Chapter - IV
RESEARCH

4.1 Agricultural Research Council

The Agricultural Research Council was constituted according to the provision of the Gujarat Agricultural Universities Act 2004 in exercise of the power vested under Section 62(1) in pursuance of Section 17(5). Dr. C.J. Dangaria supervised and guided the research activities during the reporting year.The members of Agricultural Research Council during 2011-12 were as under.

No.	Name	Designation
1	Dr. N. C. Patel	Vice Chancellor (Chairman)
2	Dr. C. J. Dangaria	Director of Research & Dean, P.G. Studies (Secretary)
3	Dr. A. M. Parakhiya	Director of Extension Education
4	Dr. I. U. Dhruj	Associate Director of Research
5	Dr. Pramod Mohnot	Associate Director of Research
6	Dr. K. N. Akbari	Associate Director of Research
7	Dr. A. V. Barad	Dean, Agricultural Faculty
8	Prof. J. B. Savani	Dean, Agril. Engineering & Technology Faculty
9	Dr. A. Y. Desai	Dean, Fisheries Science Faculty
10	Dr. R. R. Shah	Dean, Veterinary Science & Animal Husbandry Faculty
11	Dr. K. A. Khunt	Principal, PG Institute of Agri. Business Management
12	Dr. K. L. Dobariya	Research Scientist (Groundnut)
13	Dr. K. L. Raghvani	Research Scientist (Millet)
14	Dr. P.U. Gajbhiye	Research Scientist (Animal Genetics)
15	Dr. K. L. Jetani	Research Officer (Fisheries)
16	Dr. M. D. Khanpara	Research Scientist (Cotton)
17	Dr. R. Subbaiah	Research Scientist (Agril. Engg.)
18	Dr. P. K. Kapadia	Research Scientist (Fruit Crop)
19	Dr. R. L. Shiyani	Professor & Head, (Agricultural Economics)
20	Dr. B. A. Golakiya	Professor & Head, (Biochemistry)
21	Dr. M. N. Kapadia	Professor & Head, (Agril. Entomology)
22	Dr. R. S. Chovatia	Professor & Head, (Horticulture)
23	Dr. P. M. Chauhan	Professor & Head, (Renewable Energy & Rural Engg.)

4.2 Brief Report of Research Activities

The Junagadh Agricultural University comprises of seven districts covering 32.82 per cent area of the Gujarat state. The university is functioning in a typical arid and semi-arid situation where frequent droughts, erratic rainfall, low fertility and salinity ingress are the major constraints for productivity and prosperity of agriculture in this region. The University represents mainly two Agro-climatic Zones *viz.,* North and South Saurashtra Agro-climatic Zones.

Junagadh Agricultural University has five colleges, 30 research stations which include multidisciplinary main research stations, research stations on various crops and research stations/testing centres spread over the North Saurashtra Agro-climatic Zone and South Saurashtra Agro-climatic Zone. These research stations are working in the field of Agriculture, Agricultural Engineering, Animal Sciences and Fisheries for catering the needs of farmers, artisans, livestock holders, fishermen and rural masses for their

upliftment. At these research stations, scientists are working hard with sincere efforts for development of high yielding varieties, new improved agronomical practices and eco-friendly strategies for pest & diseases management. The research work is also undertaken on natural resource management (bio-diversity, land & water uses), improved farm equipments, post harvest processes, protected cultivation and renewable energy. Research efforts are continuing for improvement of cattle breeds, nutritive cattle feeds, fisheries and allied industries. Apart from these, agricultural information related to latest technology and techniques are disseminated for end users through five *Krishi Vigyan Kendras* of the University. The research activities, research accomplishments and recommendations, achievements made by the Junagadh Agricultural University during 2011-12 are given hereunder.

I. Crop Improvement

Four varieties/hybrid, of different crops *viz.,* Brinjal GJB-3; Indian bean (*Papdi*) GJIB-2; Ridge gourd GJRGH-1 and Sesame G. Til-3 were recommended for cultivation to the farmers for the state and one new technical programme formulated during 2011-12.

A. Vegetable Research Station, JAU, Junagadh

Brinjal: Gujarat Junagadh Brinjal-3 (GJB-3)

The farmers of Gujarat, growing brinjal during late *kharif* (15th August to 15th September) season are advised to grow brinjal variety Gujarat Junagadh Brinjal-3 (GJB-3). The variety was developed from a cross JNDB-37 x JNDB-92. This variety has recorded mean fruit yield of 393.9 q/ha, which was 43.6 and 29.3 per cent higher over checks varieties JBGR-1 (274.25 q/ha) and GOB-1 (304.56 q/ha), respectively. The fruits of GJB-3 are medium to big in size and oval in shape with green colour and good shining. Fruit pulp is creamy white with less seed. The plants are medium in size and semi spreading. The variety is relatively tolerant to little leaf disease and jassid compared to checks *viz.,* JBGR-1 and GOB-1.

Indian Bean (*Papdi*): Gujarat Junagadh Indian Bean-2 (GJIB-2)

The farmers of Saurashtra and middle Gujarat, growing Indian bean (*Papdi*) during late *kharif* (15th August to 15th September) season are advised to grow Indian bean (*Papdi*) variety Gujarat Junagadh Indian Bean-2 (GJIB-2). The variety was developed from a cross JNDIB-88 x JNDIB-23. The variety GJIB-2 has recorded a green pod yield of 112.5 q/ha, which was 25.6 per cent higher over check variety Gujarat Papdi-1 (89.56 q/ha). The pods of this variety are tender, flat and medium long in shape with green colour. The immature seed colour is light green and inflorescence length is more as compared to Gujarat Papdi-1. The plants are semi spreading; leaf spot and leaf blight disease intensity are less than Gujarat Papdi-1. Pod borer damage is at par with check.

Ridge Gourd: Gujarat Junagadh Ridge Gourd Hybrid-1 (GJRGH-1)

The farmers of Saurashtra and Middle Gujarat, growing ridge gourd during *kharif* season are advised to grow Gujarat Junagadh Ridge Gourd Hybrid-1 (GJRGH-1). This is a first public sector ridge gourd hybrid developed at Junagadh from a cross combination of JRGL-11 x JRGL-32. This hybrid recorded a fruit yield of 113.30 q/ha, which was 24.6 per cent higher over national check variety Pusa Nasdar (90.96 q/ha). The fruits of GJRGH-1 are long in size with green colour. It is moderately resistant to downy mildew and major pests.

