnut (*kharif*) and onion (*rabi*), respectively) + biofertilizer (*Rhizobium* / *Azotobacter* @ 1250 ml/ha) for N + rock phosphate to meet P requirement of crops (100 kg/ha in groundnut and 600 kg/ha in onion) + PSB (1250 ml/ha) for higher groundnut equivalent yield and net income along with maintenance of soil fertility.

Identification of suitable row ratio for sesame with pigeon pea and soybean intercropping system

The farmers of North Saurashtra Agro-climatic Zone growing sesame with intercropping system in *kharif* are recommended to sow pigeon pea as an intercrop with sesame in the row ratio of 2:1 with 60 cm distance between two rows to get higher yield and net return.

Weed management

Year 2014-15

Weed management in cumin

The farmers of South Saurashtra Agro-climatic Zone growing cumin are recommended to apply oxadiargyl 75 g/ha (6 EC 25 ml/10 lit) as early post-emergence application at 7 DAS followed by hand weeding at 45 DAS for achieving higher yield and net realization as well as effective weed management.

Evaluation of pre and post emergence herbicides for irrigated Bt. cotton

The farmers of South Saurashtra Agro-climatic Zone growing Bt. cotton are recommended to apply pendimethalin 900 g/ha (30 EC 60 ml/10 lit) as pre-emergence followed by hand weeding and interculturing at 30 and 60 days after sowing (DAS) or pendimethalin 900 g/ha (30 EC 60 ml/10 lit) as pre-emergence followed by quizalofop 40 g/ha (5 EC 16 ml/10 lit) at 45 DAS for achieving higher yield and net realization as well as effective weed management.

Weed management in *kharif* urdbean

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* urdbean are recommended to apply quizalofop-ethyl 40 g/ha (5 EC 16 ml/10 lit water) at 20 days after sowing (DAS) and hand weeding at 40 DAS for obtaining higher yield and net realization as well as effective weed management.

Year 2015-16

Integrated weed management in summer sweet corn

The farmers of South Saurashtra Agro-climatic Zone growing sweet corn in summer season are

recommended to apply atrazine 500 g/ha (50% WP 20 g/10 l) as pre-emergence followed by one interculturing and hand weeding at 40 DAS for effective weed management along with higher yield and net realization.

Water Management

Year 2014-15

Effect of crop geometry and irrigation levels on sugarcane

The farmers of South Saurashtra Agro-climatic Zone growing sugarcane are recommended to adopt drip method of irrigation and plant the crop in paired rows (60-90-60 cm) and irrigate the crop at 0.9 PEF with laying laterals in each paired rows for securing higher cane yield and net return. Nitrogen and potassium should be applied at 80 per cent of recommended dose (i.e. 200-100 N-K_2O kg/ha) under drip irrigation in 10 equal splits starting from 45 DAP at an interval of 20 days.

Drip system details:

Details	Operating time-Alternate days	
	Month	Minutes
Dripper spacing: 60 cm	March-May	2 hr. 20 min
Dripper discharge: 4 lph	June	2 hr. 10 min
Operating pressure: 1.2 kg/cm^2	July-September	1 hr. 30 min
Operating frequency: Alternate days	October-November December-January	1 hr. 40 min 1 hr. 25 min

Soil management

Year 2014-15

Effect of soil amendments on different genotypes of castor under salt affected soil

The farmers of South Saurashtra Agro-climatic Zone growing castor with saline irrigation water are recommended to select variety GC 3 and apply FYM @ 10 t/ha and gypsum 50% GR (3 t/ha) along with recommended dose of fertilizers.

III. PLANT PROTECTION

Agricultural Entomology

Year 2014-15

Management of sucking pests through insecticides in brinjal

For effective and economical control of brinjal whitefly, three sprays of chlorantraniliprole 18.5 SC, 0.002 %, 1.08 ml/10 litre water at 15 days interval starting from the pest infestation are recommended under South Saurashtra Agro climatic Zone. The PHI for chlorantraniliprole 18.5 SC, 0.002 % is one day.

Storage potential of bio-agent under refrigerator conditions

Farmers are advised to store the field collected ladybird beetles (*Coccinella septempunctata* (L.)) in jar containing folded papers under domestic refrigerator conditions (6.0 to 7.5 ^{0}C) up to 120 days with the survival rate of 84 per cent without hampering their longevity and fecundity. These stored predatory beetles can be released in field crops for biological control of insect pests.

Storability of HaNPV and SNPV under refrigerator condition

Farmers are advised for biological control of *Helicoverpa armigera* and *Spodoptera litura* through Nuclear Polyhedrosis Virus (NPV) to store the field collected NPV infected larvae under domestic refrigerator conditions (6.0 to 7.5 ^{0}C). These NPV infected larvae can be stored up to 8 months of storage period with 100 per cent virulence, which can be utilized for the biological management of respective pest.

Studies on effect of drip v/s flood irrigation on the incidence of important mango pests

Mango growers of South Saurashtra Agro-climatic Zone are informed that the lower incidence of gall midge, hopper and thrips is found in drip irrigated orchard as compared to flood irrigated orchard.

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

Farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet are advised to treat the seeds with imidacloprid 600 FS, 8.75 ml/kg seeds, 4.20 g a.i./kg seeds at the time of sowing followed by spray with imidacloprid 17.8 SL, 0.009 % (5.0 ml/10 liter water, 45.39 g a.i./ha) at 35 days after germination of the crop for effective management of shoot fly and stem borer. The PHI for these insecticides is 42 days.

Storage study of wheat harvested by combine harvester

The farmers storing wheat are advised that wheat harvested by combine harvester (up to 6 % mechanically damaged grain) to be stored with the treatment of castor oil (15 ml/1.0 kg grain) and can be kept in GI bin container to keep safe against lesser grain borer up to eight months of storage as it reduces pest population, grain damage, weight loss as compared to untreated wheat kept in jute bags.

Testing bio-efficacy of certain insecticides against pod borer complex on urdbean

Farmers of South Saurashtra Agro-climatic zone are advised to apply two sprays of chlorantraniliprole 18.5 SC, 0.006 % (3 ml/ 10 litre water) or flubendiamide 48 SC, 0.0096 % (2 ml/ 10 litre water), first spray at 50 per cent flowering and second at 15 days interval for the control of pod borer complex in urdbean.

The PHI for chlorantraniliprole 18.5 SC is 20 days, whereas 11 days for flubendiamide 48 SC.

Plant Pathology

Year 2014-15

Assessment of *Trichoderma* population in the field under groundnut cultivation

Farmers of North and South Saurashtra Agro-climatic Zone are advised to apply *Trichoderma* every year for the management of stem/pod rot disease in groundnut.

Standardization of method and time of application of bio-control agents for management of stem and pod rot of groundnut caused by *Sclerotium rolfsii*

Farmers of South Saurashtra Agro-climatic Zone are advised furrow application of *Trichoderma harzianum* 2 x 10^{6} cfug^{-1} @1.25 kg in 125 kg of castor cake/ha at the time of sowing as well as its

broadcasting at plant base with same dose at one month after sowing for effective and economic control of stem and pod rot (*Sclerotium rolfsii*) of groundnut.

Compatibility of *Trichoderma* with different seed dressing agrochemicals used for the management of diseases and pest in groundnut

Farmers of South Saurashtra Agro-climatic Zone are advised that the agrochemicals used for seed treatment in groundnut *viz.,* carbendazim 12 % + mancozeb 63 % - 75 WP @ 3.0 g/kg seed or mancozeb 75 WP @ 4.0 g/kg seed or carboxin 37.5 % + thirum 37.5 % - 75 WP @ 3.0 g/kg seed or tebuconazole 2 DS @ 2.0 g/kg seed or imidacloprid 600 FS @ 3.0 ml/kg seed against seed and soil borne diseases/sucking pests do not reduce the soil population of *Trichoderma*, hence they are compatible with *Trichoderma harzianum*.

Effect of spawn rates on sporophore production of Oyster mushroom (*Pleurotus sajor-caju*)

Mushroom growers are advised to use 3.0 per cent spawn rate in polyethylene bags (18 × 24 inch) of oyster mushroom (*Pleurotus sajor-caju*) to get the optimum sporophore production with higher biological efficiency.

Effect of substrate rates on sporophore production of Oyster mushroom (*Pleurotus sajor-caju*)

Mushroom growers are advised to use 3 kg wheat straw substrate with 3 per cent spawn rate in polyethylene bags (18 × 24 inch) for the optimum sporophore production with higher biological efficiency of oyster mushroom (*Pleurotus sajor-caju*).

Management of cumin wilt (*Fusarium oxysporum f. sp. cumini*)

Farmers of South Saurashtra Agro-climatic Zone are advised to broadcast *Trichoderma harzianum* 2 x 10^6 $cfug^{-1}$ @ 5.0 kg mixed in 1000 kg of FYM/ha at the time of sowing for effective and economical control of cumin wilt.

Efficacy of different bio-control agents against cumin wilt caused by *Fusarium oxysporum f. sp. cumini*

Farmers of South Saurashtra Agro-climatic Zone are advised to broadcast mixture of *Trichoderma viride* @ 1.70 kg + *T. harzianum* @ 1.70 kg + *Pseudomonas fluorescens* @ 1.70 kg (2 x 10^7 $cfug^{-1}$) or *T. viride* @ 2.50 kg + *P. fluorescens* @ 2.50 kg (2 x 10^7 $cfug^{-1}$) mixed in 500 kg of castor cake/ha at the time of sowing for effective and economical control of cumin wilt.

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

Farmers of South Saurashtra Agro-climatic Zone are advised to apply *Trichoderma harzianum* (2 x 10^7 $cfug^{-1}$) @ 5 kg in 500 kg of castor cake/ha at the time of sowing as well as its broad-casting @ 5 kg/ha Trichoderma in 100 kg sand at one month after germination of crop for effective and economical control of cumin wilt.

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

Farmers of South Saurashtra Agro-climatic Zone are advised that the application of herbicides oxadiargyl 6 EC, 0.075 kg a.i./ha, 25 ml/10 litre at 7 days after sowing in cumin do not reduce the soil population of *Trichoderma harzianum*.

Year 2015-16

Management of alternaria leaf blight of groundnut

The farmers of South Saurashtra growing summer groundnut are advised to apply three sprays of mancozeb 75 WP 0.2% (27 g/10 liter of water) at 35, 50 and 65 days after sowing for effective and economical management of alternaria leaf blight of groundnut.

Refining integrated disease management in groundnut

The farmers of South Saurashtra growing *kharif* groundnut are advised to apply seed treatment with tebuconazole 25 WG @1.5 g/kg seed or seed treatment with *Trichoderma viride* 1% WP 10 g/kg seed, furrow application of T. viride at the time of sowing and broadcasting at 40 DAS @ 4 kg enriched in 50 kg FYM and two sprays of tebuconazole 25.9 SC @10 ml/ 10 l at 15 days interval from initiation of foliar disease for effective and economical management of collor rot, stem rot, tikka and rust disease.

Efficacy of seed dressing chemicals against wilt and root rot complex of cotton

The farmers of South Saurashtra are advised to treat the cotton seeds with a ready mixture of carboxin 37.5% + thiram 37.5% DS @ 3.5 g/kg seeds before sowing for economical and effective control of wilt and root rot complex and to improve seed cotton yield.

IV. HORTICULTURE & AGRO-FORESTRY

Year 2014-15

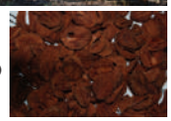
Effect of different sources of nitrogen with graded levels of inorganic fertilizer on papaya cv. Madhubindu


Farmers of South Saurashtra Agro-climatic Zone growing papaya (Madhubindu) crop are advised to apply 25 per cent N from FYM (6 kg FYM) and remaining 75 per cent N (150 g), 200 g P and 250 g K per plant from chemical fertilizers during 2nd, 3rd and 4th month after transplanting in equal splits for getting higher yield and net return.

Effect of micro nutrients on growth, yield and quality of papaya cv. Madhubindu


Farmers of South Saurashtra Agro-climatic Zone are advised to spray micronutrients *viz.,* zinc sulfate 24.0 g (Zn 0.5 %) and Borax 10.0 g (B 0.1 %) per liter of water during 2nd and 4th month after transplanting for getting higher yield and net return in papaya cv. Madhubindu.

Dehydration of sapota slices



Fruit processors are advised to dry the sapota slices of 0.5 cm thickness in solar dryer up to 33 per cent recovery to maintain quality in storage up to six months at room temperature.

Effect of soil amendment with organic materials on yield and quality of tomato (cv. Junagadh Tomato-3) under sodic soil & brackish water condition


The farmers of South Saurashtra Agro-climatic Zone growing *rabi* tomato (JT-3) under sodic soil (EC 1.48 dS/m, pH 7.81, ESP 21.84 %) and brackish water (EC 4.34 to 4.88 dS/m) condition are advised to apply FYM 5 t/ha + 50 per cent R.D.F. (37.5+18.75+ 31.25NPK kg/ha) + poultry manure (3700 kg/ha) for securing higher yield and net return.

Year 2015-16

Effects of chemical fertilizers and vermicompost on yield and quality of banana (*Musa paradisiaca* L.) cv. Grand Naine

Farmers of South Saurashtra Agro-climate Zone cultivating banana cv. Grand Naine are advised to apply total 300 g nitrogen and 4 kg vermicompost per plant in four equal split at 2nd, 3rd, 4th and 5th month after planting; along with recommended dose of phosphorus 90 g and 200 g potash per plant at 3rd month after transplanting, while 5 kg FYM as basal dose at transplanting for getting good quality, higher yield and higher return.

Feasibility of organic farming in coconut (*Cocos nucifera*) under saline water irrigation condition

The farmers of South Saurashtra Agro-climatic Zone interested organic cultivation of coconut cv. West Coast Tall (WCT) are advised to apply FYM @ 60 kg per tree under saline irrigation (EC 10-14 dSm^{-1}) condition for obtaining higher return and improving soil fertility.

