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 monitored and guided the research activities during the reporting year. The members of Agricultural Research Council during 2012-13 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. Parakhia	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, Agriculture Faculty
8.	Prof. J.B. Savani/ Dr. N.K. Gontia	Dean, Agril. Engineering & Technology Faculty
9.	Dr. A.Y. Desai	Dean, Fisheries Science Faculty
10.	Dr. R.R. Shah/ Dr. P.H. Vataliya	Dean, Veterinary Science & Animal Husbandry Faculty
11.	Dr. K.A. Khunt	Principal, PG Institute of Agri-Business Management
12.	Dr. K.L. Dobaria	Research Scientist (Groundnut)
13.	Dr. K.L. Raghvani	Research Scientist (Pearl Millet)
14.	Dr. P.U. Gajbhiye	Research Scientist (Animal Genetics & Breeding)
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 (Agricultural 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 six 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 six *Krishi Vigyan Kendras* of the University. The research activities, research accomplishments and recommendations, achievements made by the Junagadh Agricultural University during 2012-13 are given here under.

I. Crop Improvement

Two varieties *viz.*, Cotton G.J.Cot-101 and Sugarcane GS-5 were recommended for cultivation to the farmers for the state and one scientific recommendation, which are briefed below. Two new technical programmes were formulated during 2012-13.

Cotton: Gujarat Junagadh Cotton-101 (G.J. Cot-101)

The farmers of non Bt cotton (*Gossypium hirsutum*) growing areas of Gujarat state are advised to grow variety G.J.Cot-101 under irrigated condition. This variety has recorded a seed cotton yield of 2107 kg/ha, which was 13.5, 39.9, 18.7 and 48.1 per cent higher than the local check varieties viz., G.Cot-18 in South Saurashtra Agro-climatic Zone, G.Cot-10 in South Gujarat Agro-climatic Zone, G.Cot-16 in North Gujarat Agro-climatic Zone and zonal check LRA-5166 in Central Agro-climatic Zone, respectively. The calculated lint yield 676 kg/ha was produced by G.J.Cot-101, which was 9.6, 23.8, 17.5 and 41.7 per cent higher than local check varieties G.Cot-18, G.Cot-10, G.Cot-16 and zonal check LRA-5166, respectively. It has 32.0 per cent ginning outturn and 18.34 per cent oil content in seed. This variety is medium in maturity. It is found moderately resistant to *Alternaria* leaf spot disease.

Sugarcane: Gujarat Sugarcane-5 (GS-5)

The farmers of South Saurashtra Agro-climatic Zone growing sugarcane crop are advised to grow sugarcane variety Gujarat Sugarcane 5 (CoN 05071) for getting higher cane and sugar yield. This variety has recorded 121.20 t/ha cane yield in plant crop, which was 17.44, 16.44 and 19.20 per cent higher as compared to check varieties *viz.*, Co 85004, CoN 03131 and CoC 671, respectively. Ratoon crop of this variety also gave 35.24, 31.81 and 62.54 per cent higher cane yield (97.59 t/ha) over check varieties *viz.*, Co 85004, CoN 03131 and CoC 671, respectively. It is an early maturing variety.

Recommendation for the scientific community

Testing of fresh seed dormancy in bunch groundnut varieties

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

II. Crop Production

This group has released 19 farmers' recommendations, which are given below. It has also undertaken 27 new technical programmes.

Recommendation for the farming community

Nutrient Management

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

The farmers of South Saurashtra Agro-climatic Zone - VII adopting groundnut (*kharif*)-garlic (*rabi*) cropping sequence under organic farming are advised to apply FYM @ 2.5 t/ha to groundnut and 10 t/ha to garlic on sequence basis for securing higher net realization and maintaining soil fertility.

Permanent plot experiment on integrated nutrient supply system for a cereal based crop sequence

The farmers of South Saurashtra Agro-climatic Zone - VII adopting pearl millet (*kharif*)-wheat (*rabi*) cropping sequence are advised to apply FYM @ 8 t/ha and 50% RDF (40:20:25 N:P_2O_5:K_2O kg/ha) to pearl millet and 120:60:25 N:P_2O_5:K_2O kg/ha to wheat to get higher yield and net realization as well as to maintain soil fertility.

Integrated nutrient management in okra

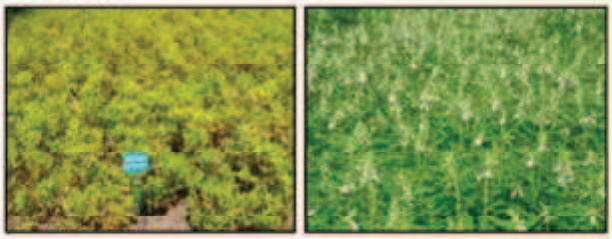
The farmers of South Saurashtra Agro-climatic Zone - VII growing okra during summer season are advised to apply FYM @ 10 t/ha + half RDF (75:25:25 N:P_2O_5:K_2O kg/ha) to get higher yield and net profit.

Integrated nutrient management in ridge gourd

The farmers of South Saurashtra Agro-climatic Zone - VII growing ridge gourd during summer season are advised to apply FYM @ 5 t/ha and 25:12.5:12.5 N:P_2O_5:K_2O kg/ha to get higher yield and net return.

Feasibility of the organic farming in respect to sustain soil productivity under rainfed agriculture

The farmers of North Saurashtra Agro-climatic Zone - VI (AES-IV) interested to follow groundnut-sesame crop rotation under organic farming during *kharif* are advised to apply compost @ 1.25 t/ha + vermicompost @ 165 kg/ha + castor cake @ 75 kg/ha to groundnut and compost @ 5 t/ha + vermicompost @ 650 kg/ha + castor cake @ 300 kg/ha to sesame along with groundnut shell mulching @ 1 t/ha, biofertilizer (*Rhizobium* & *Azotobacter*) to both the crops @ 1.5 kg/ha and *Trichoderma* @ 2.5 kg/ha for obtaining higher net returns and sustaining soil fertility under rainfed condition.