B. Agricultural Research Station, JAU, Amreli

Sesame: Gujarat Til-3 (Endorsement for summer season)

The farmers of Saurashtra region growing sesame under summer season are advised to grow sesame variety Gujarat Til-3. This variety has recorded seed yield of 1200 kg/ha, which was 7.6 per cent higher than check variety Gujarat Til-2 (1115 kg/ha). The seeds of G.Til-3 variety are white and bold containing 47.3 per cent oil and suitable for export. Disease and pest reactions are comparable with the check Gujarat Til-2.

II. Crop Production

This group has released 14 farmers' recommendations which are briefed here in. It has also undertaken 25 new technical programmes.

Recommendation for farming community

1. Nutrient Management

Fertilizer management in cotton + sesame (1:1) intercropping system under dry farming condition

The farmers of North Saurashtra Agro-climatic Zone (AES XV) adopting hybrid cotton + sesame (1:1) intercropping system under rainfed condition are advised to apply 40 kg N/ha to cotton and 25 kg N/ha + 12.5 kg P_2O_5/ha to sesame for getting higher yield and net return.

Fertilizer management in cotton + sesame (1:1) intercropping system under dry farming condition

The farmers of North Saurashtra Agro-climatic Zone (AES X) adopting cotton + sesame (1:1) intercropping system under rainfed condition are advised to apply 80 kg N/ha to cotton and 25 kg N/ha +12.5 kg P_2O_5/ha to sesame crop for getting higher yield and net return.

Effect of nitrogen and bio fertilizer on yield of *shaniar* grass (*Sehima nervosum*)

The farmers of North Saurashtra Agro-climatic Zone growing *shaniar* grass (*kharif*) are advised to apply 60 kg N/ha in two equal splits first at 10 days after first rain and second at 30 days after first application for getting higher fodder yield.

Effect of phosphorus with and without K_2O on yield of *anjan* grass

The farmers of North Saurashtra Agro-climatic Zone growing *anjan* grass in (*kharif*) are advised to apply 60 kg P_2O_5/ha as a basal dose along with recommended dose of 20 kg N/ha (10 kg as basal + 10 kg/ha at 30 DAS) for getting higher fodder yield.

Effect of potassium and zinc on yield and quality of fodder jowar under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone (AES-XIV) growing fodder sorghum (*kharif*) are advised to apply 40 kg K_2O + 20 kg $ZnSO_4$/ha along with recommended dose of fertilizers (80:40 kg NP/ha) for getting higher fodder yield.

Effect of application of potassium and zinc on growth, yield and nutrients uptake by onion and its residual effect on *kharif* groundnut in medium black calcareous soil

The farmers of South Saurashtra Agro-climatic Zone adopting onion-groundnut sequence in medium black calcareous soil are advised to apply 75 kg K_2O/ha in two splits *i.e.* ½ K_2O as basal + ½ at 30 DAS besides 25 kg $ZnSO_4$/ha and recommended fertilizer dose (75:60 kg NP/ha) to onion crop for getting higher yield and net return.

Bt. cotton response to potash with and without zinc

The farmers of South Saurashtra Agro-climatic Zone growing irrigated Bt. cotton on medium black calcareous soil are advised to apply potassium @ 150 kg/ha as basal or in two splits (*i.e.* 1/2 as basal + 1/2 at 30 DAS) along with 50 kg zinc sulphate per hectare in addition to recommended fertilizer dose (N 160 kg/ha-1) for getting higher yield and net return.

Balance fertilization in Bt. Cotton

The farmers of South Saurashtra Agro-climatic Zone growing Bt. cotton on medium black calcareous soil are advised to apply 10 t FYM/ha + 240 kg N/ha (four splits, 25% at sowing and remaining three equal splits at 30, 60 and 90 DAS) and @ 50 kg P_2O_5/ha as basal for getting higher yield and net return.

Effect of soil amendments on different geno-types of gram under salt affected soil

The farmers of South Saurashtra Agro-climatic Zone having sodic soil are recommended to grow gram variety GG-4 or GG-1 and apply 10 t FYM/ha + gypsum @ 50% G.R. for getting higher yield and net return.

Integrated nutrient management in garlic on sandy loam soil of Saurashtra

The farmers of North Saurashtra Agro-climatic Zone (AES-X) growing garlic are advised to apply 75% RDF (37.5:37.5:37.5 NPK kg/ha) along with either 2.5 t FYM/ha or castor cake 300 kg/ha for obtaining higher yield and net realization.

Integrated nutrient management for *bajra*-cotton rotation under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone (AES-XV) adopting *bajra*-cotton rotation are recommended to apply 50 per cent of recommended dose of fertilizers (*bajra* 40:20 kg NP /ha and cotton 40 kg N/ha) along with castor cake @ 900 kg/ha for getting higher yield and net realization.

Evaluation for the potentiality of bio-fertilizer and organic resources for sustaining sesame yield under rain fed condition

The farmers of Western *Bhal* and Coastal Zone (AES-1(a), 1(b) and 3) growing sesame under rainfed condition are advised to apply 50% of recommended dose of fertilizers *i.e.* 12.5:12.5 kg NP/ha along with 500 kg castor cake/ha and besides seed treatment of *Azotobacter* and PSB (CFU 108/g) each of 30 g/kg seed for getting higher yield and net realization along with 50% saving of fertilizers.

2. Package of Practices

Evaluation of different seed pellets on production of pasture grasses

The farmers of North Saurashtra Agro-climatic Zone growing *anjan* grass (*kharif*) are advised to prepare small balls containing seeds (40,000 balls/ha) using 200 kg soil + 200 kg FYM + 4 kg seeds mixture to get higher germination and fodder yield.

3. Weed Management

Weed management in *kharif* pearl millet

The farmers of North Saurashtra Agro-climatic Zone growing hybrid pearl millet during *kharif* season are advised to keep their field weed free through pre emergence application of atrazine @ 0.5 kg/ha (dissolve in 500 litres water) to obtain higher yield and net return.

III. Plant Protection

The research work carried out by plant protection group is to develop the economically viable technology for increasing production of agricultural commodities without any adverse effect on the environment and livelihood of the people. Three farmers' and five scientific recommendations from Agricultural Entomology group and two farmers' recommendations from Plant Pathology group were released. Further, 23 new technical programmes have also been formulated by plant protection group.