V. AGRICULTURAL ENGINEERING

Year: 2014-15

Impact of irrigation regimes and mulching on the economic productivity of drip irrigated cotton

Farmers of South Saurashtra Agro-climatic Zone growing Bt. Cotton are advised to adopt drip irrigation (with 1.2 m lateral spacing, 40 cm dripper spacing and emitter discharge of 2 lph) in raised bed covered with silver black plastic mulch of 20 micron and irrigate every alternate day at 0.8 ET_c level (or to operate system for 2 to 3.5 hrs., 2.25 to 3.25 hrs. and 1.25 to 3 hrs. during September-October, November-December and January, respectively) for acquiring higher yield (33 %) and water use efficiency (79 %), higher water productivity (91%) and higher net return over no mulch.

Extraction of Pectin from Kesar Mango Peel by Resins

Mango processors are recommended to adopt a process technology developed by Junagadh Agricultural University for the production/extraction of pectin from mango peel using cation exchange resin as an extracting medium with peel to extracting medium ratio of 1:4, extraction pH of 2.56, extraction temperature of 80 °C, extraction time of 60 min and two extractions. This method can give better yield and quality of pectin with benefit cost ratio (BCR) of 1.17.

Development and performance evaluation of low cost greenhouse fertigation irrigation system

The greenhouse / net house growers are advised to use low cost greenhouse fertigation system developed by Junagadh Agricultural University to apply fertilizer through drip irrigation as well as interested manufacturers are recommended for manufacturing this system.

Studies on micro climate and plant growth of capsicum under different type of shade net

The farmers of South Saurashtra Agro-climatic Zone are recommended to adopt white coloured 50 per cent shade net house for cultivation of capsicum. This type of net house results in early production approximately 10-12 days, protection from insects/pests, diseases and higher yield of capsicum as compared to use of green, black and blue coloured shade net house.

Effect of mulch and irrigation level by drip on water use efficiency and yield of watermelon

The farmers of South Saurashtra Agro-climatic Zone are advised to use silver black plastic mulch (20 µm) with drip irrigation at 0.6 ETc level to achieve higher crop production of watermelon in summer season.

Details of mulching technology :		Details of irrigation system :	
1	Mulch film: 20 µm silver black plastic	1	Lateral spacing : 180 cm
2	Bed size: (a) Top width : 40 cm (b) Bottom width : 70 cm (c) Height : 30 cm	2	Dripper spacing : 40 cm
3	No. of rows per bed : 2	3	Dripper discharge : 2 lph
4	Spacing : (a) Bed spacing : 180 cm (b) Row spacing : 20 cm (c) Plant spacing : 40 cm	4	Irrigation scheduling : Feb. : 20 to 45 min/day March: 30 to 95 min/day April : 70 to 105 min/day May : 70 to 90 min/day

Year 2015-16

Evaluation of different mulches for Sapota crop under drip irrigation

Farmers of South Saurashtra Agro-climatic Zone growing sapota (*kalippati*) are advised to adopt drip irrigation (2 drippers per plant up to 2 years and after that 4 dripper per plant, dripper discharge of 4 lph) covered with black plastic mulch of 100 micron and irrigate every alternate day at 0.6 IW/ETc (or apply water 14, 34, 48, 34, 8, 11 and 9 liters per day per plant during January-February, March-April, May, June, July-August, September-October and November-December, respectively) for acquiring higher yield and net return of sapota over no mulch.

Preparation of extruded products from flour of amaranth grain, sago and defatted groundnut

Food processors are advised to prepare quality cold extruded pasta by blending defatted groundnut flour, amaranth flour and sago flour (as a binder) in the ratio of 20, 70 and 10 % respectively followed by sun drying for 14 hours in summer months or in solar cabinet dryer for 1 hour at 55 ^{0}C. The product can be stored in transparent polyethylene (LDPE) bags of 75 micron to retain the good quality at least up to two months of storage period.

Development of power operated sapota cleaner

The farmers are recommended to use power operated sapota cleaner developed by Junagadh Agricultural University for cleaning and shining sapota surface after harvesting. This machines saves 90 per cent cost of cleaning as compared to manual cleaning. Machine capacity is 575 kg/h.

Effect of different structures on protection of cumin crop against adverse climate

The farmers of South Saurashtra Agro-climatic Zone are recommended to adopt plastic (LDPE-50 micron) low tunnel (sing tunnel size: 4 x 2 x 1 m) covered with 30 per cent shade net at both the ends for cultivation of cumin. This type of structure protects the crop from adverse climate, insects/ pests, diseases and results in better quality and higher yield of cumin. It can be used for seed production also.

VI. FISHERIES SCIENCE

Year: 2014-15

Growth, mortality and stock assessment of Soldier cat fish *Osteogeneiosus militaris* of Veraval coast

The present level of fishing of the Soldier cat fish confirmed that the stock is over exploited in Veraval. Hence, it is recommended to fishermen of Veraval not to increase the fishing efforts.

Study the effect of some natural cryoprotectants on quality of Japanese threadfin breams (*Nemipterus japonicus*) surimi during frozen storage

Surimi processors and exporters are recommended to use 1 per cent shrimp chitosan as natural cryoprotectant in Japanese threadfin bream surimi to get better gel strength and good water holding capacity instead of commercially used cryoprotectants (sugar, sorbitol, polyphosphate) up to 240 days under frozen storage at -18 °C.

Effect of salinity on survival rate of *Penaeus monodon* larvae

It is recommended to hatchery entrepreneurs to use 15 ppt salinity water for larval (zoea and mysis) rearing and 20 ppt salinity water for post-larval (PL1 to PL20) rearing of *Penaeus monodon* for higher survival.

Year 2015-16

Study of density dependent growth and survival of *Macrobrachium rosenbergii* (scampi)

Fish farmers are recommended to stock freshwater prawn *Macrobrachium rosenbergii* (Scampi) seeds @ 20,000 per hectare in grow-out ponds for obtaining better growth, survival rate and economic returns.

Aspects of biology and fishery of *Scylla serrata* and *Portunus pelagicus* in and around Sikka

Fishermen community engaged in crab fishing are advised to avoid capture of berried female crabs having orange, greenish, brownish or blackish eggs for sustainable crab resource.

VII. BASIC SCIENCE

Year: 2014-15

Effect of Brassinolide foliar spray on yield and yield attributing characters of wheat

The farmers of South Saurashtra Agro-climatic Zone growing wheat under irrigated condition are recommended to spray growth promoter Brassinolide (BS) @ 0.01 mgL^{-1} (12.5 ml Brassinolide dissolved in 5 litres water, from which 150 ml is taken and diluted to 15 litres solution) at milk dough stage to obtain higher grain yield and net return.

Response of sesame (*Sesamum indicum* L.) to growth regulators

The farmers of North Saurashtra Agro-climatic Zone growing sesame in *kharif* season are recommended for foliar spray of Indole Acetic Acid (IAA) 100 ppm (1 gram/10 liter water) at flowering stage for obtaining higher yield and net return.

Effects of foliar application of organic and inorganic substances on the yield of chickpea (GJG-3) under limited water supply

The farmers of North Saurashtra Agro-climatic Zone (AES-VI) growing chickpea (Var. GJG-3) in *rabi* season are recommended to apply two irrigation (one at flowering and second at pod development stage) along with recommended dose of fertilizer (20:40 NP kg/ha) and foliar application of KNO_3 @ 2 per cent twice at flowering and pod development stages for obtaining higher yield and maximum net return.

Effect of foliar spray of plant growth retardants on growth and yield parameters of *kharif* groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are recommended for foliar spray of cycocel (50 % SL) @ 1000 ppm (2.0 ml/lit) at 30 days after sowing (DAS) or foliar application of paclobutrazol (23 % w/w SC) @ 500 ppm (2.5 ml/lit) at 60 DAS to suppress the excess vegetative growth and to get higher pod yield and net return.

Year 2015-16

Effect of foliar spray of micro-nutrients on growth and yield parameters of summer groundnut

The farmers of South Saurashtra Agro-climatic Zone growing summer groundnut are advised to apply the foliar spray of zinc sulfate 0.5 % (2.5 Kg ha^{-1} in 500 liter water) at 35 and 70 DAS for higher vegetative growth, pod yield and net return.

Effect of plant growth regulators and detopping on yield of Bt cotton (*Gossypium hirsutum* L.) under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone growing Bt cotton in *kharif* season are advised for detopping at 75 DAS + spray of ethrel (Ethylene-39 %) 50 ppm (1.3 ml/10 liter water) at 90 DAS for obtaining higher yield and net return. This is due to higher values of tap root length, number of monopodia and number of sympodia per plant and improved quality of seed i.e. ginning percentage, increase uniformity ratio, elongicity percentage and tenacity.

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

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton under irrigated condition are recommended for detopping the cotton plant at 75 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, number of sympodia, plant spread and number of bolls.

Table 5.2: Recommendations for scientific community in different disciplines

Sr. No	Sub-committee	No. of recommendations finalized for Scientists		Total
		2014-15	2015-16	
1	Crop Production	03	05	08
2	Plant Protection	09	07	16
3	Agricultural Engineering	02	04	06
4	Animal Science	08	09	17
5	Fisheries Science	05	02	07
6	Basic Science	05	07	12
7	Social Science	-	02	02
	Total...	**32**	**36**	**68**

I. CROP PRODUCTION

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.

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.

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.

Year 2015-16

Weed management in pre-monsoon groundnut

The effective weed management along with higher yield and net return from pre-monsoon groundnut can be achieved by pre-plant incorporation of pendimethalin 38.7% CS @ 0.75 kg a.i./ha followed by interculturing and hand weeding at 40 DAS under South Saurashtra Agro-climatic Zone.

Integrated weed management in *kharif* pearl millet

The application of atrazine @ 0.4 kg/ha as post emergence at two leaf stage of weed followed by one hand weeding at 35 days after sowing for effective weed management in *kharif* pearl millet was found as effective as pre-emergence application of atrazine @ 0.5 kg/ha followed by one hand weeding at 35 days after sowing under North Saurashtra Agro-climatic Zone.

Bio-efficacy of different herbicides for broad spectrum weed management in chickpea

The application of pendimethalin 30% EC 1.0 kg a.i./ha as a pre-emergence followed by hand weeding at 25-30 days after sowing gave higher yield with effective weed management in chickpea. However, pendimethalin 38.7% CS 1.0 kg a.i./ha as a pre-emergence followed by hoeing at 30-35 days after sowing found economical under South Saurashtra Agro-climatic Zone.

Soil test based fertilizer recommendation for targeted yield of pigeon pea crop

The nutrient requirements for production of one quintal pigeon pea seed was assessed as 6.09, 1.98 and 1.78 kg; N, P_2O_5 and K_2O, respectively. The fertilizer prescription equation are as: for N (FN: 5.46 T - 0.25 SN - 0.16 FYM), P (FP_2O_5 :4.11 T - 1.34 SP - 0.15 FYM) and K (FK_2O : 11.93 T - 0.51 SK - 0.45 FYM) with FYM. Targeted yield concept could be effectively adopted to bring in site specificity in fertilizer use and achieve high yields of pigeon pea in the medium black calcareous soils of Saurashtra region of Gujarat.

Establishment of critical limit of sulphur for Bt cotton in medium black calcareous soils

The critical limit for sulphur application to Bt cotton crop grown on calcareous soils of Saurashtra, was found as 15 ppm in soil and 0.475 per cent in cotton plant at 60 DAS.

II. PLANT PROTECTION

Agricultural Entomology

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.

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.

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.

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.

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.

Year 2015-16

Field efficacy of newer insecticides against sucking pests of cumin

Spray of imidacloprid 17.8 SL 0.004% (2.24 ml/10 l water) or spinosad 45% SC 0.009% (2.0 ml/10 l water) or acetamiprid 20% SP 0.004% (2.0 g/10 l water) at the appearance of pests was found effective and economical for control of aphids and thrips in cumin.

Residue was not detected in cumin at harvest of imidacloprid 17.8 SL 0.004% or spinosad 45% SC 0.009% or acetamiprid 20% SP 0.004%.

Management of sucking pests through seed treatments in cluster bean

Seed treatment with imidacloprid 600 FS @ 10 ml/kg seed or thiamethoxam 30 FS @ 10 ml/kg seed found effective and economical for control of whitefly of cluster bean var. Pusa Navbahar.

Field efficacy of newer insecticides against inflorescence pests of mango

For effective management of inflorescence pests of mango *viz.,* hopper, thrips and flower bug, two sprays of spinosad 45 % SC 0.018% (4 ml/10 l water) or carbosulfan 25 % EC 0.05% (20 ml/10 l water) or acetamiprid 20 % SP 0.01% (5 g/10 l water) at 15 days interval starting from pests infestation were found effective.

Survey of various pests in mango orchard

The incidence of leaf gall midge, mango hopper, shoot borer and thrips were found enormously during the month of September to October, January to March, July to September and August to December, respectively.

Maximum population of leaf gall midge and mango hopper was noticed in Chalala and Mendarda area, while shoot borer and thrips were found maximum in Talala area of Saurashtra region.

Plant Pathology

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.

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.

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.

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.

Year 2015-16

Management of alternaria leaf blight of groundnut

Three sprays of difenconazole 25 EC 0.025% (10 ml/10 l. of water) at 35, 50 and 65 days after sowing was found effective and economical for management of alternaria leaf blight of groundnut grown in summer season.

Integrated management for wilt disease of chickpea

Seed treatment of *Trichoderma harzianum* 1% WP @ 4 g/ kg of seed or carboxin 37.5 + thiram 37.5 DS (Ready mix Vitavex powder) @ 2 g/kg seed alongwith soil application of *T. harzianum* 1% WP @ 4.0 kg/ha at the time of sowing in furrow was found effective against chickpea wilt under irrigated condition.

Management of foliar and fruit spot diseases in bottle gourd

Four sprays of difenconazole 25 EC 0.025 % (10 ml/10 l. of water) or hexaconazole 5 EC 0.005 % (10 ml/10 l. of water) at 10 days interval after appearance of the disease was found effective and economical for management of foliar and fruit spot diseases of bottle gourd grown in *kharif* season.