Irrigation and nutrient management in *rabi* bajra

The farmers of South Saurashtra Agro-climatic Zone - VII growing bajra in *rabi* season are advised to apply nine irrigations *i.e.* two common irrigations for germination and the remaining seven irrigations at 10 days interval to get higher yield and net realization. Farmers are also advised to apply fertilizer @ 120:60 N: P_2O_5 kg/ha and potassium on soil test basis.

Effect of multi-micronutrient formulations on wheat

The farmers of South Saurashtra Agro-climatic Zone - VII growing wheat are advised to apply multi-micronutrients mixture Grade-V @ 40 kg/ha or apply micronutrients on soil test basis beside the recommended dose of fertilizer (120:60 N:P_2O_5 kg/ha) to get higher yield and net return.

Efficacy of multi-micronutrient formulations for improving crop production in castor

The farmers of South Saurashtra Agro climatic Zone -VII growing castor are recommended to apply micronutrients on soil test basis or four sprays of multi-micronutrients mixture Grade-IV @ 1% at 45, 60, 75 and 90 DAS besides recommended dose of fertilizer (75:50:50 N:P_2O_5:K_2O kg/ha) to get higher yield and net return.

Effect of multi-micronutrient formulations on pigeonpea

The farmers of South Saurashtra Agro-climatic Zone -VII growing pigeonpea are advised to apply micronutrients on soil test basis or multi-micronutrient mixture Grade-V @ 40 kg/ha besides recommended dose of fertilizer (25:50:0 N:P_2O_5:K_2O kg/ha) to get higher yield and net return.

Balance nutrient management in groundnut (*kharif*)–wheat (*rabi*) cropping sequence on LTFE basis

The farmers of South Saurashtra Agro-climatic Zone -VII adopting groundnut (*kharif*)-wheat (*rabi*) cropping sequence are advised to apply FYM @ 10 t/ha + 6.25:12.5 N:P_2O_5 kg/ha through fertilizer to groundnut and 120:60:60 N:P_2O_5:K_2O kg/ha through fertilizer only to wheat for securing higher net return and maintaining soil fertility.

Package of Practices

Effect of sowing time and spacing on summer sesame

The farmers of South Saurashtra Agro-climatic Zone - VII growing summer sesame are advised to sow the crop in second week of February by keeping 30 cm row spacing for obtaining higher yield and net realization.

Evaluation of tillage practices in pigeonpea

The farmers of South Saurashtra Agro-climatic Zone - VII growing pigeonpea are advised to till the field by cross cultivation followed by blade harrowing and subsoiling between two rows to get higher yield and net realization.

Response of summer sesame to date of sowing and row spacing

The farmers of North Saurashtra Agro-climatic Zone - VI growing sesame in summer season are advised to sow the crop in third week of February at a spacing of 30 cm x 10 cm to get higher yield and net return.

Response of sugarcane varieties to wider row spacing

The farmers of South Saurashtra Agro-climatic Zone - VII interested to grow sugarcane at wider row spacing are advised to plant sugarcane variety CoN 05071 at 90 cm distance or in paired rows (30 : 150 cm) to get higher cane yield and net returns.

Study of intercropping system with bunch groundnut under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone - VI (AES-XV) growing bunch groundnut under rainfed condition may also take either greengram or sesame as intercrop by keeping row ratio of 1:1 or 3:1 to get higher yield and net return. The mothbean cultivation either as sole crop or intercrop with groundnut was not found remunerative.

Weed Management

Integrated weed management in summer sesame

The farmers of South Saurashtra Agro-climatic Zone - VII growing summer sesame are advised to keep the crop weed free by hand weeding and interculturing. Under the shortage of labourers, apply quizalofop-ethyl 5% EC 40 g/ha (16 ml/10 lit.) as post-emergence at 20-25 DAS + 1 HW & IC at 45 DAS or pendimethalin 30% EC 0.45 kg/ha (30 ml/10 lit.) as pre-emergence + 1 HW & IC at 30 DAS to get higher yield and net realization as well as effective weed management.

Integrated weed management in castor under irrigated condition

The farmers of South Saurashtra Agro -climatic Zone - VII growing castor are advised to keep the crop weed free by hand weeding and interculturing. Under paucity of farm labourers, they are advised to apply pendimethalin 30% EC 1 kg/ha (67 ml/10 lit.) as pre-emergence + quizalofop-ethyl 5% EC 0.05 kg/ha (20 ml/10 lit.) as post emergence (25 days after sowing) for effective weed control as well as to get higher yield and net returns.

Water Management

Response of chickpea to drip irrigation and integrated nutrient management

The farmers of South Saurashtra Agro-climatic Zone - VII growing chickpea are advised to irrigate the crop through drip system at 0.8 PEF and apply recommended dose of fertilizer, *i.e.*, 20:40 N:P_2O_5 kg/ha along with FYM @ 1 t/ha to get higher yield and net realization.

The system details are as under

1.	Type of drip system	:	In line
2.	Lateral diameter	:	16 mm
3.	Lateral spacing	:	90 cm
4.	Dripper spacing	:	60 cm
5.	Dripper discharge	:	4 LPH
6.	Operating pressure	:	1.2 kg/cm^2
7.	Operating frequency	:	Alternate day
8.	Operating time	:	65 minutes

Response of summer sesame to drip irrigation and nitrogen levels

The farmers of South Saurashtra Agro-climatic Zone - VII growing sesame in summer season are advised to irrigate the crop through drip system at 1.0 PEF with laying in paired row (30-60-30 cm) and apply 40 kg N/ha along with 25 kg P_2O_5/ha to get higher yield and net return.