Recommendation for the farming community

Agricultural Entomology

Efficacy of newer insecticides against cabbage aphid

For effective and economical management of cabbage aphids under South Saurashtra Agro-climatic Zone, two spray of acetamiprid 20 SP 0.004% (2 g/10 litre water) at 15 day interval starting from aphid infestation are recommended. The waiting period of acetamiprid 20% SP (15 g. a.i./ha) should be maintained 7 days between last spray and harvesting of the crop.

Monitoring of *bajra* worm Helicoverpa *armigera* (Hubner) through sex pheromones during *kharif*

The farmers of North Saurashtra Agro-climatic Zone growing *kharif bajra* are advised to install sex pheromone traps for monitoring of adult male moths of ear head worm (*Helicoverpa armigera* Hubner) @ 5 traps/ha at 1 ft height above earhead after the formation of earhead.

Management of *Eriophyid* mites in coconut cv. DxT with nutrient and fertilizers

For the effective and economical management of *eriophyid* mite in hybrid coconut (D x T Mahuva), application of half dose of recommended chemical fertilizers (NPK 0.750: 0.375: 0.750 kg/palm/year) with 50 kg FYM, 1.5 kg gypsum and 0.075 kg borax/palm/year in June and remaining half dose of recommended chemical fertilizers (NPK 0.750:0.375:0.750 kg/palm/year) in October is recommended under South Saurashtra Agro-climatic Zone.

Plant Pathology

Integrated management of major diseases of groundnut

The farmers of South Saurashtra Agro-climatic Zone growing groundnut are advised to treat the seeds with tebuconazole 2% DS @1.5 g/kg and spray tebuconazole 250 EC @ 10 ml/10 l water at 45 and 60 days after sowing.

OR

Apply talc based *Trichoderma* @ 10 g/kg seed and @ 4 kg/ha with 250 kg castor cake in furrow at the time of sowing and spray hexaconazole 5 EC @ 10 ml/10 l water twice at 45 and 60 days after sowing for economic and effective control of soil borne (collar rot & stem rot) and foliar (tikka & rust) diseases. The waiting period of tebuconazole 250 EC (125 g a.i./ha) and hexaconazole 5 EC (100 g a.i./ha) should be maintained 49 and 30 days, respectively between last spray and harvesting of the crop.

Wilt management in chickpea

The farmers of the South Saurashtra Agro-climatic Zone growing irrigated chickpea during *rabi* season are advised to adopt seed treatment of carbendazim 1g + thiram 2 g/kg seed along with soil application of *Trichoderma viride* (106 cfu/g) @ 2.5 kg mixed in 250 kg either castor cake or FYM/ha at the time of sowing in furrow for management of wilt and to get higher seed yield.

Recommendation for the scientific community

Agricultural Entomology

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

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

Monitoring of fruit flies in mango orchard through methyl eugenol trap

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

Monitoring of fruit flies in mango orchard through methyl eugenol trap

In mango orchards of North Saurashtra Agro-climatic Zone, the population of fruit fly (*Bactocera dorsalis* Hendel) males was maximum during 1st week of April to last week of July (13th to 31st Met. Standard week). Its activity was related positively with maximum (32 to 42^{0}C) and minimum (21 to 27^{0}C) temperature and relative humidity (63 to 89%).

Monitoring of pod borer by pheromone trap in chickpea

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

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

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

IV. Horticulture & Agro-forestry

This group has released five farmers and two scientific recommendations which are briefed below. This group formulated two new technical programmes during 2011-12.

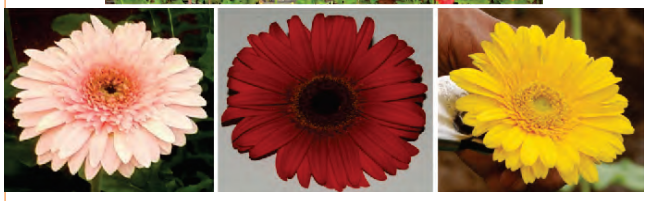
Recommendation for the farming community

Fertigation system in guava cv. Bhavnagar Red

The farmers of Saurashtra region growing guava cv. Bhavnagar Red (6 years and above old tree) for *Mrig Bahar* crop are advised, to apply 1.0 kg urea per plant through drip irrigation and 0.4 Kg MOP per plant in soil in four equal splits during June, August, October and December; while phosphorus (SSP-1.5 Kg) as a basal dose with drip system operating for 3.00 hours daily during October to December and 4.00 hours during January to March with 4 drippers per tree, each having discharge 4 lit. per hour keeping dripper 1.0 meter away from trunk of tree, which will save 40.69% irrigation water for higher production and income.

Varietal evaluation of gerbera (*Gerbera jamesonii*) under green house

The farmers of South Saurashtra Agro-climatic Zone, interested to cultivate gerbera flower crop under green house are advised to grow varieties Pink Elegance (pink), Savannah (red) and Dana Allen (yellow) for obtaining higher yield and income with good quality of cut flowers.



Integrated nutrient management in Sapota cv. Kalipatti

The farmers of South Saurashtra region growing sapota cv. Kalipatti are advised to apply full recommended dose of phosphorus and potash (450 g/plant P & K each) along with half dose of nitrogen (11.25 kg castor cake) and 100 g *Azatobacter* per plant during onset of monsoon and half recommended dose of nitrogen i.e. 450 g/plant during October to get higher fruit yield and net return.

Application of nutrients through root feeding of coconut cv. D x T (M)

The coconut growers of South Saurashtra Agro-climatic Zone are advised to apply full recommended dose of chemical fertilizer (1500, 750, 1500 NPK g/palm) and two dose each of 400 ml of nutrient solution in June and October [10 g each urea and murete of potash, 5 g zinc sulphate, 2 g ferrous sulphate, magnesium sulphate, manganese sulphate and borax each, 1 g copper sulphate, 10 mg sodium molybdate, 10 mg citric acid and 460 mg NAA (10 ml planofix) dissolved in one litre of water] through root feeding to get higher nut yield and net return in coconut cv. D x T (Mahuva).