III. AGRICULTURAL ENGINEERING

Year 2014-15

The impact of seawater intrusion on the qualitative parameter of groundwater

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

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.

Year 2015-16

Response of Groundnut to supplemental irrigation

The farmers of North Saurashtra Agro-climatic Zone growing groundnut GG-20 are advised to apply supplemental irrigation at soil moisture deficit of about 40 per cent (about 20 % soil moisture content) for obtaining higher productivity, maximum net returns and improving crop and field water use efficiency under dry farming conditions.

Performance of MIS in Canal Command Area

- Irrigation planners are advised to use either the regression formula or ANN approach for determining seasonal runoff from the seasonal rainfall for Uben command area:

  $Y = 0.010X^{1.118}$, $R^2 = 0.754$..... and

  ANN model architecture 1 - 6 – 1 with $R^2 = 0.82$, $\eta_{model} = 80\%$
- Irrigation planners are advised to adopt the following optimal cropping pattern under surface irrigation system for Uben command area.
- Under surface irrigation system, 250 ha groundnut and 2250 ha green gram during the *kharif* season and 50 ha wheat and 1529 ha onion during the *rabi* season can be irrigated to get maximum return with cropping intensity of 163.15.
- Irrigation planners are advised to adopt the following optimal cropping pattern under drip irrigation system for Uben command area.
- Under drip irrigation system, 2475 ha groundnut and 25 ha green gram during the *kharif* season and 50 ha wheat and 1992 ha onion during the *rabi* season i.e. an additional 463 ha area can be brought under irrigation in *rabi* season by constructing 315 intermediate storage structures having 260 m^3 capacity each to serve one chuck (8 ha area).

Type of Irrigation system in Command Area	Season	Crop	Crop Area (ha)	Cropping Intensity (%)	Remark
Surface	*Kharif*	Groundnut	250	163.15	
		Green gram	2250		
	Rabi	Wheat	50		
		Onion	1529		
Pressurized	*Kharif*	Groundnut	2475	181.68	315 intermediate storage structures having 260 m^3 capacity (9 m x 9 m x 3.2 m) each to serve a chuck of 8 ha area will bring additional area of 462 ha in *rabi* season under irrigation
		Green gram	25		
	Rabi	Wheat	50		
		Onion	1992		

Online HRD Programme

It is recommended to staff members of JAU to use the online HRD programme developed by Junagadh Agricultural University to obtain the permission from concerned authority for participating or attending the programmes as per statute 121 Item No. 28.

Assessment of microbial floral strength during post-harvest handling of mango, custard apple and lemon

The presence of harmful fungus and bacteria during transportation stage was observed maximum amongst all stages of post-harvest handling in mango, custard apple and lime fruits and found increasing in subsequent stages. Therefore, farmers and traders are recommended to take control measures to check microbial growth prior to transportation.

IV. ANIMAL HEALTH & ANIMAL PRODUCTION

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*.

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.

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.

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'-TAAGAGGGATCCCAGTAAGGTT T-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

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' Reverse 5'-AATATTTCTGCTGAATAGGA -3'	280
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

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.

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.

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.

Year 2015-16

Preliminary evaluation of antibacterial activity of extracts of *Cassia auriculata, Prosopis juliflora* and *Annona squamosa*

Alkaloid rich fractions of *Prosopis juliflora* leaves can be a good drug entity against resistant bacteria due to its antibacterial property against various bacteria including Methicillin-Resistant *Staphylococcus aureus.*

Survey on indigenous plants use for medicinal purpose in animals in Junagadh region

Farmers of Junagadh, Mendarda and Vanthali taluka are commonly using *Adansonia digitata* (Gorakhambli) for gastric problems, *Elephantopus scaber* (Ghaa Jadvu) and *Clerodendrum phlomidis* (Arni) for wound healing, *Psoralea corylifolia* (Baauchi) for skin infection, *Enicostemma littorale* (Mamejvo) for internal parasites and *Tecomella undulata* (Ragatrohido) for fracture healing in animals.

Assessment of Blood cells' Immunocompetence around Parturition in Gir cows and Jaffarabadi buffaloes

During peripartum period phagocytic activity and lymphocyte proliferation responses are lower in Gir cows as compared to Jaffarabadi buffaloes.

Haemato-biochemical profiles of horses in and around Junagadh

In Kathiawari horses, total granulocyte per cent and MCHC (g/dl) are higher in females and lymphocyte per cent higher in males.

Diagnosis of Babesiabigemina and Trypanosomaevansi in bovines in and around junagadh: traditional vs molecular detection and assessment of risk factors

In cattle and buffaloes PCR is the most effective technique in diagnosis of subclinical and latent infections of *Babesia spp.* (Sensitivity, 100%; Specificity, 82.90%) and *Trypanosme spp.* (Sensitivity, 100%; Specificity, 95.92%).

Study of parasitic infections/infestations in animals presented at TVCC, Junagadh

The major parasites recorded in domesticated animals in and around Junagadh are as below:

Name of Parasite	Animal species
Buxtonell asulcata, *Eimeria* spp., *Fasciola gigantica, A*mphistomes, *Babesia* spp.	Cattle , Buffaloes
Eimeria spp.	Goat, Bird
Strongyle , *Babesia* spp.	Horse
Hook Worm, *Babesia*spp., Demodex	Dog
Trypanosoma evansi	Camel

Effect of replacement of graded levels of maize with raw and detoxified mango seed kernel (*Mangifera indica*) in conventional concentrate mixture on in vitro rumen fermentation pattern

Total phenol content in raw mango seed kernels is reduced by 60.00 per cent and 70.40 per cent by boiling in water and treatment with 1.00 per cent calcium hydroxide, respectively. Based on *in vitro* studies, treated mango seed kernel can replace 100 per cent maize in ISI grade-II concentrate mixture for cattle.

Aetio-Pathological studies on broiler mortality in and around Junagadh

E. coli infection is the major cause (31.21 per cent) of mortality in broilers of 16-30 days (22.55 per cent) during winter (22.40 per cent) in and around Junagadh.

Study on Postnatal Development of Adrenal Gland in Gohilwadi Goat (*Capra hircus*)

Adrenal gland of day old Gohilwadi kid has definite foetal, cortex and medulla, while adult adrenal exhibits the structures of typical zones of cortex and medulla. Width of definite cortex increases, while that of foetal zone decreases with increasing age.

V. FISHERIES SCIENCE

Year 2014-15

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*

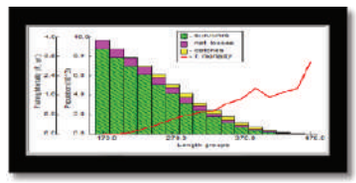
sp., Cypselury obligolepis, Remora remora, Therapon jarbua, Therapon theraps, Harpodon nehereus, Plotosus conius, Coryphaena hippurus are available in very less proportion at Veraval fish landing center.

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.

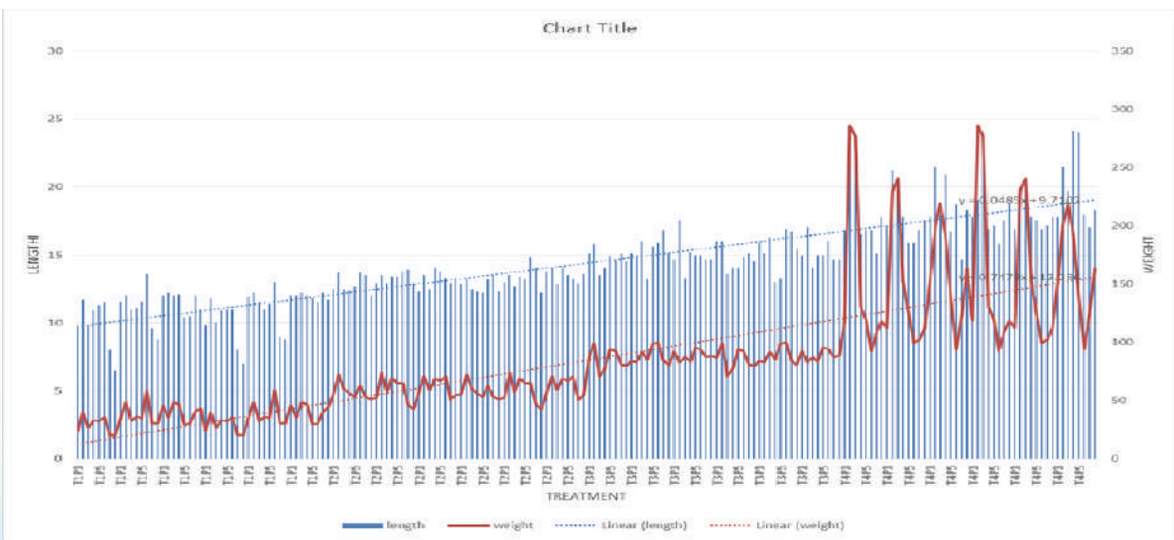
Growth, mortality and stock assessment of soldier catfish *Osteogeneiosus militaris* (Linnaeus, 1758) off Veraval coast

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.



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%).



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.

Year 2015-16

Impact of insectivorous Birds on Fish Drying Grounds at Veraval

Fishes dried on open grounds during the fishing season are infested with maggots and adults of technids fly attracting of several insectivorous birds especially cattle egret, which play an important role in the natural control of the infested pests.

Study of seaweed diversity at selected intertidal areas of Saurashtra and Diu (UT)

In the coastal belt of Saurashtra and Diu, 117 seaweed species are available (Intertidal and drifted), of which 38 Chlorophyceae, 34 Phaeophycea and 45 species of Rhodophyceae are found during September to April. The economically important species from Chlorophyceae group are 14, Phaeophyceae group 07 and Rhodophyceae group 15.

VI. BASIC SCIENCE

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 -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.*

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

JAU C1 to JAU C5 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).

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.

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).

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.

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/l gibberellic acid (GA_3) for 12 hrs to cumin seed at ambient temperature increases germination with enhanced seedling vigour in cumin.

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.

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.

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 (70^0C + 20^0C) condition packed with cloth bag or polyethylene 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.

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 (70^0C + 20^0C) 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.

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.

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 polyethylene 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.

VII. SOCIAL SCIENCE

Year 2015-16

An Economic Analysis of Groundnut Productivity Differentials in Saurashtra Region of Gujarat

Increase in the frequency of contact of extension functionaries with farmers throughout the crop season for crop specific information would reduce the productivity differences in groundnut crop. Increase in provision of incentives is needed for mechanization, micro irrigation system and to develop the assured irrigation sources to boost up the productivity. The availability of institutional credit should increase adequately to adjust the prevailing inflation level to enhance the productivity level.

Effective Number of Replications for Field Experiment on Wheat Crop in Saurasthra (*Triticum aestivum* L.)

For effective control of soil variation, an experiment plot having 12 basic units each of 0.90 m^2 with size 4.0 m x 2.7 m (4 x 3 units) were found optimum with minimum 2 replications are recommended for scientific community to conduct field experiment on wheat crop at Junagadh.

5.3 Breeder Seed Production

Table 5.3. Breeder Seed Production of different crops

No.	Crop	2014-15 (q)	2015-16 (q)	Total (q)
1	Groundnut	2233.10	2100.01	4333.11
2	Pearl millet	6.41	8.69	15.10
3	Sesame	17.16	28.50	45.66
4	Chickpea	204.80	154.00	358.80
5	Wheat	360.70	270.30	631.00
	Total…	**2822.17**	**2561.50**	**5383.67**

5.4 New Projects Sanctioned

Table 5.4. New Projects Sanctioned during the year 2014-15 and 2015-16

Sr. No.	Agency	2014-15		2015-16		Total	
		No.	Amt. San. (Rs. in lakh)	No.	Amt. San. (Rs. in lakh)	No.	Amt. San. (Rs. in lakh)
1	**ICAR**	02	30.28	05	277.28	07	307.56
2	**Govt. of India**	02	98.09	02	13.28	04	111.37
3	**Govt. of Gujarat**	01	14.49	01	4.57	02	19.06
	GOG-Plan	04	167.49	-	-	04	167.49
4	**RKVY**	01	15.00	-	-	01	15.00
5	**Other Agencies**	20	83.51	23	129.92	43	213.43
6	**ICRISAT**	-	-	01	01.00	01	1.00
	Total…	30	408.86	32	426.05	**62**	**834.91**

The university has received the sanction of total 62 new projects from ICAR, GOI, Govt. of Gujarat, RKVY, ICRISAT and Other Agencies during year 2014-15 and 2015-16. The main sanction projects are given herein:

ICAR/ Government of India

1. Consortia Research Platform (CRP) on Biofortification.
2. Estimation of Coconut Yield and Production in the State of Gujarat.
3. Enzymatic pre-treatment in the processing of pigeon pea.
4. Utilization of chickpea genome sequence for crop improvement.
5. Shuttle breeding for developing wheat genotypes for warmer areas.
6. Transcriptone and proteome analysis for identification of candidate genes responsible for pistillate nature in castor.
7. Transcriptone analysis in coriander for identification of candidate genes against stem gall disease.
8. Genome and transcriptone sequencing of cumin (*cuminum cyminum*) to reveal insight of its genomic archeticulture.
9. AICRP on Farm Implements & Machinery.
10. Modeling water and energy fluxes over Forest system (Gir Forest).
11. Estimation of Coconut yield and production in the state of Gujarat.

Government of Gujarat

1. Crop improvement in papaya at Junagadh.
2. Integrated pest management in seed spices at Junagadh.
3. Evaluation of pharmacological activity of indigenous medicinal plants of Saurashtra region.
4. Identification & documentation of marine fish biodiversity using mitochondrial DNA bar coding at Veraval.
5. Biochemical and molecular characterization of *Bacillus* spp. isolated from rhizosphere of plants and their biocontrol potential against *Fusarium oxysporum* f. sp. cumini.
6. Effect of sulphate of potash (SOP) with and without FYM on yield and quality of summer groundnut

RKVY

1. Production of groundnut breeder seed at farmer's field.

ICRISAT

1. Heterotic Pool Formulation in Pearl millet.

Other Agencies

Several projects (43) on testing of genotypes/varieties of different crops and agro-chemical as sanctioned by various sponsored agencies like Govt. & Non Govt. organization and private agencies.