The system details are as under

1.	Type of drip system	:	In line
2.	Lateral diameter	:	16 mm
3.	Lateral spacing	:	90 cm
4.	Dripper spacing	:	60 cm
5.	Dripper discharge	:	4 LPH
6.	Operating pressure	:	1.2 kg/cm^2
7.	Operating frequency	:	Alternate day
8.	Operating time	:	2 hrs and 35 minutes

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. Seven farmers' and one scientific recommendation from Agricultural Entomology group and two farmers' recommendations from Plant Pathology

group were released. Further, 18 new technical programmes have also been carried out by plant protection group.

Recommendation for the farming community

Agricultural Entomology

Field efficacy of newer acaricides for the management of mites in garlic

For effective and economical management of mite in garlic under South Saurashtra Agro-climatic Zone, two sprays of abamectin 1.9 EC @ 0.003 % (16 ml/10 lit water) or carbosulfan 25 EC @ 0.05 % (20 ml/10 lit water) or difenthiuron 50 WP @ 0.07 % (14 g/10 lit water) at 15 days interval starting from mite infestation are recommended.

The pre-harvest interval of 27 days is recommended for abamectin, carbosulfan and difenthiuron.

Field efficacy of bio-pesticides against pest complex of okra

For effective and economical bio-pesticide based management of *Kharif* okra pests *viz.*, jassid and fruit and shoot borer, two sprays of *Metarhizium anisopliae* (cfu 1 x 10^7/g) @ 4 g/lit 15 days interval starting from the pest infestation is recommended under South Saurashtra Agro-climatic Zone.

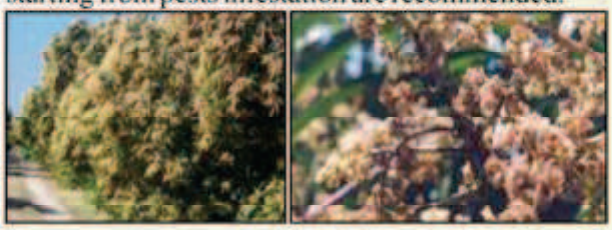
Bio efficacy of newer miticides against mites in cluster bean

For effective and economical management of mites in cluster bean under South Saurashtra Agro-climatic Zone, two sprays of difenthiuron 50 WP @ 0.07 % (14.0 g/10 lit water) or abamectin 1.9 EC @ 0.003 % (16 ml/10 lit water) or buprofezin 25 EC @ 0.025% (10 ml/10 lit water) at 15 days interval starting from mite infestation are recommended.

The pre-harvest interval of 10, 1 and 10 day(s) is recommended for difenthiuron, abamectin, and buprofezin, respectively.

Field efficacy of bio-pesticides against inflorescence pests of mango

For higher fruit setting and effective management of inflorescence sucking pests *viz.*, hopper, thrips and flower bug in mango orchard under South Saurashtra Agro-climatic Zone, two sprays of bio-pesticides, *Beauveria bassiana* (cfu 1x10^7/g) @ 20 g/ 10 lit water or *Verticillium lecanii* (cfu 1 x10^7/g) @ 20 g/10 lit water at 15 days interval starting from pests infestation are recommended.



Field efficacy of different insecticides against the leaf webber of mango

For effective management of leaf webber in mango orchard under South Saurashtra Agro climatic Zone, two sprays of profenophos 50 EC @ 0.05 % (10 ml/10 lit water) or novaluron 10 EC @ 0.01 % (10 ml /10 lit water) or spinosad 45 SC @ 0.015 % (3 ml /10 lit water) or quinalphos 25 EC @ 0.05 % (20 ml /10 litre water) or carbaryl 50 WP @ 0.2 % (40 g/10 lit water) at 15 days interval starting from leaf webber infestation are recommended.

Eco-friendly management of sesame leaf webber, *Antigastra catalaunalis* Duponchel under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone, cultivating sesame under rainfed condition are advised to give two sprays of cartap hydrochloride 50 SP 0.075 % (15 g/10 lit water) or Neem Seed Kernel Extract 3% (300 g/10 lit water) for effective and economic control of the leaf webber. The first spray should be applied when the pest population reach at 5 larvae/20 plants (ETL) and second spray at 15 days after the first spray.

The residue of cartap hydrochloride in sesame seeds at 30 days after second spray was found below detection limit.

Chemical control of sucking pests through foliar application of new insecticides in cotton

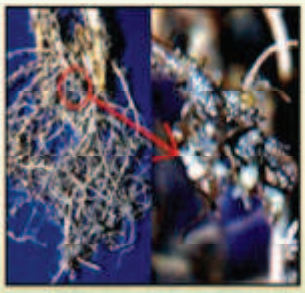
Farmers of South Saurashtra Agro-climatic Zone, growing cotton are advised to apply three sprays of imidacloprid 200 SL @ 40 g a.i. /ha (4 ml/10 lit water) or thiamethoxam 25 WG @ 25 g a.i./ha (2 g/10 lit water) or acephate 75 SP @ 750 g a.i./ha (20 g/10 lit water) for effective and economic control of sucking pests (jassids and whitefly) at 15 days interval starting from the pest infestation. The waiting period of thiamethoxam 25 WG @ 25 g a.i/ha should be maintained 21 days between last spray and harvesting of the crop. The residue of imidacloprid 200 SL @ 40 g a.i. /ha and acephate 75 SP @ 750 g a.i./ha after first and second picking was found below detection level in the cotton lint and seeds.

The pre-harvest interval of 104 days is recommended for imidacloprid, thiamethoxam and acephate.