Effect of soil amendment with organic materials on yield and quality of bottle gourd cv.Pusa Naveen under sodic soil and brackish water condition

Vegetable growers of South Saurashtra Agro-climatic Zone, growing bottle gourd cv. Pusa Naveen under sodic soil and brackish irrigation water condition are advised to apply FYM 5 t/ha along with half recommended dose of chemical fertilizer *i.e.* 50:25:25, N:P:K kg/ha and poultry manure 3.3 t/ha to get maximum yield and net return.

Recommendation for scientific community

Response of different genotypes of custard apple to weather parameters

The climatic parameters like temperature, humidity and rainfall influenced the flowering, fruit setting, fruit retention percentage, fruit yield and disease-pests incidence. More humidity and off

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

Survey of coconut gardens in Gujarat state

From the survey of five districts of South Saurashtra and South Gujarat region, it was observed that only 14.29% farmers are growing hybrid coconut varieties (D x T and T x D) and 45.71% farmers preferred seedlings from nursery of university as well as horticulture departments of state Government. While, 38.10% farmers are growing coconut as per recommended spacing and 50% farmers follow recommended dose of fertilizers. It was also observed that only 10% farmers adopt the recommended irrigation practices and none of the farmers is using drip irrigation and plant protection measures in their orchards. Therefore, it is suggested that the extension functionaries are required to motivate the farmers to adopt recommended cultivation practices for coconut.

V. Agricultural Engineering

The Agricultural Engineering group accomplished the studies on design, development and fabrication of agricultural machinery, equipments, tools, renewable energy, processing and soil and water management. Agril. Engineering group has six farmers, two scientific recommendations and five new technical programmes.

Recommendation for the farming community

Modified Atmosphere Packaging of spine gourd cv. Local

The farmers, processors and exporters are recommended to adopt modified atmosphere packaging technique developed by JAU for increasing the shelf life of spine gourd by packing in 50 µ LDPE bag with a combination of 2% O_2 + 4% CO_2 gas concentration and stored at 8ºC temp. The spine gourd can be stored up to 20 days by using this technique.

Transportation losses for sapota

The farmers, processors and exporters are recommended to adopt foldable plastic box with cells developed by JAU for local transportation of sapota fruit. This box was found cheaper compared to other containers considering cost of container, transportation, returning empty container/bag and total losses after transportation including decay after storage and also quality of the fruits retained during transportation.

Dehydration and storage of vegetables

The processors, exporters are advised to store dehydrated onion, garlic and unripe mango powder

in polyethylene (HDPE) bags of 50 micron in vacuum packaging (740 mm Hg) to retain the quality up to 120 days of storage period.

Storage study of onion

The farmers and traders who are interested to store the onion for more than four months are recommended to use forced air ventilated storage structure to get 36 per cent of more marketable red onion.

Method of sowing of groundnut under poor drainage condition

The farmers of South Saurashtra Agro-climatic Zone growing bunch type groundnut under poor drainage field condition are advised to sow by broad bed furrow method (55 cm width and 15 cm depth of furrow and 100 cm bed width between two furrows) for getting higher yield and net return.

New horticultural crops in coastal belt area of Saurashtra region using saline water with drip and mulching technology

The farmers of South Saurashtra Agro-climatic Zone having saline ground water (EC-3.15 ds/m) and medium black calcareous soil (EC-0.88 ds/m) conditions are advised to introduce trees like; seemaruba, tamarind, anola, pomegranate, sapota, date palm, ber, carambola and guava with drip irrigation.

Date palm

Seemaruba

Recommendation for the scientific community

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

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

Option 1: Using surface irrigation methods

In Meghal river basin, if surface irrigation system is adopted at 60 per cent application efficiency, about 9084 ha of wheat crop (irrigation water requirement 457 mm) can be irrigated using 5187 ha m of water. The remaining amount of water can be used for irrigating horticultural crops *viz.* coconut, mango and sapota (gross irrigation requirement 1097, 453 and 768 mm) of about 3669, 1005 and 596 ha area, which covers about 2/3rd area of horticultural crops.

Option 2: Allocating all crops under micro irrigation system

In Meghal river basin, if drip irrigation system is adopted (90% application efficiency) for existing horticultural crops of coconut, mango and sapota in 5595, 1602 and 796 ha area water required is 6137, 725 and 611 ha-m, respectively. The remaining water can be utilized through sprinkler irrigation (80% application efficiency) for irrigating wheat crop will cover about 11,950 ha area. This can bring under irrigation all horticultural crops and an additional area of 2866 ha (31.6%) of wheat crop.

Rainfall analysis for crop planning

1) Rainfall amount of 25.4 mm & 37.1 mm and 8.98 mm & 30.64 mm will be received at 75% and 60% probabilities in 27th and 29th MSW, respectively. The conditional probability of getting 30 mm is 66.64% and 65.17% during 27th and 29th MSW, respectively. Therefore sowing operation can be carried out during this period.
2) Annual, seasonal rainfall and rainy days followed the increasing trend after 2000. The average length of the rainy season was

observed 99 days. Drought resistance, low water requirement, short duration crop and its varieties having crop growth period maximum 99 days should be grown.

3) During 32 MSW, probability of a dry spell of length 7 is higher (0.64).Therefore, this period can be used to carry out interculturing operations and formation of ridges. Fertilizer top dressing needs to be done when the soil is sufficiently moist i.e. before 32 MSW. During 35 MSW to 37 MSW, probability of a dry spell of length 21 or more is higher; therefore spraying of anti-transparent and mulching can be done to reduce evapo-transpiration losses.

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

VI. Fisheries Science

This group has released one fish farmers' and four scientific recommendations which are briefed below. Group has also taken out 12 new technical programmes during 2011-12.

Recommendation for fish farmers

Foulers and borers of pearl Oyster (*Pinctada fucata*) in around Sikka area

The aqua farmers of the Gulf of Kutch are advised to take appropriate control measures as the Pearl Oysters has been found to be infested by the foulers and borers such as sponges like *Cliona vastifica, Cliona carpenteri, Cliona celata,* Coelenterate like Bryozoans and Hydroids, crustaceans like copepod, *Balanus amphrite,* pea crab, bivalves like Crassostrea, animals of minor phyla like isopod, amphipod and tunicates like Ascidians sp. and annelids like Tubiculous and Serpulid worms.

Information for scientific community

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

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

Qualitative studies of zooplankton in Meghal river at Chorwad

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

Identification and quantification of rotifer fauna of Okhamandal region

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

Cycle evaluation for fish landing at Veraval of Veraval coast

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

VII. Basic Science

This group has released two scientific recommendations which are briefed below. It also conducted six new technical programmes during 2011-2012.