5.5 Memorandum of Understanding (MoUs)

The university has signed six MoUs with different institutes for education, research and extension education activities.

Table 5.5. MoUs signed during the year 2014-15 and 2015-16

SN	Name of institution	Year
2014-15		
1	M/S Jain Irrigation Systems Limited (JISL), Jalgaon, Haryana	12.06.2014
2	India Meteorological Department, New Delhi	04.06.2014
2015-16		
3	National Council For Climate Change Sustainable Development & Public Leadership, Ahemedabad	19.9.2015

5.6 Front Line Demonstration (FLDs)

Crop scientists have successfully organized total 575 front line demonstrations on farmers' fields during the year 2014-15 and 2015-16 in addition to the FLDs organized by KVKs of JAU. The yields of different crops were recorded higher under research technologies over that of respective farmers' practices during both years.

Table 5.6. FLDs organized on farmers' field

Sr. No.	Name of Crop	No. of FLDs		Total
		2014-15	2015-16	
1	Groundnut	45	40	85
2	Chickpea	10	15	25
3	Vegetable & Spices	16	19	35
4	Sesame	20	14	34
5	Castor	20	15	35
6	Wheat	10	15	25
7	Pearl millet	95	108	203
8	Cotton	50	50	100
9	Pigeon pea	10	23	33
	Total...	**276**	**299**	**575**

5.7 Human Resource Development (HRD)

Human resource development is an important aspect of a scientific institute. It makes possible the scientists expertise, mutual exchange of opinions, seeing new research etc. University sent the scientists in other universities of the country for summer/winter school, seminar, symposia, conference etc. During the year 2014-15 and 2015-16 about 1377 attended different programmes at different places.

Table 5.7 HRD Programmes attended/organized

SN	Particulars	2014-15	2015-16	Total
Number of Scientists attended Seminar/ Symposium/ Workshop etc.				
1	International Conference / Symposium etc. (held in India)	28	35	63
2	Summer & Winter School/ Short & Refresher Course/ Orientation / Short Training etc.	117	160	277
3	Workshop/ Group, Annual & QRT Meeting etc.	133	152	285
4	Seminars/ Symposium/ Conference/ Convention etc.	258	244	502
5	AICRP Monitoring/ Visit/ Exam / Lecture etc.	109	141	250
6	Foreign Training	-	-	-
	Total	**645**	**732**	**1377**
Organisation of National/State level Seminar/ Symposia/Conference				
1	Seminar/ symposium/ conference/ workshop/ training/ summer school/ winter school etc. organized by JAU	05	07	12

Organizing International/ National/ State Level Seminars/Workshops

The seminars and workshops are very important for strengthening the research work and for mutual exchange of the knowledge among the scientists of the country. During the year 2014-15 and 2015-16, the University organized five national level and seven state level programmes. About 1842 scientists have participated in these programmes as per the details given below.

Table 5.8 National and State HRD Programme conducted by JAU

Sr. No	Particulars	Organized by	Duration	No. of Participants
National (Year 2014-15)				
1	Summer school training programme on "Agribusiness and Marketing Opportunities and Challenges	PGIABM, JAU, Junagadh	September 1-21, 2014	22
2	National Seminar "Water Management and Climate Smart Agriculture".	RTTC, JAU, Junagadh	February 13-14, 2015	240
State (Year 2014-15)				
3	State level Seminar on "Pasu kalian na vividh pasao"	College of Vet. Sci. & A.H., JAU, Junagadh	August 03, 2014	525
4	Training programme on "Use of Plastic in Agriculture"	Dept. of RERE, CAET, JAU, Junagadh	February 23, 2015	315
5	Brainstorming Session on establishment of cow sanctuary in Gujarat	College of Vet. Sci. & A.H., JAU, Junagadh	February 28, 2015	45
National (Year 2015-16)				
1	Winter School on “Implications of Climatic Change on Pedagogical Issues of Water Resources Management”	RTTC, JAU, Junagadh	September 21 to October 11, 2015	36
2	ICAR sponsored Winter School training programme on "Recent Advances in Production of Bio Pesticides, Bio Agents and Bio Fertilizer for Sustainable Agriculture"	Department of Entomology, JAU, Junagadh	December 01-21, 2015	37
3	National Seminar on "Contemporary Innovations for Quantum Extensin in Agricultural Development"	Dept. of Extension Education, CoA, JAU, Junagadh	March 18-19, 2016	300

State (Year 2015-16)				
4	One day Seminar on "Entrepreneur-ship Orientation"	PGIABM, JAU, Junagadh	August 20, 2015	112
5	Shrimp farming management training	Agril. Re. Station, JAU, Mahuva	August 24-28, 2015	30
6	Farmers training programme on spices crops	Agril. Res. Station, JAU, Halvad	September 10-11, 2015	100
7	Workshop on "Character Building and Personality Development"	PGIABM, JAU, Junagadh	November 16, 2015	80
			Total…	**1842**

Scientists from Florida Agril. and Mechanical Uni. (FAMU), Florida visited RTTC Farm, JAU, Junagadh on July 26, 2015

Project Coordinator, Coimbatore visited Cotton Research Station, JAU, Junagadh for monitoring of AICCP on Cotton on October 28, 2015

Coconut Farmers & Entrepreneurs Meet jointly organized by Coconut Development Board,;Dept. of Agri. & Coooperation and JAU, Junagadh on September 12, 2015

CHAPTER - VI
AGRICULTURAL EDUCATION

The Junagadh Agricultural University imparts residential instructions of undergraduate and post graduate degrees as well as diploma courses at its constituent colleges/PG institute/polytechnics.

The series of steps taken during XI plan period include: up-gradation of course curricula in different faculties, introduction of new courses, adoption of common eligibility criteria for admission at UG level, introduction of RAWE programme, reservation of 15 per cent seats at UG level and 25 per cent seats at PG level for student coming through All India Entrance Exam for Admission (AIEEA) conducted by ICAR, introduction of Written Entrance Test for admission in PG Programmes, deputation of teachers for refresher courses, training, higher education, creation of IT facilities and establishment of student's counseling cell. The details of which are as under:

Table 6.1 Degree courses offered by different Colleges

Sr. No.	Name of degree course	College
1	B.Sc. (Hons.) Agri. M.Sc. (Agri.) Ph.D. (Agriculture)	College of Agriculture, Junagadh
2	B.Sc. (Hons.) Horti. M.Sc. (Horti.) Ph.D. (Horticulture)	College of Horticulture, Junagadh
3	B.Sc. (Hons.) Agri.	College of Agriculture, Motabhandariya, (Amreli)
4	B.Sc. (Hons.) Agri.	College of Agriculture, Khapat, Porbandar
5	B.Tech. (Agri. Engg.) M.Tech. (Agril. Engg.) Ph.D. (Agril. Engg.)	College of Agricultural Engineering and Technology, Junagadh
6	B.F.Sc. M.F.Sc. Ph.D. (Fisheries Science)	College of Fisheries Science, Veraval
7	B.V.Sc. & A.H. M.V.Sc. Ph.D. (Veterinary Science)	College of Veterinary Science and Animal Husbandry, Junagadh
8	M.B.A. in Agri-Business Ph.D. (Agri-Business)	PG Institute of Agri-Business Management, Junagadh

Table 6.2 Diploma courses offered by different Polytechnic Colleges

Sr. No.	Name of diploma course	Polytechnic College
1	Diploma in Agriculture (3 years divided into 6 semesters)	Polytechnic in Agriculture, Dhari
2	Diploma in Horticulture (3 years divided into 6 semesters)	Polytechnic in Horticulture, Junagadh
3	Diploma in Agro-processing (3 years divided into 6 semesters)	Polytechnic in Agro-processing, Junagadh

4	Diploma in Home Science (3 years divided into 6 semesters)	Polytechnic in Home Science, Amreli
5	Diploma in Animal Husbandry (3 years divided into 6 semesters)	Polytechnic in Animal Husbandry, Junagadh
6	Diploma in Agril. Engineering (3 years divided into 6 semesters)	Polytechnic in Agril. Engineering, Targhadia

The concept of education is based on two-tier system. The first one consists of the higher education covering Agriculture, Horticulture, Agricultural Engineering & Technology, Fisheries Science, Veterinary Science & Animal Husbandry and Agri-Business Management, which includes graduate and post graduate resident instruction programmes and polytechnic diploma programmes. The second consists of lower education programme provided at the Agricultural School, School of Baking, Mali Training Centre and Extension Education Training Centres. The higher education programmes are looked after by the Deans and Registrar, while lower education programmes by the Director of Extension Education at the University level.

6.1 Under Graduate Programmes

Procedure of Admission

The admission criteria in the Under Graduate programmes in Junagadh Agricultural University are purely on merit basis considering weightage of 60% marks obtained in science subjects like Physics, Chemistry and Biology/ Mathematics at HSC and 40 % marks obtained in Gujarat Common Entrance Test/ Joint Entrance Examination conducted by GSEB/CBSE. English is a compulsory subject for all the under graduate programmes. The students passed science subjects with vocational stream may also be admitted. For admission to B.Sc. (Hons.) Agri., B.Sc. (Hons.) Horti., B.F.Sc. and B.V.Sc. & A.H.; Physics, Chemistry and Biology, while for B.Tech. (Agril. Engg.), Physics, Chemistry and Mathematics subjects are compulsory. Among the seats allotted for admission, 49% seats are reserved for various Backward Classes, i.e. 15% for Schedule Tribes, 7% for Schedule Caste and 27% for Socially and Educationally Backward Communities as declared under Baxi Commission (Mandal Panch). One per cent of available seats are reserved for children of defence personnel and ex-servicemen. Moreover, 3% seats are reserved for disabled (physically challenged) candidates as per the directives from the Supreme Court of India. The students of CBSE, who have passed their examination from school located in Gujarat state, are considered eligible as per prorata. There is provision of additional seats for Kashmiri Migrants and parsi community (domicile of Gujarat State) also. Out of State quota, 15% seats are reserved for ICAR candidates, who have cleared All India Entrance Examination conducted by ICAR. The admission procedure is centrally administered by the Registrar at University level.

Weightage of marks for participation in sport is given in admission as per the rank obtained in various sports activities. Weightage of 5% marks is given to farmer's son/daughter and students of vocational stream who have passed HSC with Agriculture subject in addition to Physics, Chemistry and Biology for admission to B.Sc. (Hons.) Agri. and B.Sc. (Hons.) Horti. degree course. In B.F.Sc. degree course, 12% seats are reserved for Fisherman's son/daughter and weightage of 15% marks is also given for admission. Weightage of 5% marks is given to farmer's son/daughter for admission to B.F.Sc.

From the academic year 2003-04, the Board of Management resolved to fill up NRI/ Payments Seats in Under Graduate courses with a fees of 3500 US$ per semester for NRI candidate and Rs. 25000 per semester for payment seat.

Centralised online admission procedure is adopted by all the agricultural universities of Gujarat for all UG programmes.

Table 6.3 Admission requirements for under graduate

Sr. No.	Name of the degree	Duration of course and colleges	Minimum qualifications required for admission
1.	B.Sc. (Hons.) Agri. B.Sc. (Hons.) Horti.	Four years (Eight semesters) College of Agriculture, Junagadh / Amreli / Porbandar College of Horticulture, Junagadh	The candidate should have passed Higher Secondary School Certificate Examination in Science stream with Physics, Chemistry and Biology with English as compulsory subjects from any statutory Board in Gujarat state. Candidates who have passed HSC with vocational stream in Agriculture as well as Post Basic stream with Science subjects and English as compulsory subject be also admitted. The minimum r equirement of marks in theory (Physics, Chemistry and Biology) papers shall be as under: 1. For SC: 35% 2. For ST: 35% 3. For SEBC: 40% 4. For others: 40%
2.	B.F.Sc.	Four years (Eight semesters) College of Fisheries Science, Veraval	The candidate should have passed Higher Secondary School Certificate Examination in Science stream with Physics, Chemistry and Biology with English as compulsory subjects from any statutory Board in Gujarat state. The minimum requirement of marks in theory (Physics, Chemistry and Biology) papers shall be as under: 1. For SC: 35% 2. For ST: 35% 3. For Fishing community: 35% 4. For others: 40%
Note :-The Merit List of above 1 & 2 shall be prepared on the basis of 60 % of PCB theory marks of HSC & 40 % of PCB marks of GUJCET of respective year of admission			
3.	B.V.Sc. & A.H.	(5 years divided into 10 semesters with 6 months of compulsory internship) College of Veterinary Science and Animal Husbandry, Junagadh.	The candidate should have passed Higher Secondary School Certificate Examination in Science stream with English, Physics, Chemistry and Biology from any statutory Board in Gujarat state. The min imum requirement of marks in theory (Physics, Chemistry, Biology and English) papers shall be as under: 1. For SC: 40% 2. For ST: 40% 3. For SEBC: 40% 4. For others: 50% Merit list shall be prepared on the basis of 100 % marks obtained in GUJCET of respective year of admission.
4.	B.Tech. (Agril. Engg.)	Four years (Eight semesters) College of Agricultural Engineering and Technology, Junagadh	The candidate should have passed Higher Secondary School Certificate Examination in Science stream with Mathematics, Physics and Chemistry with English as compulsory subject from any statutory Board in Gujarat state. The minimum requirement of marks in theory (Mathematics, Physics and Chemistry) papers shall be as under:

			1. For SC: 35% 2. For ST : 35% 3. For SEBC: 40% 4. For others : 40% Merit list shall be prepared on the basis of 60% of PCM theory marks of HSC and 40% of PCM JEE marks of respective year of admission.

Table 6.4 Number of students admitted and passed for the various Degrees

Sr. No.	Faculty	Students admitted		Students passed	
		2014-15	2015-16	2014-15	2015-16
1	B.Sc. (Hons.) Agri., Junagadh	118	116	115	133
2	B.Sc. (Hons.) Agri., Amreli	23	25	-	-
3	B.Sc. (Hons.) Horti.	35	46	-	36
4	B.Tech. (Agril.Engg.)	81	89	75	100
5	B.F.Sc.	35	50	19	46
6	B.V.Sc. & A.H.	38	56	18	27

6.2 Post Graduate Programmes

The Junagadh Agricultural University imparts post-graduate education as constituent part of its research schemes with the help of the teachers of the under graduate colleges and scientists engaged in research.