Plant Pathology

Management of root knot nematode, *Meloidogyne arenaria* in groundnut

The groundnut growing farmers of South Saurashtra Agro-climatic Zone are advised to apply talc based *Paecilomyces lilacinus* (cfu 1 x 10^6/g) as seed treatment @ 10 g/kg seed or soil application of *Paecilomyces lilacinus* (cfu 1 x 10^6/g) @ 2.5 kg/ha for effective and economical management of root knot nematode.



Management of leaf blight disease in tomato

For economical and effective management of leaf blight disease *Alternaria solani* and to get higher tomato fruit yield, farmers of South Saurashtra Agro-climatic Zone, growing tomato in late *kharif* season are advised to apply three sprays of copper hydroxide 77 WP @ 0.2% (25 g/10 lit water) at 10 days interval starting from the initiation of the disease.

Recommendation for the scientific community

Agricultural Entomology

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

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

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

IV. Horticulture & Agro-forestry

This group has released five farmers' recommendations, which are briefed below. This group formulated nine new technical programmes during 2012-13.

Recommendation for the farming community

Evaluation of guava fruit varieties for processing into nectar beverage

Fruit processors are advised to use 20 % pulp of cv. Allahabad Safeda with 0.3 % of acidity and 17 % TSS to prepare a good quality of guava nectar (RTS) which can be stored up to 150 days.

Integrated nutrient management in guava cv. 'Lucknow-49' under Saurashtra region

The farmers of South Saurashtra Agro-climatic Zone growing guava cultivar Lucknow-49 are advised to apply either vermicompost @ 10 kg along with 75% recommended dose of fertilizers (450 g nitrogen, 225 g phosphorus and 225 g potash) per tree or FYM 75 kg + 25% RDF (150 g nitrogen, 75 g phosphorus and 75 g potash) + PSB (20 g per tree) + *Azospirilium* (20 g per tree), in which half dose of nitrogen, full dose of phosphorus, potash and vermicompost should apply at the onset of monsoon and remaining half dose of nitrogen in first week of October to get higher yield and net return.

Preparation and preservation of lasora in different brine preservatives

Fruit processors are advised that the freshly harvested fruits of lasora should be dipped either in Brine 30% + $CaCl_2$ 2% (LR grade) or sea water @ 35 ppt (part per thousand, collected from 1 km inside the sea shore) for enhancing storage life up to 180 days with good quality fruit.

Testing of seasonal forage/fodder crops as a inter cropping in coconut orchard cv. T x D

Coconut growers of South Saurashtra Agro-climatic Zone are advised to grow sorghum cv. *Gundari* for green and dry fodder or maize cv. African Tall for dry fodder purpose as an intercrop in adult plantation of coconut hybrid T x D to get additional net return without decreasing coconut yield.

Testing of forage/fodder crops as a inter cropping for coconut orchard cv. T x D

Coconut growers of South Saurashtra Agro-climatic Zone are advised to grow either multi cut sorghum cv. SSG-59-3 or multi cut Napier grass cv. APBN-1 (hybrid Napier) for green fodder purpose as an intercrop in adult plantation of coconut hybrid T x D to get additional net return without decrease in coconut yield.

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 & water management. Agricultural Engineering group has six farmers and two scientific recommendations. Fourteen new technical programmes have also been formulated by this group.

Recommendation for the farming community

Determination of groundwater potential of the South West Saurashtra region

Groundwater utilization and management policy guidelines are recommended for the South West Saurashtra region to Farmers as well as concerned Planners, NGOs and line departments.

- In normal years, the groundwater potential of South West Saurashtra region is estimated at 4060.66 MCM, which is just sufficient to meet requirement of existing cropping pattern. The water table in the North East area (Talukas: Bhesan, Dhari, Part of Visavadar, part of Junagadh) usually goes down up to 20 m during pre-monsoon. Therefore, water harvesting activities and low water requirements crops should be encouraged to improve the groundwater conditions.
- Around Veraval and Talala, the transmissibility of aquifer is observed around 32 sq.m/hr. Veraval is near sea cost having low altitude, where as Talala having higher altitude. Talala, Mendarada and Visavadar and Malia talukas should be encouraged for surface water harvesting and well recharging (aquifer recharging) as this part has higher transmissibility and upland which creates groundwater flow seaward after recharge which helps to improve ground water quality at coastal belt as well enhance groundwater potential.
- Conjunctive use planning is recommended in good quality groundwater area also to reduce groundwater draft and save power costs.

- Around 2130 sq.km (23%) area of region is under degraded groundwater class during pre monsoon mostly found along coastal line. The area must be improved by bandharas construction along coastal areas, water harvesting structures and conjunctive water use planning. Also salt tolerance and low water requirement crops should be introduced.
- The absolute head continuously falling from North-East upland to sea cost. Just near coastal line 20 m of head remains in pre monsoon. Under such head condition, water harvesting and conjunctive water use planning should be encouraged. The streams must be checked before 2 km from sea coast by Bandhara system, which will reduce sea water intrusion as well as not affects the river livelihood up to the end of river.
- In the area of good class of groundwater, high value crops, which can grow under local climatic conditions, may be encouraged beside existing cropping pattern as good groundwater quality supply is possible to meet.

Conjunctive use of surface water with groundwater for irrigating wheat crop

It is recommended to farmers, planners and NGOs that conjunctive use of surface water from nearby water harvesting structures with groundwater for irrigating wheat crop in Junagadh region is benefited. Further, it is recommended to Irrigation Department of Government of Gujarat to allow to use check dam water to nearby farmers freely instead of keeping it for recharge only after monsoon. As under conjunctive use 533.94 cum (7.72%) of groundwater draft per ha. can be reduced and 123.8 units power per ha. (4.9%) can be saved per irrigation given from check dam. It is economical when at least two irrigations given from surface sources and from second irrigation B/C can rise by 0.038 per irrigation given from check dam as compare to without conjunctive water use. The conjunctive use can control up to 101 mm of evaporation loss from surface water sources. Good scopes are lying to avoid deep pumping, reduce groundwater draft and achieve higher economy by utilizing spill over water before it escapes from water harvesting structures.