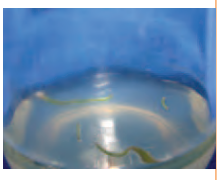
Recommendation for scientific community

Regeneration protocol for *Malkankani* (*Celastrus peniculata* Willd)

a) Surface sterilization

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

b) Callus induction



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

c) Shoot multiplication

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

d) *In vitro* rooting

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

e) Hardening

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

Effect of brassinolide on germination and biochemical parameters of chickpea

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

Research carried out by Department of Genetics and Plant Breeding on induction of somaclonal variation in *Allium sativum* by callus culture, low cost micropropagation in banana, in vitro screening for salinity tolerance in onion (*Allium cepa* L.), micropropagation in coconut, amelioration of simulated water stress by brassinolide application during germination and early seedling growth of groundnut, effect of brassinolide foliar spray on yield and yield attributing characters of wheat, standardization of plant regeneration protocol in castor, seed vigour as influenced by different seed priming in okra [*Abelmoschus esculentus* (L.) Moench], allelopathic effects of different weed extracts on seed germination and vigour in groundnut, cowpea and greengram, the effect of harvesting dates on fresh seed dormancy in pearlmillet hybrids, effect of pre-soaking treatments of growth regulators on germination and seed vigour of cumin (*Cuminum cyminum* L.)

Department of Biochemistry and Department of Biotechnology carried out research worked on quality differences in *"kesar mango"* of different locations of Saurashtra, varietal identification of onion and garlic through molecular markers, studies on bioactivity in cow urine, biochemical mechanism of *Trichoderma* spp. for inhibition of *Fusarium oxysporum f. sp. ciceri* causing chickpea wilt, effect of brassinolide on germination and biochemical parameters of chickpea, molecular characterization of indigenous mango cultivars through DNA finger printing, biochemical and physiological markers for wheat varieties against high temperature stress, estimation of pesticides residues from soil and water resources of Saurashtra region, estimation of pesticides residues in vegetables of Junagadh region and surface micro-flora & pathogenic bacteria analysis of fresh vegetables, amelioration of simulated water stress by brassinolide application during early seedling growth of groundnut, *In situ* detection of potassium status in cotton plants and biochemical characterization of *Trichoderma* strains for inhibition of Rhizoctonia solani causing root rot in castor.

The research work done at Main Oilseeds Research Station on screening of groundnut entries for partitioning of dry matter produced during pod development phase from various breeding trials, screening of bunch entries of groundnut for fresh seed dormancy (FSD) from various breeding trials, screening of spanish bunch groundnut genotypes for fresh seed dormancy (FSD) from IVT-SB-I trial, yield assessment of some promising drought tolerant bunch groundnut genotypes and effect of plant growth retardant on growth & yield of groundnut.

VIII. Social Science

Agricultural economists worked on the different research projects *viz.,* farm cost studies of important crops in Gujarat, economics of Bt. cotton (LS) production in South Saurashtra region of Gujarat, scheme for creating a permanent machinery for studying the cost of cultivation/production of principal crops in Gujarat state, visioning policy analysis and gender (NAIP-V-PAGe), establishing and networking of agricultural market intelligence centres in India (NAIP-AMIC). Price forecasts of different crops *viz.,*

groundnut, sesame, blackgram, cotton, castor, pigeonpea, chickpea, wheat, mustard and cumin were published for benefits of farmers in English and *Gujarati* news papers. Extension educationists have conducted study on Impact of climate change on the livelihood of peasantry in South Saurashtra Agro-climatic Zone and currently working on project of socio-economic impact assessment & evaluation. PG Institute of Agri-Business Management has conducted study on farmers' perception of brand and brand loyalty for pesticides in South Saurashtra. Social science group has formulated eight new technical programmes during 2011-12.

IX. Animal Health & Animal Production

Cattle Breeding Farm, Junagadh Agricultural University (Previously part of Gujarat Agricultural University) is the largest and oldest farm and is the only organized research station where pure bred *Gir* Cattle and *Jaffrabadi* Buffaloes are maintained in the country. This research station is involved since last many years in the conservation, improvement and advancement of *Gir* Cattle and *Jaffrabadi* Buffaloes through selective breeding Research Programmer such as Progeny Testing, Establishment of Elite herd of *Gir* Cattle and *Jaffrabadi* Buffaloes and ICAR sponsored research projects Genetic improvement in indigenous germ-plasm and Network Project on *Jaffrabadi* Buffaloes are the key projects running at the research station.

The herd of *Gir* Cattle was established as early as in 1920 by the erstwhile Nawab of the Junagadh state, while *Jaffrabadi* herd was established in the year 1978 since that this research station always maintains about 450 heads of *Gir* Cattle and 200 heads of *Jaffrabadi* Buffaloes Besides maintaining the purebred herds of *Gir* Cattle and 200 heads of *Jaffrabadi* buffaloes at the station, the centre is also involved in conservation and improvement of filed animals of these breeds through field Progeny Testing programmers and supply of high quality males to different gram Panchayats.

Presently the station has a 184 hectare total area under cultivation and out of it, 42 hectare is pasture land. The subsidiary farms is Narsimehta Talav 16 hectare and Jonepur Farm (Grassland) 130 hectare are additional source of green and dry fodder. During the year 2011-12, total 16698 frozen semen doses were produced from *Jaffrabadi* Buffalo bulls, whereas total 6952 frozen semen doses were produced from *Gir* bulls.

Performance of *Gir* and *Jaffrabadi* Herds during Year-2011.

No.	Particulars	*Gir* Cows (Mean Value)	*Jaffrabadi* Buffaloes (Mean Value)
1	Total Lactation Milk Yields (Lit.)	1996	2402
2	300-D Milk Yield (Lit.)	1859	2255
3	Lactation Days	320	307
4	Dry Days	131	219
5	Calving Intervals (Days)	436	497
6	Age at 1st Calving (Days)	1422	1142
7	Age at 1st Heat (Days)	1147	1452
8	Service period (Days)	117	178
9	No. of Services or AI / Conception	1.54	1.83
10	Overall Mortality (%)	2.44	3.18

Jaffrabadi Buffalo bull

Gir Cow bull

This group has released four farmers' and three scientific recommendations which are briefed here. During the year, two new experiments were conducted on genetic improvement, animal nutrients, animal production and health.