Post Graduate Courses

1. M.Sc. (Agri.)
2. M.Sc. (Horti.)
3. M.Tech. (Agri. Engg.)
4. M.F.Sc.
5. M.V.Sc.
6. M.B.A. in Agri-business
7. Ph.D.

Table 6.5 Admission requirements for post graduate programme

Sr. No.	Degree course	Duration of course and colleges	Minimum qualification requirement
1	M.Sc. (Agri.) & M.Sc. (Horti.)	Two years divided into 4 semesters; College of Agriculture, Junagadh College of Horticulture, Junagadh	Candidate should have bachelor's degree in agriculture/horticulture or equivalent with an OGPA not less than 6.00 (10.00 basis) or its equivalent.
2	M.Tech. (Agril. Engg.)	Two years divided into 4 semesters; College of Agricultural Engineering & Technology, Junagadh	Candidate should have bachelor's degree in Agril./Electrical/ Mechanical/ Civil/Chemical Engineering with an OGPA not less than 6.00 (10.00 basis) or its equivalent as well as in the subject in which admission is sought.
3	M.F.Sc.	Two years divided into 4 semesters; College of Fisheries Science, Veraval	Candidate should have bachelor's degree in Fisheries or equivalent with an OGPA not less than 6.00 (10.00 basis) or its equivalent.
4	M.V.Sc.	Two years divided into 4 semesters; College of Veterinary Science and Animal Husbandry, Junagadh	Candidate should have bachelor's degree in Veterinary Sci. & A.H. or equivalent with an OGPA not less than 6.00 (10.00 basis) or its equivalent.

5	M.B.A. in Agri-Business	Two years divided into 4 semesters; P.G. Institute of Agri-Business Management	Candidate should have bachelor's degree in Agriculture, allied science and Life Science, Bio Science, BBA, B.Com BRS and B.E. with an OGPA not less than 6.00 (10.00 basis)
6	Ph.D.	Three years divided into 6 semesters 1. College of Agriculture, Junagadh 2. College of Agril. Engg. & Tech., Junagadh 3. College of Veterinary Science and Animal Husbandry, Junagadh 4. College of Fisheries Science, Veraval 5. PG Institute of Agri-Business Management	Candidate should have master's degree in concerned discipline with an OGPA not less than 6.5 (10.00 basis) or its equivalent.

Procedure of Admission

(A) A candidate for admission to the Master's degree should possess Bachelor's degree with an OGPA not less than 6.00 (10.00 basis) or its equivalent in aggregate.

(B) A candidate for admission to the Ph.D. degree programme should possess Master's degree with an OGPA of not less than 6.50 (10.00 basis) or its equivalent in aggregate.

(C) A candidate for admission to Master and Ph.D. degree shall have to appear in entrance test and admission is given on merit based on marks obtained in the entrance test and marks obtained at last degree in the ratio of 50: 50 %.

(D) Relaxation of 5% marks is given in eligibility to ST, SC and SEBC candidates for admission to Master/Ph.D. degree.

Seats for ICAR and Govt. of India nominees, ST, SC, SEBC, Gujarat State nominees, in-service candidates are reserved as per the University rules.

Table 6.6 Number of admissions and turnout of students from post graduate faculty

Sr. No.	Degree course	No. of students admitted		No. of students passed	
		2014-15	2015-16	2014-15	2015-16
1	M.Sc. / M.Sc. (Agri.)	81	96	60	48
2	M.Sc. (Horti.)	16	20	11	09
3	M.Tech. (Agril. Engg.)	24	26	18	19
4	M.F. Sc.	10	06	02	07
5	M.V.Sc.	16	08	01	08
6	M.B.A. in Agri-Business	39	38	16	27
7	Ph.D.	41	40	20	23

6.3 Polytechnic Diploma Programmes

Looking to the present scenario of changing pattern in education system, Junagadh Agricultural University has started three years Polytechnic Diploma programmes in Agriculture, Horticulture, Agro-processing, Animal Husbandry, Agricultural Engineering and Home Science from academic year 2009-

10. The present intake capacity is 35 seats in each course. The programmes aim to cater the present needs in the different areas of Agriculture and allied fields.

The admission criteria in the Diploma programmes in Junagadh Agricultural University are purely on merit basis i.e. percentage of marks obtained at SSC (10^{th} Standard) with English as a compulsory subject from any statutory Board in the Gujarat State or Examinations recognized as equivalent thereto. Among the seats allotted for admission, 49 % seats are reserved for various Backward Classes, i.e. 15 % for Schedule Tribes, 7 % for Schedule Caste and 27 % for Socially and Educationally Backward Communities as declared under Baxi Commission (Mandal Panch). Moreover, 3 % seats are reserved for disabled (physically handicapped) candidates as per the directives from the Hon. Supreme Court of India. One per cent seat is also reserved for children of defense personnel/ ex-servicemen.

Central admission procedure is adopted by all the agricultural universities of Gujarat for all polytechnic programmes. Weightage of marks for participation in sport is given in admission. Weightage of 5 % marks is given to farmer's son/daughter for admission to Agriculture and Horticulture Polytechnic Programmes.

Table 6.7 Admission requirements for polytechnic programmes

Name of the Diploma course	Duration of course and colleges	Minimum qualifications required for admission
Diploma in Agriculture Diploma in Horticulture Diploma in Agro - processing Diploma in Home Science Diploma in Animal Husbandry Diploma in Agril. Engg.	Three years (Six semesters) Polytechnic in Agri. / Horti. / Agro Processing / Home Sci. / A.H. / Agril. Engg.	The candidate should have passed Secondary School Certificate Examination (SSC) with English as compulsory subjects from any statutory Board in Gujarat state. The minimum requirement of aggregate marks (as mentioned in mark sheet) shall be as under: 1. SC & ST: 35% 2. For SEBC & others: 40 %

Table 6.8 Number of admissions and passed out at Diploma level in the University

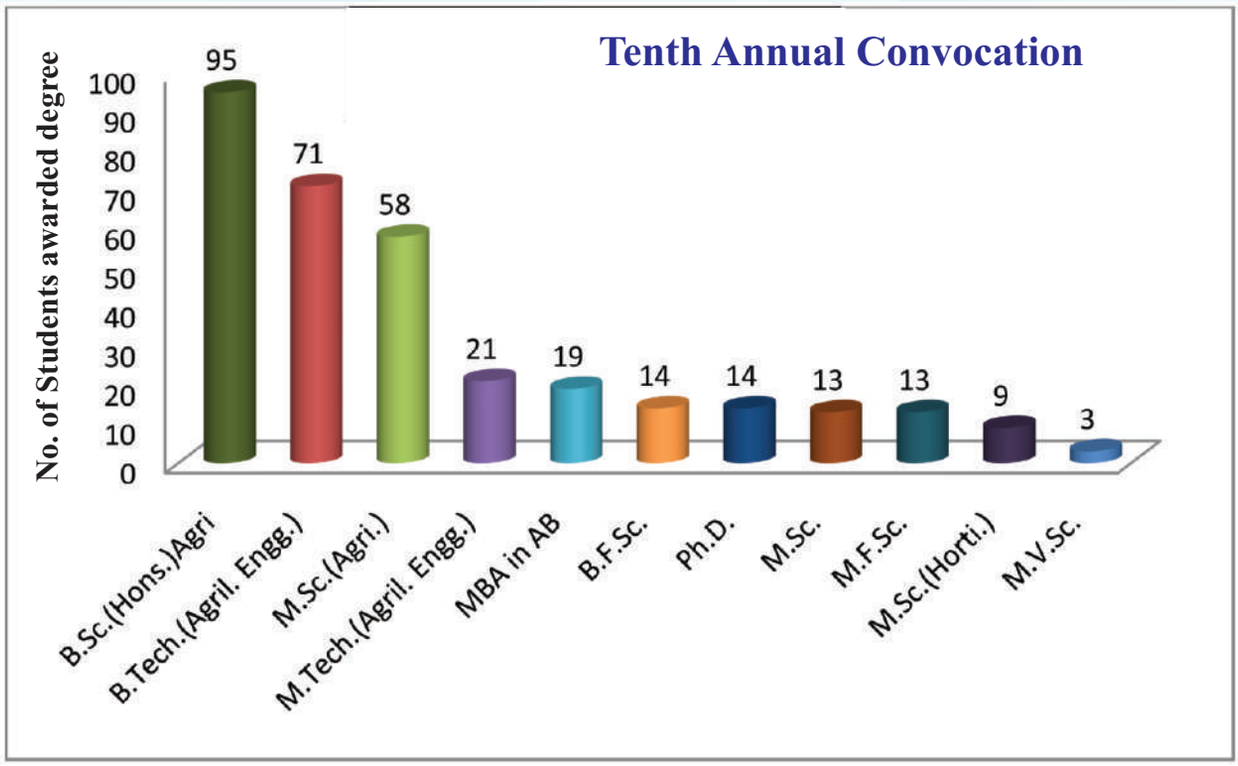
Sr. No.	Diploma Courses	Students admitted		Students Passed	
		2014-15	2015-16	2014-15	2015-16
1	Diploma in Agriculture	33	35	30	30
2	Diploma in Horticulture	32	35	33	33
3	Diploma in Agro-processing	34	35	26	30
4	Diploma in Home Science	19	35	18	10
5	Diploma in Animal Husbandry *	33	14	-	12
6	Diploma in Agril. Engineering *	27	31	-	25
	* Started in 2013-14				

6.4 Annual Convocation

Tenth Annual Convocation

The Tenth Annual Convocation was held at Junagadh on January 20, 2015. Dr. Arvind Kumar, Deputy Director General, (Education) ICAR, New Delhi, was the chief guest. As many as 330 students were awarded Under Graduate and Post Graduate degrees by Hon'ble Governorshri of Gujarat and

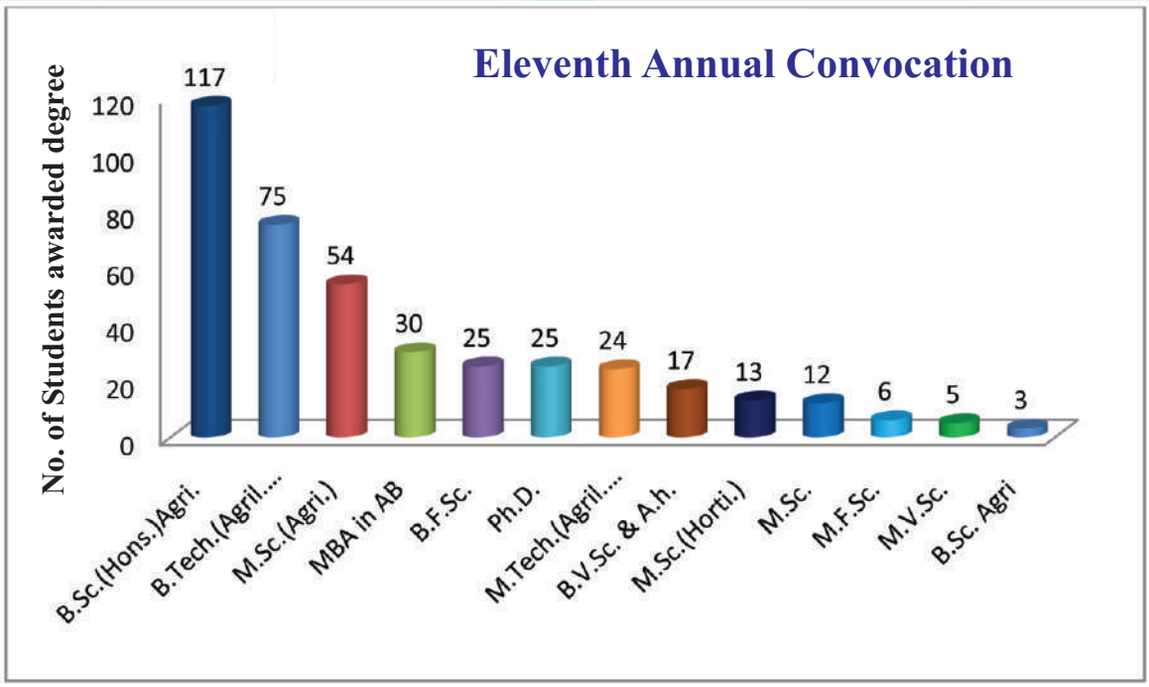
Chancellor of this University, Shree O.P. Kohli. 42 Gold Medals/Gold Plated Silver Medals and two Cash Prizes were awarded to students for their outstanding performance at examination, achieving high percentage of marks and stood first on merit in various examinations.



Tenth Annual Convocation on January 20, 2015

Eleventh Annual Convocation

The Eleventh Annual Convocation was held at Junagadh on January 16, 2016. Padma Bhushan Dr. R.S. Paroda, Former Secretary, DARE & Director General, ICAR, New Delhi, was the chief guest. As many as 406 students were awarded Under Graduate and Post Graduate degrees by Hon'ble Governorshri of Gujarat and Chancellor of this university, Shree O.P. Kohli. For the academic year 2013-14, 35 Medals and two Cash Prizes whereas, for the academic year 2014-15 total 46 Medals and two Cash Prizes were awarded to students for their outstanding performance at examination, achieving high percentage of marks and stood first on merit in various examinations.