Summer sesame response to irrigation under drip and mulching technology

The farmers of the South Saurashtra region sowing summer sesame (GTil-3) crop are advised to adopt any one of the following two irrigation scheduling options through high discharge drip irrigation system (20 lph drippers 1 m dripper spacing and 2 m lateral spacing) with mulch application (5 t/ha wheat straw) for getting the maximum return.

Option - I: When water availability is not limiting factor

The irrigation should be scheduled at IW/ET_c of 1.0. For that, the above said high discharge drip system should be run for 4 hr & 25 min (40 mm irrigation) immediately after sowing and 3 hr & 15 min (29.5 mm irrigation) at 8, 18, 28, 36, 43, 49, 54, 59, 64, 69 and 74 days after sowing.

Option - II: When Water availability is limiting factor

The deficit irrigation should be scheduled at IW/ET_c of 0.6. The saved water should be used to bring additional area under sesame crop cultivation at same deficit irrigation scheduling level. For that the said high discharge drip system should be run for 4 hr & 25 min (40 mm irrigation) immediately after sowing , 3 hr & 15 min (29.5 mm irrigation) at 10 days after sowing and 3 hr & 40 min (33.3 mm irrigation) at 23, 36, 47, 58 and 70 days after sowing.

Drought investigation using Standardized Precipitation Index (SPI) for Junagadh

The farmers of South Saurashtra Agro-climatic zone are advised to use the excess rainfall prevailing during 27-32nd standard weeks (2nd July to 12th August) judiciously and frugally towards supplemental irrigation to sustain crop productivity under rainfed agriculture.

Effect of land configuration on groundnut yield

Farmers of South Saurashtra Agro-Climatic Zone growing bunch type groundnut are advised to prefer Broad Bed Furrow (55 cm width and 15cm depth of furrow and 100 cm bed width between two furrows) land configuration for getting more moisture retention and higher return under rain fed agriculture.

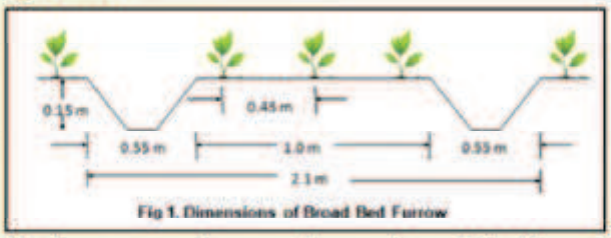


Fig 1. Dimensions of Broad Bed Furrow

Performance of screen house for cultivation of capsicum

The farmers of South Saurashtra Agro-climatic Zone who are interested to cultivate the capsicum in protected structures are advised to use JAU developed screen house (poly-cum-shadenet house) covered with 50% green shadenet on periphery for natural ventilation and roof covered with 200 UVS PE sheet to get sufficient light. Under such type of structure, drip irrigation system with IW: CPE=0.8 should be used.

Recommendation for the scientific community

Summer sesame response to irrigation under drip and mulching technology

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

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

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

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

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

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

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

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

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

Drought investigation using Standardized Precipitation Index (SPI) for Junagadh

The Scientists, Policy makers and Irrigation planners of South Saurashtra Agro-climatic Zone

are advised to plan their irrigation water schedules to the crop based on the following guidelines:

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

VI. Animal Health & Animal Production

Cattle Breeding Farm, Junagadh Agricultural University is the largest and oldest farm and is the only organized research station where purebred *Gir* Cattle and *Jaffrabadi* Buffaloes are maintained in the country. This research station is involved since its inception in the conservation, improvement and advancement of *Gir* Cattle & *Jaffrabadi* Buffaloes through selective breeding. Research programmes such as "Progeny Testing in *Gir* Cattle" and "Establishment of Elite herd of *Gir* Cattle and *Jaffrabadi* Buffaloes", ICAR sponsored research projects such as "Genetic improvement in indigenous germ-plasm" and "Network project on *Jaffrabadi* buffaloes" are the key projects functional at the research station.

The herd of *Gir* Cattle was established as early as in 1920 by the erstwhile Princely state of Sorath (Junagadh). while *Jaffrabadi* herd was established in the year 1978. Since then this research station always maintains about 450 heads of *Gir* Cattle and 200 heads of Buffaloes. Besides maintaining pure bred herds of *Gir* Cattle and *Jaffrabadi* buffaloes, at the station. The centre is involved in conservation and improvement of field animals of these breeds through Field Progeny Testing programmes and supply of high quality males to different *Gram Panchayats*.

Presently, this station has 134 hectare of land out of which about 30 hectare is pasture land. The subsidiary farm known as Narsimehta Talav has 16 hectare and Jonpur farm has grass land of 130 hectare from where annually 3 to 4 lakh kg of dry grass is made available for feeding the animals.

During the year 2012-13, total 4169 frozen doses from *Gir* bulls and 6882 frozen semen doses from *Jaffrabadi* bulls were produced at the semen station at Cattle Breeding Farm. Out of these 2490 doses of *Gir* bulls and 4067 doses of *Jaffrabadi* bull were used for Artificial Insemination in the village around the centre through 14 rural A.I. centres.

During the year 2012-13, 30 *Gir* breeding bull calves were distributed among various *Gram Panchayat* for breeding the rural *Gir* population. Similarly, during the year nine *Jaffrabadi* growing males were sold to the different *Gram Panchayats* for breeding the *Jaffrabadi* buffaloes.