Impact of herd composition on herd performance traits in *Gir* cattle

On a large farm of *Gir* cattle in South-Saurashtra region, herd structure of 330-345 heads with 100-110 (30-33%) cows, 65-70 (18-21%) breedable heifers and 245-250 (72-75%) total female proportion in the herd is optimum to achieve higher wet average (7.3-7.7 lit), herd average (4.2-4.7 lit), % milch cows (55-60%) and higher return over feed cost (140%) in the herd.

Impact of herd composition on herd performance traits in *Gir* cattle

Dairy farmers/gaushalas of *Gir* herd in South-Saurashtra region desiring to improve herd performance and return should set optimum targets of herd performance traits of 7.6 lit. wet average, 4.3 lit. herd average and more than 64 % milch cows for economical and sustainable dairy farming.

Breeding and lactation efficiencies of *Gir* cows

Dairy farmers of large herd of *Gir* cattle in South Saurashtra region should set the target of age at first calving < 44 months and calving interval of 14 months to improve these traits for maximum return. They can maintain *Gir* cows up to 8 lactations for economical dairy farming; however, high yielding cows may be maintained for more than 8 lactations also.

Breeding and lactation efficiencies of *Jaffrabadi* buffaloes

Dairy farmers of large herd of *Jaffrabadi* buffaloes in South Saurashtra region should set age at first calving of 47 months and calving interval of 15 months as targets to improve these traits for maximum return. They can maintain *Jaffrabadi* buffaloes up to 6 lactations for economical dairy farming; however, high yielding buffaloes may be maintained for more than 6 lactations also.

Recommendation for scientific community

Impact of herd composition on herd performance traits in *Gir* cattle

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

Breeding and lactation efficiencies of *Gir* cows

In organized large dairy herd of *Gir* cattle in South Saurashtra region-i) Over all breeding efficiency, lactation efficiency, age at first calving, calving interval and lactation period of *Gir* cows were 86.9 ± 0.5 %, 61.1 ± 1.1 %, 1527.8 ± 14.2 (50.1 mo.), 481.2 ± 4.9 (15.8 month) and 281.0 ± 4.6 days, respectively. About 29 % of heifers calved for the first time below the average age of 44 months and 38 % of cows calved at an average calving interval of 14 months. ii) Average milk production of *Gir* cows increased with increase in parity and reached peak of 2300 lit. of 300-d milk yield in 5th lactation. In subsequent lactations also, 300-d lactation milk yield remained between 1950 and 2100 lit. up to 8th lactation which indicated high persistency of production over parity. Productive life of cows averaged 8.5 years (*i.e.,* 3108 days) with 10,000 lit. life time milk production with an average of 4.3 calvings during life time. iii) About 19 % *Gir* cows remained in the herd for more than 12 years of age (on an average 14.6 years) and more than 25% of cows performed in the herd for more than 6 lactations. Hence, breeding goals of less than 44 months of age at first calving and 14 months of calving interval may be set for *Gir* cattle.

Breeding and lactation efficiencies of *Jaffrabadi* buffaloes

In organized large dairy herd of *Jaffrabadi* buffaloes in South Saurashtra region. i) Over-all breeding efficiency, lactation efficiency, age at first calving, calving interval and lactation period of *Jaffrabadi* buffaloes averaged 79.0 ± 1.5%, 58.2 ± 1.6 %, 1656.7 ± 28.6 (54.3 month), 541.9 ± 7.9 (17.8 month) and 291.9 ± 5.0 days, respectively. About 28% of heifers calved for the first time below

the average age of 47 month and 31 % of buffaloes calved at an average calving interval of 15 months. ii) Average milk production of *Jaffrabadi* buffaloes increased with increase in parity and reached peak of 1900 lit. of 300-d milk yield in 4th lactation. In subsequent lactations also, 300-d lactation milk yield remained between 1700 and 1800 lit. up to 6th lactation which indicated high persistency of production over parity. Productive life of buffaloes averaged 10.1 years (*i.e.,* 3701 days) with 8500 lit. life-time milk production with an average of 4.7 calvings during life-time. iii) About 20 % *Jaffrabadi* buffaloes remained in the herd for more than 12 years of age (on an average 16.6 years) and more than 38 % of these animals performed in the herd for more than 6 lactations. Hence, breeding goals of less than 47 months of age at first calving and 15 months of calving interval may be set for *Jaffrabadi* buffaloes.

Total twenty research schemes are operation at Cattle Breeding Farm, JAU, Junagadh. These schemes are aimed at genetic improvement in these bovines maintained at the farm and also in the field through supply of genetically superior bulls to Gram Panchayats and other agencies associated with breeding and improvement of *Gir* and *Jaffarabadi* breed and also through supply of frozen semen doses to field A. I. centres. Strengthening of livestock inspectors training centres, establishment of insemination centres in Saurashtra and establishment of mobile ambulatory clinic at Cattle Breeding Farm. During the year, the training of 33 livestock inspectors has been completed at LITC. About 1462 dairy farmers and farm women visited this research station. Milk processing plant has been established and made fully functional at Cattle Breeding Farm under RKVY scheme. The milk is being collected in hygienically and pasteurized milk is supplied to the beneficiaries.

X. Breeder seed production

The breeder seeds of different crops produced to fulfill the demand of private and public sectors as per the national and state indents are given in following table. The required nucleus seeds of different crops were also produced for the breeder seed production in the ensuing season.