Eleventh Annual Convocation on January 16, 2016

6.5 Student welfare and other activities

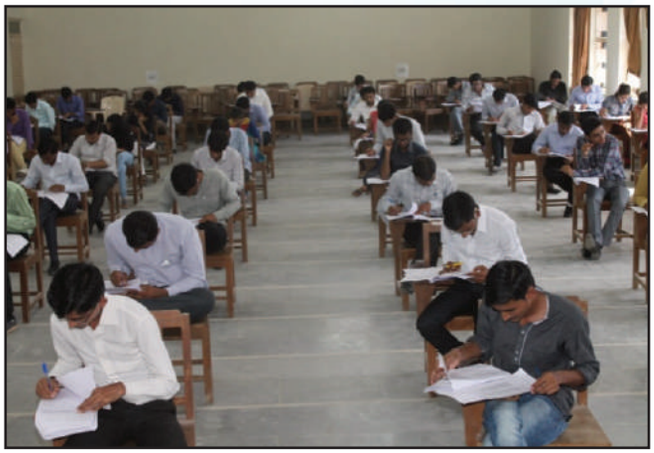
The Director Students' Welfare, JAU, Junagadh is always looking after students' welfare activities viz; sports, cultural/literary, adventure, NSS, health, Students' Counseling and Placement, students' training, residential facilities, scholarship, Gold medal. Govt. campaign and awareness programme, with a view to develop personality, leadership, communication skills, character, dignity and high human values in UG and PG students of the University.

Table 6.9 Students' activities during the year 2014-15 & 2015-16

Activity		2014-15	2015-16
Sports	(Inter College)	10 (745)	10 (789)
	(Inter University)	10 (183)	11 (199)
Cultural/ Literary	(Inter College)	6 (222)	6 (241)
	(Inter University)	7 (53)	7 (55)
Placement		80	56
NSS		20 (1474)	21 (1611)

Gold Medal	43	83 (for 2 year)
Cash Prize	2	2 + 2 (for 2 year)
Scholarship	7 (364)	7 (421)
Students' training	12 (673)	9 (579)
Special Lecture/ Programme	09 (547)	12 (1270)
Adventure	2 (84)	3 (149)

Note: Figure in the Parenthesis indicates the no. of participants, enrolled NSS volunteers and scholarship recipients. while, figure outside of the parenthesis indicates no. of sports, cultural/ literary items, NSS activities, no. of scholarship, no. of students' training, no. of special programmes and no. of Adventurous camps.



HDFC Bank written test & campus interview for the students of JAU organized by DSW on June 08, 2015

Adventure Camp for the students of College of Veterinary Science & A.H. and College of Fisheries Science at Dharmashala during September 20-29, 2015

Intercollege Volleyball & Kabaddi Tournament of JAU on October 17, 2015

Volleyball, Basketball & Table Tennis Tournament of all State Agricultural Universities at JAU, Junagadh on October 29, 2015

National Integration Camp for the students of College of Agriculture at Vijyapur during December 07-13, 2015

Students of JAU received awards at Students' Research Connvention (West Zone) during January 12-13, 2016

Life Skill and Personality Development Training organized by DSW at Department Biotechnology, JAU, Junagadh on March 21-23, 2016

Students of JAU received awards from Hon'ble Chief Minister Smt. Anandiben Patel, Gujarat during Krushi Mahotsav-2016 on May 14, 2016

CHAPTER - VII
EXTENSION EDUCATION AND TRANSFER OF TECHNOLOGY

Extension Education is one of the triple functions of the Junagadh Agricultural University to boost up the agricultural production. The University has been making substantial contribution in diffusing and communicating agricultural technologies among the extension personnel and farming community of the region. The technologies generated in agriculture and allied sciences by the University is being transferred to the end users through (i) Training to the extension personnel of the line departments and NGOs, (ii) Organizing vocational training in agriculture and allied enterprises for the practicing farmers, farm women, farm youth etc. (iii) Farm advisory services (iv) Electronic media like radio and television (v) Print media publishing farm literature (vi) Telephone help line and Kisan Call Centre.

It is known fact that knowledge and technology dissemination are the key to economic growth of rural sector and farmers' prosperity. The allocation of fund to Extension Education was Rs. 2,10,87,067 in 2015-16 in order to strengthen its capability, reach and efficiency for the establishment of KVKs office buildings and residential quarters.

The vital aspect, which received greater attention, was vocational education. Here the aim was to improve the educational standards in Agricultural School awarding diploma, Agro Base ITI Training Centres, at Junagadh and Mahuva, Bakery Schools etc. for developing highly professional level of human resource base in the Saurashtra region of the State to provide support services to voluntary organization, business houses and others. To match the need of the expanding horticulture occupation, a project on Mali Training was introduced by the University.

The Front Line Extension is yet another area in which the University is contributing a lot. It is unique in the sense that (i) there is no intermediary involved between scientists and farmer (ii) it is all in participatory mode and therefore, farmers learn the technology by physically doing it and (iii) it provides scientists an opportunity to assess his technology and refine if necessary. The coverage under Front Line Extension has speedily been going up because of its symbiotic functioning.

There has been a large-scale shift in the University's extension approach towards the Front Line Extension Programmes as shown by the number of FLDs conducted during 2014-2015 to 2015-2016. The adoption of high tech frontier technologies by the farmers is indicative of the benefits of this Front Line Extension interface.

7.1 Diploma / Certificate Courses for Farm Youths

A distinct feature of JAU is that it offers diploma and certificate courses in agriculture, livestock, baking and gardening.

Table 7.1 Diploma/Certificate courses conducted

Sr. No.	Name of Diploma / Certificate Course	Duration	School/ Centre	Intake capacity	No. of Students completed the course	
					2014-15	2015- 16
1	Agriculture Diploma	2 years	Halvad	30	29	30
2	Bakery Training	20 &15 weeks	Junagadh	16 + 16 (2)	32 (2 Batches)	30 (2 Batches)
		1 week	Junagadh	-	128 (8 Batches)	188 (10 Batches)

3	Mali Training	6 months	Junagadh	20	-	03
4	Agro Base ITI:					
i	Seed production technology	6 months	Junagadh	50	37	28
ii	Greenhouse construction & system managements	6 months	Junagadh	50	50	50
iii	Use of Micro-irrigation systems its operation and managements	6 months	Mahuva	50	00	00
iv	Scientific cultivation, storage and value addition of Onion	6 months	Mahuva	50	00	00

Bakery Training

Practical field work by Agro base ITI Students

7.2 Training to Extension Workers

Junagadh Agricultural University is imparting need-based training to the extension functionaries through T & V Training Centers and Sardar Smruti Kendra.

Apart from this, pre-seasonal (Kharif and Rabi) trainings to senior staff of Department of Agriculture are organized by the University and about 1605 extension worker/ officer beneficiaries were trained through 37 training programmes.

Table 7.2 Training of the extension workers conducted

Sr. No.	Training	No. of Training Programmes (Ext. workers/Officer Beneficiaries)	
		2014-15	2015-16
1	Pre-Seasonal	02(69)	03(57)
2	Bimonthly	05(124)	04(114)
3	Short term	11(566)	12(645)
	Total...	**18(789)**	**19(816)**

Pre seasonal Training programme under T & V scheme

Bi monthly Training programme under T & V scheme

7.3 Training to farmers / farm women / rural youths

On campus as well as off-campus training programmes are being organized based on the needs and interests of the farming community. These training programmes are conducted through various front-line TOT centers of the University.

Table 7.3 Training programmes for farmers / farm women / rural youths

Sr. No.	Centre		Year	
			2014- 2015	2015-16
1	KVK, Jamnagar	A	42(2344)*	20 (1438)
		B	41(2729)	38 (2161)
2	KVK, Targhadia	A	30(805)	35(846)
		B	32(926)	44(888)
3	KVK, Amreli	A	34(1072)	30(892)
		B	32(1015)	37(1308)
4	KVK, Khapat	A	21(504)	31(800)
		B	45(1218)	52(1548)
5	KVK, Nana Kandhasar	A	34(885)	23(553)
		B	37(858)	34(802)
6	KVK, Pipalia	A	06(172)	24(748)
		B	12(386)	35(1553)
	Sub Total...	A	167(5782)	163(5277)
		B	199(7132)	240(8260)
	Grand Total...		**366 (12914)**	**403(13537)**

A=On campus, B=Off campus, * Parenthesis indicate No. of Participants

The trainings were imparted to 26,451 trainees through 769 on-campuses as well as off-campus training programmes.

On Campus training programme to farm women at KVK Amreli

Off Campus training programmeto farm women at KVK Nana Kandhasar

Table 7.4 Training programmes for extension functionaries

Sr. No.	Centre	2014- 2015		2015-16	
		No.	Participant	No.	Participant
1	KVK, Jamnagar	2	62	2	65
2	KVK, Targhadia	4	125	3	105
3	KVK, Amreli	2	56	3	84
4	KVK, Khapat	1	45	2	89
5	KVK, Nana Kandhasar	3	89	1	40
6	KVK, Pipalia	1	23	1	25
	Total...	**13**	**400**	**12**	**408**

7.4 Farm Advisory Service

The Farm Advisory Service Scheme is working under SSK at Junagadh, with a view to provide guidance and the latest information to the farmers. The farmers were advised to ask their farm problems through correspondence or in person while their field visits. The centre is working as a link between the research scientists, extension workers and farmers.

Table 7.5 Activities of farm advisory service

Sr. No.	Activity	2014-15		2015-16	
		No. of activities	Benefic-iaries	No. of activities	Benefic-iaries
1	Agril. Exhibition	08	1,97,263	07	2,81,765
2	Agril. Fair	03	1,92,680	03	2,80,355
3	Guidance through personal contact	-	8763	-	9042
4	Farmers group meeting	02	106	01	46
5	Guidance through telephone	-	11725	-	11725
6	Guidance through post	02	02	01	01
7	Guidance to visitor	442	13100	1165	10270
	Total...	**457**	**33696**	**1177**	**31084**

The activities were carried out for the **64,780** beneficiaries through **1634** different activities.

Table 7.6 Extension activities carried out by extension education centers

Sr. No.	Name of Activities	Year	
		2014-15	2015-16
1	*Krushi mela*/Agri. Exhibition	05(195763)*	4(279765)
2	Farmer/ Farm women *Khedut shibir*	4(162)	01(46)
3	Guidance on farm	--	02(32)
4	*Parisanvad*/ Seminar / Workshop/ *Kisan Gosthi shibir*	02(390)	--
5	Demonstration	03(110)	--
6	Film/ Slide/ video cassette show Radio talk/TV programme	--	1
7	Guidance through letter/ Telephone	5	10
8	Distribution of Agri. Literature	01(10544)	01(14454)
9	Press note	2	10
10	Guidance to visitors	41(8966)	(8773)
11	Agri. Literature show	08(197263)	07(267715)
12	Visitors	(1925)	--
13	Bakery training	04(982)	05(1920)
14	Fisheries training	02(1615)	02(2513)
15	Publication of Agri. Literature	03	06
	Total...	**80 (4,17,720)**	**49 (5,75,218)**

* Parenthesis indicates No. of Beneficiaries.

7.5 Frontline Demonstrations

The KVKs have organized total 1583 front-line demonstrations on various oilseeds, pulses and other field crops in 635 ha at farmers' fields during *Kharif* and *rabi* seasons

Table 7.7 FLDs organized by KVKs

Sr. No.	Centre	Season	Year			
			2014-2015		2015-16	
			No. of FLDs	Area (ha)	No. of FLDs	Area (ha)
1	KVK, Jamnagar	*Kharif*	60	24.0	115	28.0
		Rabi	45	20.0	110	44.0
2	KVK, Targhadia	*Kharif*	61	22.0	22	8.8
		Rabi	30	12.0	30	12.0
3	KVK, Amreli	*Kharif*	70	28.0	120	48.0
		Rabi	45	18.0	189	75.6
4	KVK, Khapat	*Kharif*	55	24.0	55	22.0
		Rabi	74	32.0	77	36.8
5	KVK, Nana Kandhasar	*Kharif*	74	27.8	60	24.0
		Rabi	66	32.0	55	24.0
6	KVK, Pipalia	*Kharif*	40	23.0	70	23.0
		Rabi	30	13.0	30	13.0
	Total...		**650**	**275.8**	**933**	**359.2**

In Oilseeds, increased in yield in FLDs over local check was **10.22** per cent. In pulses, increased in productivity in FLDs over local check was **13.69** per cent.

Table 7.8 Increase in yield in FLDs over yield of check varieties

Crop	FLD (Yield Quintal/ha.)	Farmer's practice (Yield Quintal/ha.)	Increase yield over check (%)
Groundnut	21.10	18.82	12.09
Soybean	7.90	6.74	15.34
Cotton	22.86	20.30	12.61
Sesame	7.60	7.01	8.35
Green Gram	9.53	8.25	15.52
Gram	15.84	14.37	10.23
Wheat	44.77	41.34	8.30
Cumin	9.65	8.63	11.82
Pearl millet	28.14	25.4	10.67

7.6 Other Extension Activities

The Transfer of Technology (ToT) centers of the University had organized various extension activities like field days, farmers' days, field visits, exhibitions, farmers' shibirs, veterinary clinical camps, video shows, crop demonstrations, etc. and a large number of farmers/ farm women have participated in these activities. Other extension activities like farmers' days, group meetings, agricultural exhibitions, agricultural fairs, seminars, workshops, film shows, slide shows, guidance through letters and personal demonstrations, visitors, night meetings, agricultural publications, radio talks, television coverage, krishi goshties etc. were also conducted for the benefits of farming community by our main extension centers.

Table 7.9 Extension activities carried out by KVKs

Sr. No.	Name of Activities	Year	
		2014-2015	2015-16
1	Farmers Day/Field Day	57(1310)*	68(1995)
2	*Krushi mela*/Agri. Exhibition	10(197000)	48(36294)
3	Farmer/ Farm women *Khedut shibir*	53(3363)	67(4200)
4	Guidance on farm	325(1983)	850(2474)
5	*Parisanvad*/ Seminar / Workshop/ *Kisan Gosthi shibir*	69(15492)	140(4893)
6	Cattle Camp	20(1004)	06(902)
7	Film/ Slide/video show/ Radio talk/ TV programme	151(5784)	215(10082)
8	Guidance through letter/ telephone	(11725)	(11725)
9	Distribution of Agri. Literature	(23911)	(11041)
10	Press note	23	34
11	Demonstration	54(730)	25(768)
12	Subscription of *Krushi Govidhya* magazine	16	20
13	Guidance to visitors	442(13100)	1165(10270)
14	Publication of Agri. Literature	33	61
15	Lectures	451(46809)	552(62295)
16	Popular articles	45	38
17	Diagnostic team	82(446)	172(657)
18	Celebration of technology week	05(3689)	06(2990)

19	Vocational training	16(401)	16(493)
20	Sponsored/ Collaboration training	56(4271)	44(3167)
21	Field visit of scientist	274(970)	863(1920)
22	Soil sample analysis	(8801)	(6489)
23	Child day	00	00
24	Student (R A W E)	13(146)	12(594)
25	Parthenium week	03(338)	04(378)
	Total...	**2201 (341273)**	**4406 (173627)**

* Parenthesis indicates No. of Beneficiaries.