Performance of *Gir* and *Jaffrabadi* herds at CBF during the year 2012

No.	Particulars	*Gir* herd	*Jaffrabadi* herd
1	Total lact. Milk yield (Lit.)	2074	1867
2	300-D milk yield (Lit.)	1892	1705
3	Lactation days	346	329
4	Dry days	155	182
5	Calving interval (days)	503	465
6	Age at 1st Calving (days)	1461	1620
7	Age at 1st Heat (days)	1181	1231
8	Service period (days)	223	209
9	No. of service/AI/Conception	1.51	1.25
10	Overall mortality (%)	3.60	4.02

A.I. Performance in the field during the year 2012-13

No.	Name of the Centre	AI done in *Gir* cow	Cows conceived	AI done in *Jaffrabadi* buffalo	Buffaloes conceived
1	Shedaya	159	112	141	94
2	Pipli	166	94	164	89
3	Loez	240	159	912	519
4	Movana	307	152	493	260
5	Surva	348	234	271	142
6	Mandlikpur	296	116	415	181
7	Sherdi	167	45	323	70
8	Hadmadiya	191	81	102	40
9	Ghumli	110	59	97	48
10	Gundala	92	35	137	52
11	Chaparda	169	79	252	110
12	Porbandar	118	06	583	134
13	Khorasa	38	07	81	25
14	Dolasa	89	79	96	12
	Total	**2490**	**1258**	**4067**	**1776**

In the area under operation of these centres 4821 *Gir* cow calves and 13158 *Jaffrabadi* buffalo calves, were born till date. These calves are breed specific and of excellent genetic worth to farmers in increasing milk production in the region.

Frozen semen doses produced on the farm were sold at the rate of ₹ 20/- per dose and the following number of semen doses of the bulls are available at the research station for sale and distribution.

No.	*Gir* bulls		*Jaffrabadi* bulls	
	Name of the bull	Semen doses available	Name of the bull	Semen doses available
1	Murari	1208	Bhagaro	6990
2	Bhavik	366	Laxman	3294
3	Rupak	792	Moti	5853
4	Pankaj	2338	Haresh	2394
5	Bhola	1681	Sunder	3093
6	Raj	1212	Raja	1361
7	Krishna	602	Nagaraj	2653
8	Milan	820	Dhinglo	4215
9	--	--	Bholenath	2289
	Total	**9019**		**32142**

Total 20 research schemes are in 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 and pedigreed bulls to *Gram Panchayat* and other agencies associated with breeding and improvement of *Gir* and *Jaffrabadi* breed and also through supply of frozen semen doses to field A.I. centres. Strengthening of Livestock Inspector Training Centre, Establishment of Artificial Insemination Training Centres in Saurashtra, and Establishment of Mobile Ambulatory Clinic at Cattle Breeding Farm are the extension schemes functional at the centre. During the year, 33 students passed Livestock Inspector one year certificate course from LITC. About 1340 farmers, 755 women farmers, 52 young farmers, 90 extension workers visited this station and were provided technical guidance.

During the year 2012-13, a mini Cattle Feed Plant (Roughage Processing Plant and Block making machine) was established at the Centre with cost of ₹ 27.84 lakhs through which the agricultural byproducts like Groundnut haulms and Wheat Bhusa are being converted in to enriched palletted Cattle Feed. Similarly, in the same year a mini dairy plant was also established under RKVY projects costing ₹ 27.52 lakhs. The objective of the same was to produce clean and hygienic milk and to pasteurize and pack the same in the milk pouch for distribution. Also, the unit is being used for training the Agricultural Engineering graduates and B.Tech. (Dairy Engineering) graduates.

Visit of the Hon'ble Vice Chancellor of Cattle feed plant at CBF, JAU, Junagadh

Mini Dairy Plant at CBF, JAU, Junagadh

Jaffrabadi buffalo bull

This group has released three recommendations for farmers and one scientific recommendation, which are briefed here after. During the year, 18 new experiments were conducted on genetic improvement, animal nutrients, animal production and health.

Recommendations for famers

Effect of restricted suckling on lactation and reproductive performance of *Gir* cows

Dairy farmers keeping *Gir* cows are advised to practice restricted suckling of calves to reduce the incidences of short lactations and low lactation milk yields due to short lactations. There is increased overall milk production in suckled cows as compared to non-suckled cows. Even though there is delay in service period by 1 cycle, it is offset by overall benefits in production performance of suckled cows.

Effect of restricted suckling on growth performance of *Gir* calves

Dairy farmers keeping *Gir* cows are advised to practice restricted suckling up to 5 months of age (daily 2 to 2.5 lit during birth to 1 month, 3 to 4 lit during 1 to 3 month and 1 to 1.5 lit during 4 to 5 month age) and then stop suckling of the calves. This improves growth performance (412 vs. 312 g/d) and body weight of calf at 3 months of age (59 vs. 51 kg) with lesser milk consumption (319 vs. 279 lit per calf) over that in weaning.

Gir bull

Effect of age and body weight at calving on lactation performance of primiparous *Gir* cows

Farmers keeping *Gir* animals are advised to maintain 300 to 350 kg body weight at first calving in *Gir* heifers for obtaining higher lactation milk yield.

Information for scientific community

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

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

VII. Fisheries Science

This group has released one recommendation for fish farmers and two scientific recommendations, which are briefed below. It has also taken up five new technical programmes during 2012-13.

Recommendation for fish farmers

Survey for cultivable brackish water fish seeds along coast of Okha mandal to Harshad creek

The fish farmers of Saurashtra are recommended to collect the fry of cultivable mullet species *Mugill cephalus* available abundantly during February at Rupen and Harshad creeks; *Mugill seheli* during October-November at Khatumba and *Mugill parsia* during August-September at Rupen and Harshad creeks.