Production of Nucleus / Breeder seeds during year 2011-12

No.	Crop	Variety	Nucleus Seed (q)	Breeder Seed (q)		Total (q)
				National	State	
1	Groundnut	GG-2	11.27	2.10	100.50	113.87
		GG-5	18.00	-	52.80	70.80
		GG-6	1.40	-	-	01.40
		GG-7	4.50	3.00	3.20	10.70
		GG-8	5.80	4.50	-	10.30
		GAUG-10	8.94	-	23.40	32.34
		GG-11	20.40	-	33.00	53.40
		GG-14	1.50	42.20	-	43.70
		GG-16	2.70	21.00	-	23.70
		GG-20	171.90	40.80	310.23	522.93
		GG-21	4.50	7.80	-	12.30
		GJGHPS-1	12.00	5.10	23.70	40.80
		GJG-9	7.88	-	-	07.88
		GJG-31	22.50	-	9.00	31.50
		GJG-17	3.75	-	-	03.75
		GJG-22	2.25	-	-	02.25
		Sub Total	**299.29**	**126.50**	**555.83**	**981.62**
2	Pearl Millet	GHB-538	-	-	9.28	09.28
		GHB-558	-	-	6.20	06.20
		GHB-719	-	-	3.43	03.43
		GHB-732	-	-	6.05	06.05
		GHB-744	-	-	1.24	01.24
		Sub Total	**-**	**-**	**26.20**	**26.20**

3	Sesame	G.Til-1	-	0.30	3.14	03.44
		G.Til-2	-	1.96	8.03	09.99
		G.Til-3	-	1.15	13.89	15.04
		G.Til-10	-	0.30	0.50	0.80
		Purva	-	-	0.21	0.21
		Sub Total	**-**	**3.71**	**25.77**	**29.48**
4	Chickpea	GG-1	9.91	25.00	32.00	66.91
		GG-2	4.70	11.40	29.25	45.35
		GG-3	5.13	37.15	16.40	58.68
		GG-4	3.83	43.50	-	47.33
		Sub Total	**23.57**	**117.05**	**77.65**	**218.27**
5	Wheat	GW-366	10.76	359.60	187.20	557.56
		GW-496	-	-	158.80	158.80
		Sub Total	**10.76**	**359.60**	**346.00**	**716.36**

XI. Mega seed unit

At mega seed processing plant, the crop seeds produced in the farms were processed. The processed good quality seeds were sold to farmers under the brand name of *"Sawaj Beej"*. Very good response was observed among the farmers to avail this facility.

Production of truthful seeds of field crops under mega seed project during year 2011-12

No.	Crop	Production (q)
1	Groundnut	1035.39
2	Pearl Millet	227.01
3	Chickpea	1571.84
4	Sesame	88.01
5	Wheat	8509.52
6	Cotton	03.77
7	Castor	24.95
8	Cumin	567.40
9	Coriander	162.68
10	Soybean	136.07
11	Mungbean	116.75
12	Uradbean	135.18
13	Pigeon pea	45.44
14	Fenugreek	21.00
15	Sugarcane sets	750.00
16	Vegetable Seeds	06.94
17	Ajwain	02.00
18	Garlic	95.00
19	Fennel	02.00
20	Lucerne	0.20
21	Papaya Seeds	0.75
22	Oat Cant	0.30
	Total...	**13502.20**
23	Planting Materials, Nos.	**2,56,506**

XII. Front line demonstrations organized on farmers' field during year 2011-12

Crop scientists have successfully organized total 339 Front Line Demonstrations on farmers' fields in addition to the FLDs organized by KVKs of JAU.

No.	Name of Crop	No. of FLD
1	Groundnut	40
2	Chickpea	40
3	Vegetable	08
4	Sesame	04
5	Castor	23
6	Wheat	04
7	Pearl millet	100
8	Cotton	100
9	Spices	20
	Total...	**339**

XIII. Production of *Sawaj-Trichodarma*

The Department of Plant Pathology has produced and supplied 8300 litres (16,600 bottles) of *SAWAJ-Azotobacter,* a liquid bio-fertilizers to the State Department of Agriculture for distribution to farmers as an integrated part of *Krushi Mahotsava* Kits.

The department has also produced and distributed 25,461kg (packets) of bio-agent *Trichoderma harzianum* under the brand name of *Sawaj-Trichodarma* for the management of various soil borne diseases especially stem and pod rot of groundnut in the Saurashtra region. There was 161% rise in the production of *Trichoderma harzianum* as compared to the year 2010-11.

XIV. Geographical Indication (GI) for *Gir Kesar Mango*

Junagadh Agricultural University, Junagadh and Gujarat Agro Industries Corporation had applied for Geographical Indication (GI) for *Kesar mango* to Office of GI Registration, Chennai, Government of India during the year 2009. The proposal was prepared by the Department of Horticultural, Junagadh Agricultural University. The proposal was critically evaluated by the members of GI Registration committee. Due to its pleasant and unique characteristics, interesting history, geographical and climatic effect on *Gir Kesar mango,* The proposal was accepted and GI registration number 185 is given to *Gir Kesar mango*. The advantage of the registration is that the legal protection will be provided to *Gir Kesar mango*, the demand and price will be increased and the owners of *Kesar mango* orchard surrounding *Gir* region will be given a logo for its identification, so that these farmers only can sell the mangoes under the brand name *Gir Kesar.*

XV. MoUs

The University has signed one MoU with Rajkot District Co-operative Milk Producers Union Ltd. (Rajkot Dairy) for collaborative work in PG research in faculty of Veterinary Science.

XVI. New research programmes sanctioned during year 2011-12

No.	Agency	No. of Research Programmes	Amount (₹In Lakh)
1	ICAR/GOI	01	02.00
2	ICRISAT	01	30.00
3	Other Agencies	31	126.90
4	Govt. of Gujarat	05	221.24
	Total...	**38**	**380.14**

XVII. RKVY PROJECTS

Total seventeen projects under RKVY were implemented in Junagadh Agricultural University during the year 2011-12 as per details given below. Among these, seven projects have been completed this year and others will be continued during subsequent years.

Project-1 Establishment of bio-control lab. for mass production of bio-agents

In this project, mass rearing of laboratory host *Corcyra cephalonica* for the production of egg parasitoid *Trichogramma* and *Chrysoperla carnea* and entomopathogenic fungi *Beauveria bassiana* was carried out. During the current year 9.45 lakh eggs of *C. cephalonica,* 37 trichocards, 100 eggs of *C. carnea* and 2 kg *Beauveria* fungus were produced.


Corcyra rearing unit

Project-2 Quality seed production of groundnut, wheat and pearl millet

Under the quality breeder seed production of groundnut, wheat and pearl millet, in total 264 quintals of groundnut (GG-20, GG-5, GG-6), 189 quintals of wheat (GW-366, GW-496) and 27.37 quintals of pearl millet (parent) seeds were produced.