Technology Week at KVK Khapat

SAC meeting at KVK, Amreli

SAC meeting at KVK, Khapat

Training Programme on "Improved Agriculture Technology" at SSK, Junagadh

7.7 Centre of Communication (CoC) Scheme

Objectives of CoC Scheme

a. To establish the Gram Kisan Samities (GKS) in the rural areas.

b. To train the members of Gram Kisan Samities in leadership communication and cooperation for transfer of technologies.

c. To disseminate the latest agricultural and allied technologies through Gram Kisan Samities in rural areas.

d. To carry out different extension activities through Gram Kisan Samities (GKS) in different villages.

e. To know the feedbacks from the farmers.

Table 7.10 Different activities carried out by CoC

Sr. No.	Name of Activities	Year	
		2014-15	2015-16
1	Gram Kisan Samittee	16	22
2	Khedut Shibir**	06(399)*	09 (525)
3	Bakery Training	06(195)	03(121)
4	Three days on campus training programme	09(308)	03(115)
5	One day on campus training programme	12(433)	09(373)
6	Folder published	20	22
	Total...	**69(1335)**	**68(1134)**

* Parenthesis indicates No. of Beneficiaries.
** Khedut shibir were organized in 15 villages of four districts.

Training Programme on "Innovative Farmers' meet" at JAU Junagadh

Farmer Training under CoC Scheme at Vadala

Table 7.11 Farm literatures published

Sr. No.	Publication	Subject	No. of Publication
1	Folder published	Different subject	42
2	Booklet/Books	Different subject	09

7.8 Agricultural Technology Information Centre (ATIC)

ATIC centers are working at Junagadh, Jamnagar, Targhadia, Amreli, Khapat and Nana Kandhasar with the following objectives:

1. To provide a single window delivery system for the products and species available from JAU to the farmers and other interested groups as a process of innovativeness in technology dissemination.
2. To facilitate direct access to the farmers to the institutional research available in terms of technology, advice, technology products, etc. for reduction technology dissemination losses.
3. To provide mechanism for feedback from the users to the institute.

Table 7.12 Training programme conducted at various KVKs and SSK through ATIC for farmers / farm women / rural youth

Sr. No.	Centre	Name of Training	2014-2015		2015-16	
			No.	Ben.	No.	Ben.
1	KVK, Amreli	All subjects	22	673	11	381
2	KVK, Targhadia	All subjects	8	283	4	136
3	KVK, Jamnagar	All subjects	5	140	14	613
4	KVK,Khapat	All subjects	8	268	7	279
5	KVK, Nana Kandhasr	All subjects	6	176	4	199
6	SSK, Junagadh	All subjects	3	145	8	551
		Total...	**52**	**1685**	**48**	**1546**

Table 7.13 Extension activities carried out by different ToT by ATIC

Sr. No.	Activities	2014-15		2015-16	
		No.	Beneficiaries	No.	Beneficiaries
1	Technology info	248	9390	145	12891
2	Telephonic guidance	-	4998	-	5985
3	Video Show	15	1160	12	1395
4	Letter received & replied	-	12	-	12
	Total...	**263**	**15560**	**157**	**20283**

Table 7.14 Technology products sold by ATIC to end users

Sr. No	Name of product	2014-15		2015-16		Total	
		Quantity	Amount (Rs.)	Quantity	Amount (Rs.)	Quantity	Amount (Rs.)
1	Seeds	10,710.64 Qtl.	55,53,500	1668.55 Qtl	85,08,534	12,379.19 Qtl.	1,40,62,034
2	Planting materials	2,80,030 No.	28,00,300	36480 No.	5,83,970	316510 No.	33,84,270
3	Bio products	42610 Kg.	29,82,830	45389 Kg.	1,17,41,560	87999 Kg.	1,47,24,390
4	Milk	2212 Lit.	46,452	2332 Lit.	50,327	4544 Lit.	96,779
5	Fruits	27.38 Qtl.	29,160	30.27 Qtl.	32,255	57.65 Qtl.	61,415

7.9 Information and Reception Centre at Junagadh

Information and reception centre is situated near the main gate of the campus. Visitors can get all the information about the various activities of the University. Farmers can also get the solution of their problems related to farming. Telephonic helpline service is also provided by the centre.

Table 7.15 Other training Programmes conducted

Sr. No.	Name of the training	Duration days	No. of Trainees
1	Training Programme on Crop's Grown in Green House/ Net house	February 04-18, 2015	25
2	ATMA Farmer's Friend Training Progra mme for the " Control of Pink Bollworm in Cotton"	August 11-12, 2015	106
3	Mahila Kausaliyvarghan Talim	March 04, 2016	120
4	Innovative Farmer's meet	March 08-09, 2016	154
5	Unnat Bharat Abhiyan-Farm Women Training	March 25-30, 2016	30

Distribution of Certificate during Training Programme on Crops grown in Green House/ Net house to Farmers at JAU, Junagadh

Training programme of MRS Second year for Master degree students of Lok Bharti, Lok Seva Mahavidyalaya, Sanosara, Dist. Bhavnagar conducted at JAU Junagadh for 30 and 32 trainees during 12-25 july,2014 and 10-14 August, 2015 respectively

Table 7.16 Collaborative training programmes conducted

Sr. No.	Name of training	Duration	Organizer	No. of Trainees
1	"Scientific Cotton Cultivation & its economics"	July 10-11, 2014	Action for Food Production (AFPRO), NGO, Dhoraji	78
2	Training Programme on "Agricultural Knowledge Management"	October 13-16, 2014	National Institute of Agriculture Extension Management (MANAGE) Hyderabad	32
3	AGR-6 (Cotton Mini Mission)	November 3-4, 2014	Joint Director of Agriculture and Di rectorate of Extension Education	25
4	"Scientific Cultivation of Cotton Crop"	June 4-5, 2015	Spectrum International Pvt. Ltd, Surendranagar	55
5	Training Programme on "Scientific cultivation of Agri., Horti. crops & management practices of bakery & Animal husbandry"	August 5-7, 2015	ATMA, Prantij (Sabarkantha)	50

6	"Improved Agriculture Technology"	November 16-19, 2015	IFFCO, Junagadh	35
7	Training Programme on "Improved Agriculture Technology"	November 28-30, 2015	IFFCO, Rajkot	35

Table 7.17 Khedut Shibir and Diagnostic Team

Sr. No.	Subject	Year	No. of Activities	No. of Scientists allotted	Beneficiaries
1	*Khedut Shibir*	2014-15	27	3-4	6102
2	Diagnostic Team		08	4-5	464
3	*Khedut Shibir*	2015-16	23	3-4	5963
4	Diagnostic Team		07	4-5	397

7.10 Coordination of Extension Education Activities with Department of Agriculture, Horticulture, Animal Husbandry and other Departments

The Junagadh Agricultural University planned and carried out various extension education programmes/activities in close coordination with line departments of the state. The structural linkages exist under Training and Visit System by way of constituting the technical committee at district, zonal and state levels.

The functional linkages also exist under T &V system or scheme through bi-monthly workshop, pre-seasonal training, fortnightly training, diagnostic team, state level crop seminar / workshop etc. The coordination exists in follow-up programmes as well as in planning of farm trials. In ZREAC and AGRESCO meeting, the officers of line departments are the members and they contribute in formulation of technical programmes as well as finalizing the recommendations for the farmers. The agricultural programmes of All India Radio as well as Doordarshan are being finalized by such coordinated efforts. For wide spread transfer of technologies to the farmers, farmers' day, Krushi Mela, group discussion, etc. are organized by collaborative efforts.

Krushi Mahotsav

Government of Gujarat has started the celebration of Krushi Mahotsav in 2005-06. Under the Krushi Mahotsav, Junagadh Agricultural University spared services of scientists to advise the farming community about the latest agricultural recommendations. The officers of all line departments and agricultural scientists are visiting various villages/talukas along with krushi rath. Thus, every year, the farmers' awareness and curiosity has been increased which could be reflected from the farmer's participation in krushi mahotsav 2014 and 2015. Hence, during the last two years, scientific agricultural information reached to the farmers and farm women of Saurashtra region. They adopted the same therefore, the income of farmers increased to more than double. Their standard of living and economic condition is also improved. Not only this, they have also increased the number of milking animals. By this way farm women also became helpful to their family.

In the year 2014, about 2,21,549 farmers and farm women took the benefit of the experts. Moreover, one mega Krushi Mela was also organized at Morbi, more than 25,680 farmers and farm women became aware about the latest agricultural practices after visiting this mela. Two seminars on different subjects were organized at Morbi. In this seminar 450 farmers got benefitted from scientists of the University.

In the year 2015, about 1,96,174 farmers and farm women took the benefit of the experts of Agricultural University. During this Krushi Mahotsav, one seminar was organized at Shihor. In this

seminar 302 farmers got benefitted. Moreover, one Mega krushi Mela was also organized at Shihor, where more than 26,321 farmers and farm women become aware about the latest agricultural practices after visiting this mela.

Table 7.18 Beneficiaries of Krushi Mahotsav

Sr. No.	District	Beneficiaries	
		2014-2015	2015-2016
1	Junagadh	28085	28222
2	Rajkot	16994	22092
3	Bhavnagar	30941	23893
4	Amreli	55939	19175
5	Surendranagar	26045	20760
6	Jamnagar	11924	16515
7	Porbandar	8008	14473
8	Devbhumi Dwarka	9682	10547
9	Morbi	14289	13256
10	Gir Somanath	9863	20034
11	Botad	9779	7207
	Total...	**221549**	**196174**

Hon'ble VC Dr. A.R. Pathak & Agri. Minister Shri Babubhai Bokhiria welcoming to Hon'ble Chief Minister Smt. Anandiben Patel at Shihor

Hon'ble VC Dr. A.R. Pathak giving welcome speech in the Krishi Mela- 2015 held at Shihor

Hon'ble Chief Minister Shrimati Anandiben Patel giving inaugural speech in the Krishi Mela- 2015 held at Shihor

A large number of Farm women remain present in the Krishi Mela- 2015 held at Shihor

Celebration of Technology Week
at KVK Nana Kandhasar

Field Day Organized by KVK,
Pipaliya (Dhoraji)

Inauguration of "Junagadh Janavani-91.2 FM"
Community Radio Station, JAU, Junagadh.

MOU signed between JAU, Junagadh &
Dhanuka Agritech Ltd. for Diploma in Agril.
Ext. Services for input dealers.

Inauguration of World Soil Health
Day at KVK, Nana Kandhasar

Inauguration of World Soil Health
Day at KVK, Pipalia

CHAPTER - VIII
BUDGET ESTIMATES AND EXPENDITURE

University receives grants from the State Government as per section-47 of the Gujarat Agricultural Universities Act 2004. The University also receives grants from Indian Council of Agricultural Research, Government of India and other Agencies.

The financial resources and expenditure of the Junagadh Agricultural University for the year 2014-15 and 2015-16 are given in table 8.1.

The Budget Estimate for the University is classified according to the activities such as Education, Research, Extension Education, Administration and Works (Uni. Development).

Table 8.1 Budget Estimates and Expenditure of Junagadh Agricultural University for the

Year 2014-2015							**(Rs. in Lakhs)**
Sr. No.	**Particulars**	**Budget Estimates**			**Expenditure**		
		Plan	**Non-Plan**	**ICAR & Others**	**Plan**	**Non-Plan**	**ICAR & Others**
1	**Education**						
	a. State Spons. Scheme	5779.31	4831.16	50.40	4574.56	4975.24	48.87
	b. University Devep.(ICAR)	-	-	372.77	-	-	417.59
2	**Research**						
	a. State Spons. Schemes	2928.81	2625.30	379.29	2792.18	1625.34	346.62
	b. ICAR Projects	-	-	1065.90	-	-	770.89
3	**Extension Education**						
	a. State Spons. Schemes	524.94	15.65	102.20	524.94	18.65	211.65
	b. ICAR Projects	-	-	353.99	-	-	376.65
4	**Other Receipts**	-	956.59	216.73	-	-	-
	Total...	**9233.06**	**8431.70**	**2541.28**	**7891.68**	**6619.23**	**2172.27**
Year 2015-2016							**(Rs. in Lakhs)**
Sr. No.	**Particulars**	**Budget Estimates**			**Expenditure**		
		Plan	**Non-Plan**	**ICAR & Others**	**Plan**	**Non-Plan**	**ICAR & Others**
1	**Education**						
	a. State spons. Schemes	5334.95	5490.28	26.54	5084.90	6497.16	10.18
	b. University Devep. (ICAR)	-	-	340.72	-	-	339.57
2	**Research**						
	a. State Spons. Schemes	2791.46	2314.41	1558.49	3188.53	1981.18	707.90
	b. ICAR Projects	-	-	863.69	-	-	973.60
3	**Extension Education**						
	a. State Spons. Schemes	1397.22	18.90	176.17	923.91	21.40	139.34
	b. ICAR Projects	-	-	411.97	-	-	410.47
4	**Other Receipts**	-	486.00	401.43	-	-	-
	Total...	**9523.63**	**8309.59**	**3779.01**	**9197.34**	**8499.74**	**2581.06**