Information for scientific community

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

In South Saurashtra Agro-climatic Zone better biomass can be obtained by providing fish feed containing 30% protein to fish *Labeo rohita*.

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

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

VIII. Basic Science

This group released one for farmer and seven scientific recommendations, which are briefed below. This group also approved 12 new technical programmes during 2012-2013.

The effect of harvesting dates on fresh seed dormancy in pearl millet hybrids

Farmers of South Saurashtra Agro-climatic Zone taking hybrid seed production of pearl millet are recommended to harvest the crop between 25 to 35 days after flowering. They are also recommended to dry and store the seed for 20 to 30 days after harvesting them, in order to get maximum germination and enhanced seedling vigour.

Recommendation for the scientific community

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

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

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

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

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

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

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

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

Physiological evaluation of some released varieties of bunch type of groundnut

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

Quality differences in *kesar mango* of different location of Saurashtra

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

Molecular characterization of indigenous mango cultivars through DNA finger printing

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

IX. Social Science

Agricultural economists worked on the different research projects *viz*., farm cost studies of important crops in Gujarat, returns to research investment on groundnut crop in 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, chickpea, wheat, mustard and cumin were published for benefits of farmers in English and *Gujarati* news papers. For the dissemination of price forecast report to the farmers, the Voice Mail SMS service is being provided in collaboration with IFFCO *Kisan Sanchar* Ltd., Ahmadabad. It has 71,735 farmers on board. Twenty messages of price forecast were disseminated during March to December, 2012, which accounts to a total of 10,04,290 Voice Mail SMS. Market Intelligence was also disseminated through letters, E-mail messages and hard copies in training/meetings. Also, the commodity report on cumin was prepared and submitted to the PI of the project. The data base for 10 major commodity regarding area, production, productivity, monthly market prices and export-import were updated. Price forecast reports were put on JAU Website. Extension educationists conducted study on project of socio-economic impact assessment and evaluation

and research project was completed on analysis of interactive relationship among components of integrated farming system. This group released one scientific recommendation, which is briefed below. Seven new technical programmes were approved during 2012-13.

Recommendation for the scientific community

Optimum plot size in field experiment on wheat crop

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

X. Breeder seed production

The breeder seeds of different crops produced to fulfil the demand of private and public sectors as per the national and state indents are given as herein. 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 2012-13

No.	Crop	Variety	Nucleus Seed (q)	Breeder Seed (q)		Total (q)
				National	State	
1	Groundnut	GG-2	-	-	37.80	37.80
		GG-5	7.96	-	33.40	41.36
		GG-7	-	3.00	10.50	13.50
		GG-8	-	7.35	-	7.35
		GAUG-10	2.85	-	-	2.85
		GG-11	10.20	-	42.40	52.60
		GG-16	-	4.06	-	4.06
		GG-20	151.57	25.00	520.00	696.57
		GG-21	1.71	-	-	1.71
		GJGHPS-1	9.00	-	25.50	34.50
		GJG-9	-	-	20.20	20.20
		GJG-31	-	-	24.05	24.05
		GJG-17	4.10	-	8.10	12.20
		GJG-22	5.40	-	7.20	12.60
		Sub Total	**192.79**	**39.41**	**729.15**	**961.35**
2	Pearl millet	GHB-558	-	-	2.85	2.85
		GHB-744	-	-	3.00	3.00
		GHB-719	-	-	3.05	3.05
		Sub Total	-	-	**8.90**	**8.90**
3	Sesame	G.Til-2	-	0.30	0.50	0.80
		G.Til-3	-	0.14	0.35	0.49
		G.Til-4	-	-	0.04	0.04
		Purva-1	-	-	0.07	0.07
		Sub Total	-	**0.44**	**0.96**	**1.40**
4	Chickpea	GG-1	8.78	34.25	27.25	70.28
		GG-2	5.50	-	29.45	34.95
		GG-3	3.39	17.60	18.25	39.24
		GG-4	2.54	21.75	-	24.29
		Sub Total	**20.21**	**73.60**	**74.95**	**168.76**
5	Wheat	GW-366	-	118.40	27.20	145.60
		GW-496	-	-	38.80	38.80
		Sub Total	-	**118.40**	**66.00**	**184.40**
6	Castor	GCH-7	-	-	1.65	1.65
7	Cotton	Deviraj	-	-	0.36	0.36
	Grand Total		**213.00**	**231.85**	**881.97**	**1326.82**

XI. Mega seed unit

At mega seed processing plant, the crop seeds produced on 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 2012-13

No.	crop	Production (q)
1	Groundnut	630.82
2	Pearl millet	0.83
3	Chickpea	822.50
4	Sesame	111.59
5	Wheat	4682.37
6	Cotton	7.50
7	Castor	1.65
8	Cumin	980.33
9	Coriander	94.74
10	Soybean	32.31
11	Mungbean	129.79
12	Uradbean	56.59
13	Pigeon pea	127.70
14	Sugarcane setts	1292.60
15	Cowpea	0.76
16	Ajwain	3.13
17	Garlic	38.00
18	Onion	0.58
19	Papaya seeds	0.95
20	Cluster bean (Guar gum)	11.40
21	Vegetable seeds	11.28
	Total...	**9037.42**
22	Planting Materials (Nos.)	**79837.00**

Biofertilizers

XII. Front line demonstrations organized on farmers' fields during year 2012-13

Crop scientists have successfully organized total 217 Front Line Demonstrations on farmers' fields in addition to the FLDs organized by KVKs of JAU.