Project-3 Large scale production of quality seeds / planting materials of horti., vegetable and spices crops at Junagadh

Under this project quality seeds of vegetables *viz.,* brinjal (20 kg), onion (19 kg) and okra (275 kg), spices *viz.,* coriander (1000 kg), fenugreek (1800 kg) and garlic (1000 kg) and numbers of planting materials *viz.,* horticultural grafts *viz.,* mango (1250), chiku (580), citrus (1080), aonla (820) and saplings *viz.,* custard apple (6150), citrus (6035), jamun (600) and ornamentals (25715) were produced and supplied to the farmers.

Project-4 Establishment of Testing and Training Centre on Farm Machinery

After the establishment of this centre, the testing of farm machinery and equipments is carried out under this project. Two training programmes were organized in which 48 farmers and manufacturers trained. Total 211 farm machinery and implements were tested during the year.


Field testing of potato planter

Inaugural function of Farmers' training

Project-5 Centre of Excellence for Agro-Meteorological Services at Junagadh and sub centres of the University

Establishment of 8 new Agromet observatories and up-gradation of 8 old observatories at different research stations of JAU. The persons incharge of the observatories at different research station of the University were provided trainings at Indian Meteorological Department, Pune for proper recording of weather parameters.


Farmers Training Programme

Agromet Museum

Project-6 Establishment of laboratory for bioagents mass production and their use in plant diseases management.

Under this project, isolation and sub culturing of bioagent, *i.e., Trichoderma harzianum* from crop rhizosphere was carried out for mass production. 25 tonnes of *"Sawaj" trichoderma* was produced and sold to the farmers at reasonable price (₹ 70/kg).


Mass production of bioagent *Trichoderma harzianum* on sorghum grains

Production of bioagent *"Sawaj" trichoderma*

Project-7 Management of cotton mealy bug, *Ferrisia virgata* (Cockerell)

Experiment was conducted on selected 50 farmers' fields for validation of cotton mealy bug IPM modules. The IPM module-I (Deep ploughing in summer + Removal of weeds from boundaries of fields followed by application of methyl parathion 2% dust + Sowing with soil application of methyl parathion 2% dust in the field + Profenophos 0.05%

application at 30 DAS + Beauveria 2kg/ha at 45 DAS + Trizophos 0.04% spot application at 60 DAS) was found effective on farmers' fields.

Cotton mealy bug module-I field at Meghpar village Jodiya taluka

Farmer's practices cotton field

Project-8 Establishment of modern nursery for propagation and popularization of planting materials(DAP-Jamnagar district)

In this project, conservatory unit was established. Production and supply of sapling and plants is started. Further, the trainings to farmers on nursery management were carried out.

Project-9 Smart Farming for increasing agricultural production in sodic soils of coastal area of Saurashtra

After implementing the project, the monitoring of soil conditions in the field was started through the soil-moisture, EC and temperature sensors via Farm-Link system (Tower with PTZ camera, Monitoring unit and Data Logger for *Wireless Sensors, Wi-Fi Internet, etc.*). Crop could be grown in unproductive land with improvement in production and quality.

Initial condition of field - Project site

Farm-Link system with Wi-Fi Internet

Crop in untreated plot

Crop in treated plot

Project-10 Esta. of elite seed farm for coconut DxT (Mahuva) seed nut production

Under this project, development work of land was carried out for establishment of elite seed farm at Mahuva. The area was divided into the small plots of 5 ha. Planting of male and female coconut palm has been completed in 10 ha. Production of seed will start after 7 years of transplanting.

View of Elite Seed Farm of coconut

Coconut seedling nursery

PROJECTS COMPLETED

Project-11 Training programme on value added fishery products at Veraval

In this project, necessary infrastructure was developed and necessary equipments/instruments were procured which would develop a good laboratory. Two trainings were organized where in 50 trainees were trained. The analytical services of fish product has been started.

Project-12 Transfer of integrated agricultural technologies through village adoption

At different KVKs of the University, necessary infrastructures were developed and the required equipments/instruments were procured under this project. 32 trainings, 151 FLDs and 178 demonstrations (total 1720 beneficiaries) were carried out by five different KVKs. Improved implements/items like cotton shredder, rotavator, mobile seed processing unit, seed dressing drum, automatic seed drill, chaff cutter, solar cooker, etc. were allotted/ provided to each adoptive village and famers could be able to use these implements at very nominal charges decided by the committee formulated in adopted villages.

Farmers' training at KVK, Nana Kandhasar

Mobile Seed Processing Unit Demonstration, KVK, Nana Kandhasar

Project-13. Enrichment of agricultural wastes for enhanced nutritive value in *Gir* and *Jafrabadi* animals and recycling of animal wastes for promoting organic farming

Under this project, NIR feed analyzer was procured and installed at Cattle Breeding Farm. Biogas plant commissioned and biogas generated from animal wastes used for power generation and heating purposes. Roughage blocks were made manually to test the efficacy of feed formula. Installation and trials of roughage block making plant completed.

Roughage Processing Plant

Project-14. Application of biotechnology for pearl millet improvement

Under this project, laboratory equipments were procured and installed in renovated laboratory at Pearl Millet Research Station, Junagadh Agricultural University, Jamnagar. The laboratory could be strengthened with the RKVY financial support.

Project-15. Development of modules for precision dairy farming for *Gir* cattle and *Jafrabadi* buffaloes

Under this project, a mini dairy plant (250 LPD) has been commissioned. Automatic Milk Recording System also installed. Somatic Cell Counter is used to test milk samples. Erection and commissioning of pasteurization plant and milk pouch making machine completed. The bio-gas based electric power generator commissioned.

Pouch Packing Machine

Project-16. On season crop field nutrient monitoring of groundnut and cotton in Saurashtra region

For analytical works of the experimental samples, XRD, Flow Cytometer, SEP Box, *etc.* were purchased and installed. The chemical analysis of collected samples of groundnut and cotton crop were completed. On the basis of the 990 and 1013 data of soil samples, the nutrient indexing was calculated. So, on the basis of the nutrient indexing, classified the soil as low, medium and high. Total 2003 farmers of the Saurashtra region were benefited with this project.

Project-17. Demonstration models of seed production technologies in the crops of Saurashtra region

Under this project, two trainings for farmers on seed production technologies in field crops were organized and 85 farmers were trained. The high-tech Exhibition of Seed Production Technology established.

Models of seed germination for groundnut

Farmers training at Manavadar, Dist. Junagadh

The civil works for the expansion of facilities for agricultural education, boys hostel and advance training centre for farmers are in progress.