CHAPTER - IX
INFRASTRUCTURE FACILITIES

Table 9.1 Statement Showing the Details of Infrastructure Facilities Expenditure

Year 2014-15			
State Plan			
Sr. No.	**Name of Work**	**Scheme**	**Expenditure Rs. in Lakh**
1	Construction of Farm protection wall, Dhari	State Plan	20.10
2	Construction of Implement shed, Dhari	State Plan	12.74
3	Construction of Rat proof godown oil seed, Junagadh	State Plan	24.43
4	Renovation of office Bio. Lab, Quarter, Godown Repairing, Mahuva	State Plan	12.50
5	Construction of Rat proof godown oil seed, Manavadar	State Plan	12.87
6	Construction of Farm protection wall, Talaja	State Plan	21.84
7	Construction of Farm protection wall, Kukada farm	State Plan	56.73
8	Construction of Rat proof godown, Kukada farm	State Plan	11.47
9	Construction of Waste water drainage, Junagadh	State Plan	22.28
10	Construction of Farm protection wall, Halvad	State Plan	48.00
11	Campus Development	State Plan	48.72
12	Construction of Agriculture College Building, Amreli	State Plan	598.38
13	Construction of College Building for Polytechnic in Horticulture, Junagadh	State Plan	129.96
14	Construction of Hostel Building for ITI, Mahuva	State Plan	65.05
15	Construction of Hostel Building for Agriculture College, Mota Bhandaria (Amreli)	State Plan	210.00
16	Construction of Polytechnic in Agril. Engg. College, Taraghadia	State Plan	163.92
17	Construction of Farm Protection wall, Kukada	State Plan	0.15
18	Repairing & Renovation of Laboratory building, Kukada Phase I	State Plan	5.17
19	Construction of Instructional Livestock Farm Complex Veterinary College, Junagadh	State Plan	5.97
20	Construction of Clinical Complex for Veterinary College, Junagadh	State Plan	6.31
21	Extension of Girls Hostel Building, Junagadh	State Plan	7.19
22	Construction of College Building for Fisheries College, Veraval	State Plan	23.27
		Total...	**1215.37**
Minor Original Works			
1	Minor Original Works (M.O.W.)	State Plan	10.00
2	Maintenance & Repairing	State Plan	26.00
		Total...	36.00
		Grand Total…	**1543.05**
Agricultural College			
1	Repairing and Renovation of U.G. Hostel No. 2, 3, 4, Junagadh	ICAR Development	22.24
2	Repairing of Toilet Block of Hostel No. 2, 4, Junagadh		
3	Repairing and Renovation of Gymkhana, Junagadh		
Agril. Engg. & Tech. College			
1	Repairing and Renovation of Agril. Engg. & Tech. College and Hostel, Junagadh	ICAR Development	22.48
2	Repairing and Renovation of Toilet Block for Mangal Nivas, Junagadh		

3	Repairing and Renovation of Mangal Nivas Building, Junagadh		
Veterinary College			
1	Repairing, Renovation and Construction of Sheep and Goat Pen for Veterinary College , Junagadh	ICAR Development	7.41
Indoor Sports Stadium			
1	Repairing and Renovation of Indoor Sports Stadium, Junagadh	ICAR Development	2.70
2	Providing & Fixing ECO friendliness Acoutic Gypsum Ceiling and Wall Paneling for Indoor Sports Stadium, Junagadh		
		Total	**54.83**

Year 2015-16

State Plan

Sr. No.	Name of Work	Scheme	Expenditure Rs. in Lakh
1	Construction of Hostel Building for Agriculture College, Mota Bhandaria (Amreli)	State Plan	198.60
2	Construction of Office Cum Laboratory Building, Mahuva	State Plan	30.11
3	Construction of Polytechnic in Agri. Engg. College, Taraghadia	State Plan	68.70
4	Construction of Farm protection wall at Sagdividi Farm, Junagadh	State Plan	14.80
5	Construction of Implement Shed at Grassland Research Center, Dhari	State Plan	13.50
6	Construction of Farm Protection wall (Phase-II), Kukada	State Plan	78.74
7	Repairing & Renovation of Laboratory building, Kukada	State Plan	9.18
8	Construction of Farm Protection wall at Oilseed, Manavadar	State Plan	78.99
9	Construction of Farm Protection wall, Jam khambhaliya	State Plan	49.31
10	Construction of Compound Wall for (Phase-1) Agriculture College, Mota Bhandaria (Amreli)	State Plan	65.45
11	Construction of Farm Protection wall For (Phase-1) Sugarcane Research Centre, Kodinar	State Plan	50.00
12	Construction of Rat Proof Godawn, Talaja	State Plan	8.62
13	Construction of Implement Shed, Vallabhipur	State Plan	16.90
14	Construction of Approach Road at Bull Mother Farm (Phase-1), Amreli	State Plan	50.00
15	Construction of R.C.C. Approach Road (Phase-1), Kukada	State Plan	25.00
16	Construction of Implement Shed , Kukada	State Plan	10.00
17	Construction of Farm Protection wall For (Phase-1), Manavadar	State Plan	40.00
18	Construction of R.C.C. Approach Road Sugarcane Research Centre, Kodinar	State Plan	35.00
19	Renovation of Staff Quarter Building, Halvad	State Plan	12.50
20	Construction of Farm Protection Wall for Polytechnic in Agriculture, Dhari	State Plan	30.00
21	Campos Development	State Plan	74.35
22	Construction of Instructional Live Stoke Farm Complex Veterinary College, Junagadh	State Plan	164.36
23	Construction of Clinical Complex For Veterinary College, Junagadh	State Plan	221.62
24	Extension of Girls Hostel Building , Junagadh	State Plan	276.42
25	Construction of College Building for Fisheries College, Veraval	State Plan	467.32
26	Construction of Farm Protection Wall, Okha	State Plan	25.86
27	Construction of Office Building for Centre of Remote Sensing and GEO Informatics at C.A.E.T., Junagadh	State Plan	2.39

28	Construction of Girls Hostel Building for Agriculture Engineering & Technology College, Junagadh	State Plan	6.53
29	Construction of Girls Hostel Building for Agriculture College, Amreli	State Plan	8.83
30	Construction of Dean, Rector & Assistant Rector Quarter for Agriculture College, Amreli	State Plan	0.06
31	Construction of Post-mortem Room, Antemorterm Room, Mini Slater House, Poultry Slater House at Veterinary College, Junagadh	State Plan	10.54
32	Construction of Approach Road for New Campus at Fisheries College, Veraval	State Plan	7.43
33	Construction of Boys Hostel for Polytechnic in Agriculture Engineering, Taraghadia	State Plan	82.18
34	Construction of Girls Hostel for Polytechnic in Agriculture Engineering, Taraghadia	State Plan	0.06
35	Construction of Girls Hostel Building for Polytechnic in Agri., Dhari	State Plan	20.17
36	Renovation of Hostel Building, Halvad	State Plan	32.03
37	Construction of Agro Base ITI College Building, Junagadh	State Plan	2.49
38	Construction of Ret Proof Godown For Agri. School, Halvad	State Plan	9.12
39	Construction of College Building for Polytechnic in Agro Processing, Junagadh	State Plan	5.85
		Total	**2303.01**
Minor Original Works			
1	Minor Original Works (M.O.W.)	State Plan	9.99
2	Maintenance & Repairing	State Plan	27.99
		Total...	**37.98**
		Grand Total…	**2340.99**
I.C.A.R. Strengthening and Development			
College of Agril. Engg. & Tech.			
1	Mangal Nivas	ICAR Development	1.09
Registrar			
1	Exam Hall	ICAR Development	10.00
Director of Student Welfare			
1	Auditorium	ICAR Development	7.35
1	Repairing, Renovation, Refurbishing Modernization and maintenance of existing structure including model class rooms and PG Laboratories, Other Infrastructural Facilities for Education *etc.*	ICAR Development	0.71
1	Computer related to Instructions /education. Replacement of old and obsolete equipments *etc.*	ICAR Development	2.48
		Total	**21.63**

Vivekanand Hostel

Krishikar Atithi Bhavan

Atic Building

Polytechnic in Home Science, Dhari

Farmer's Hostel, Dhari

Seed Processing Unit

Food Testing Laboratory

College of Horticulture, Junagadh

Biochemistry Laboratory

Sardar Valabhbhai Patel Hostel

Chanakya Hostel

Dry Farming Res. Station, Nana Kandhasar

Krishi Vigyan Kendra, Amreli

PGIABM, Junagadh

Conference Hall, Veterinary College

Health Centre

CHAPTER - X
LINKAGES ESTABLISHED WITH ICAR, NATIONAL INSTITUTES AND OTHER STATE AGRICULTURAL UNIVERSITIES

Linkages are established for teaching, research and extension activities with international, national and other institutes by the university.

International Institutes

- International Crop Research Institute for Semi-Arid Tropics (ICRISAT), Hyderabad
- University of Venda, South Africa
- Massachusetts Institute of Technology, USA
- Saskatchewan University, Canada
- IOWA State University of Science & Technology, Ames, USA
- Cornell University, Ithaka, New York, USA
- ICRISAT- HOPE Project funded by Bill & Melinda Gates Foundation, USA
- International Potash Institute, Switzerland
- University of California, Davis
- Pennsylvania State University, USA
- Phosphate Potash Institute, Canada

ICAR

- Indian Council of Agricultural Research, New Delhi
- Indian Institute of Soil Science, Bhopal
- Indian Agricultural Statistics Research Institute, ICAR, New Delhi
- Central Institute of Fisheries Education, Mumbai
- National Academy of Agricultural Research Management (NAARM), Hyderabad
- National Institute of Agricultural Extension Management (MANAGE), Hyderabad
- National Research Centre for Onion & Garlic, Pune
- Directorate of Groundnut Research, Junagadh
- Central Institute of Agricultural Engineering (CIAE), Bhopal
- National Centre for Agricultural Economics and Policy Research, New Delhi
- Central Research Institute for Dryland Agriculture, Hyderabad
- Central Institute of Post-Harvest Engineering & Technology (CIPHET), Ludhiana
- Water Technology Centre for Eastern Region (WTCER), Bhubeneshwar
- Directorate of Weed Science, Jabalpur
- Central Institute for Cotton Research, Nagpur
- Directorate of Wheat Research, Karnal
- Indian Institute of Horticulture Research, Banglore
- Indian Institute of Vegetable Research, Varanasi
- National Bureau of Fish Genetic Resources, Lucknow

National Institutes

- Potash Research Institute of India, Gurgaon
- Department of Agriculture and Cooperation, New Delhi
- Department of Science and Technology, New Delhi
- Indian Meteorological Department (IMD), Pune
- Ministry of Non-conventional Energy Sources, New Delhi
- Space Application Centre (SAC), ISRO, Ahmedabad
- National Institute of Hydrology, Roorkee
- Agricultural and Processed Food Products Development Authority, New Delhi
- Indian Institute of Management, Ahemedabad.
- National Horticultural Research and Development Foundation, Nasik
- Ministry of Food Processing Industries, New Delhi
- Gujarat State Biotechnology Mission, Gandhinagar
- ASPEE Agricultural Research and Development Foundation, Mumbai
- Coconut Development Board, Kochi
- Indian National Center for Ocean Information Services, Hyderabad

State Universities

- Navsari Agricultural University, Navsari
- Anand Agricultural University, Anand
- Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar
- Kamdhenu University, Gandhinagar
- Saurashtra University, Rajkot
- Gujarat Ayurveda University, Jamnagar
- Bhavnagar University, Bhavnagar
- KSKV Kachchh University, Bhuj
- S.V.P. University, V.V.Nagar
- Punjab Agricultural University, Ludhiyana.
- Gujarat Technology University, Gandhinagar.
- Maharana Pratap University of Agriculture and Technology, Udaipur.

State Level Agencies

- Gujarat State Department of Agriculture, Gandhinagar
- Gujarat State Department of Horticulture, Gandhinagar
- Gujarat State Department of Animal Husbandry, Gandhinagar
- Gujarat State Department of Forest and Environment, Gandhinagar
- Commissionerate of Fisheries, Gandhinagar.
- Commissionerate of Rural Development, Gandhinagar.
- Gujarat Water Resources Development Corporation (GWRDC), Gandhinagar
- Gujarat State Seeds Corporation, Gandhinagar

- Gujarat Agro Industries Corporation, Ahmedabad
- Gujarat Green Revolution Company (GGRC), Vadodara
- Gujarat State Land Development Corporation, Gandhinagar
- Rural Development Corporation, Gandhinagar
- Gujarat Dairy Development Corporation, Ahmedabad
- Gujarat State Fertilizer Company, Vadodara
- Gujarat Narmada Valley Fertilizer Company, Bharuch
- Krishak Bharati Fertilizer Co-operative, Hajira
- Indian Farmers Fertilizer Co-operatives, Kalol
- National Bank of Agriculture & Rural Development, Ahmedabad
- Centre for Environment Planning and Technology, Ahmedabad
- Bhaskaracharya Institute for Space Applications and Geo-Informatics (BISAG), Gandhinagar
- Gujarat Livelihood Promotion Company Ltd., Gandhinagar
- Gujarat State Biotechnology Mission, Department of Science & technology, Government of Gujarat, Gandhinagar
- Krishi Vidyapeeths of Gujarat state
- Sardar Sarovar Narmada Nigam Ltd., Gandhinagar
- Sardar Patel Renewable Energy Research Institute (SPRERI), Vallabh Vidyanagar
- Rajkot District Co-operative Milk Producers Union Limited (Rajkot Dairy), Rajkot, Gujarat

Others

- Jain Irrigation Systems Ltd., Jalgaon
- Veraval Industries Association, Veraval
- Gujarat Life Sciences Pvt. Ltd., Vadodara
- Ambuja Cement Foundation, Kodinar
- Vivekanand Research and Training Institute, Mandvi
- Aga Khan Rural Development Support Programme, Ahmedabad
- United Phosphate Limited, Mumbai
- Pesticides and Insecticides Agencies
- Seed Agencies
- Farmer's Co-operatives
- Mahindra & Mahindra Limited, Mumbai
- Netafilm, Vadodara
- Indian Oilseeds and Produce Export Promotion Council (lOPEPC), Mumbai

Glimpse of the Organic Farming

JUNAGADH AGRICULTURAL UNIVERSITY
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Website : www.jau.in