No.	Crop	No. of FLD
1	Groundnut	40
2	Chickpea	10
3	Vegetable	08
4	Sesame	01
5	Castor	12
6	Wheat	11
7	Pearl millet	120
8	Spices	15
	Total...	**217**

XIII. Production of *Sawaj-Trichoderma, Sawaj-Azotobacter, Sawaj-Rhizobium* and *Sawaj* PSB

The Department of Plant Pathology produced and provided 5552 litres (11104 bottles) of *SAWAJ-Azotobacter*, a liquid bio-fertilizer, to the State Department of Agriculture for distribution to farmers as an integrated part of *Krushi Mahotsava* Kits and 1984 bottles sold directly to farmers at reasonable price (60/bottle). Production of *SAWAJ-Rhizobium* and *SAWAJ*-PSB was also started. The department also produced and distributed 22670 kg (packets) bio-agent *Trichoderma harzianum* under the brand name of *SAWAJ-Trichoderma* for the management of various soil borne diseases especially stem and pod rot of groundnut in the Saurashtra region.

Bioagent *"Sawaj Trichoderma"*

XIV. NABL accreditation of Food Testing Laboratory

The Food Testing Laboratory (FTL) at JAU, Junagadh, first of its kind providing professional interface to public and private sectors. The laboratory has been given the NABL accreditation. Exporters, progressive farmers, traders, industrialist and other agricultural related professionals of Saurashtra region will be benefitted by this lab certificate/test report, which will be accepted internationally with the standard ISO/IEC 17025:2005.

Visit of Hon'ble Agriculture Minister Shri Babubhai Bokhiria at Food Testing Laboratory

XV. New research programmes sanctioned during year 2012-13

No.	Agency	No. of Research Programmes	Amount (₹ in lakh)
1	ICAR/GOI	02	201.83
2	Other Agencies	23	91.42
3	Govt. of Gujarat	07	324.00
4	RKVY	03	108.15
	Total	**35**	**725.40**

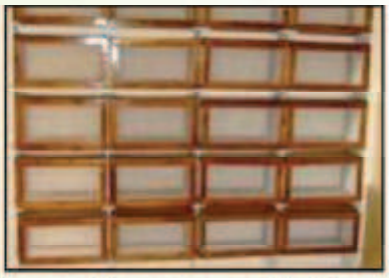
XVI. RKVY Projects

Total 16 projects under RKVY were implemented in Junagadh Agricultural University during the year 2012-13 as per details given below.

Project-1:

Establishment of bio-control laboratory for mass production of bio-agents

Under this project, mass rearing of laboratory host *Corcyra cephalonica* for the production of egg parasitoid *Trichogramma* and *Chrysoperla carnea* and entomopathogenic fungus *Beauveria bassiana* was carried out. During the year 10.00 lakh eggs of *C. cephalonica*, 75 trichocards, 500 bags of *C. carnea* and 50 kg *Beauveria* fungus were produced.



***Chrysoperla carnea* production unit**

Bottles of biopesticides

Project-2:

Quality seed production of groundnut, wheat and pearl millet

Under the quality seed production of groundnut, wheat and pearl millet, 21 q of groundnut, 27.7 q of wheat and 8.9 q of pearl millet seeds were produced during the year.

Project-3:

Large scale production of quality seeds/ planting materials of horticultural, vegetable and spices crops at Junagadh

Under this project, 275 horticultural grafts, 16070 fruit saplings and 7285 ornamental plants and high quality seed of vegetables *viz*., okra 95 kg, brinjal 20 kg, tomato 10 kg and onion 200 kg as well as spices *viz*., coriander 400 kg and garlic 1800 kg 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 was carried out under this project. Total 39 farm machinery and implements were tested during the year.

Field testing of Raised Bed Furrower

Field testing of Groundnut Digger Shaker

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 of different research station of the University were provided trainings at Indian Meteorological Department, Pune for proper recording of weather parameters.

Agromet Observatory at Oilseeds Research Station, JAU, Amreli

Agromet Observatory at KVK, JAU, Khapat (Porbandar)

Project-6:

Establishment of laboratory for bioagents mass production and their use in plant diseases management

Under this project, isolation of bioagents from crop rhizosphere was carried out. Twenty three 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)

About 1320 FLD were conducted on farmers' fields for control of cotton mealy bug through 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* 2 kg/ha at 45 DAS + Trizophos 0.04% spot application at 60 DAS) was demonstrated on farmers' fields.

Insecticide spraying in demonstration plot

Spot application of methyl parathion 2% dust in demonstration plot

Project-8:

Establishment of modern nursery for propagatioand popularization of planting materials (DAP-Jamnagar district)

Under this project, conservatory unit was established. 361 saplings were produced and supplied to 12 farmers in the Jamnagar district. Further, two trainings were conducted for 102 horticultural farmers on nursery management.

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

Wireless Sensor Module

Cotton crop could be taken during first year

Project-10:

Establishment of the elite seed farm for coconut D x T (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.

Before development

After development

Project-11:

Farm Field School

Under this project, 29 Farm Field Schools were conducted during *kharif*-2012, while 30 Farm Field Schools were conducted during *rabi*-2012-13 through five KVKs of this university.

Project-12:

Production of quality planting materials for horticultural crops

Under this project, 11205 fruit grafts, 11380 fruit saplings, 6500 papaya seedlings and 10290 ornamental plants were produced and supplied to the farmers. 35 kg of papaya seeds were also produced.

The following civil work projects are in progress.

Project-13:

Expansion of facilities for Agricultural Education

Project-14:

Expansion of boys' hostel facilities for U.G./P.G. Students

Project-15:

Establishment of Advance Training Centre for Farmers at Amreli

Project-16:

Construction of Educational building of Agro ITI at Mahuva

Poly cum net house for capsicum cultivation

View of Research Farms