JUNAGADH AGRICULTURAL UNIVERSITY
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RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS

2013

Directorate of Reasearch
Junagadh Agricultural University
JUNAGADH - 362 001(Gujarat)

Visit of Hon'ble Agriculture Minister, Gujarat State

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MESSAGE

The University undertakes research through its main research stations and sub centers in the fields of agriculture, horticulture, agril. engineering, fisheries, veterinary science & animal husbandry, and agri-business management. The research findings are discussed thoroughly at University level and subsequently at the state level before its recommendation to the farmers. I am happy to mention that the publication entitled "Research Accomplishments and Recommendations-2013" provides numerous recommendations and technologies for farmers and scientific community emerged from various scientific groups of Junagadh Agricultural University, Junagadh during the year 2013. I hope that this information will be greatly useful to the scientists, extension officers, farmers and students for their future course of action.

I congratulate and appreciate the scientists / teachers of the University for their untiring efforts in bringing out recommendations through field experiments. I also compliment the entire team of Directorate of Research for compiling and publishing this booklet.

Junagadh
November 20, 2013

(N. C. PATEL)
VICE-CHANCELLOR

Junagadh Agricultural University,
Junagadh - 362 001 (Gujarat)

PREFACE

It is a matter of great pleasure for me to highlight the research work carried out in the University and approved in the 9th Combined Joint AGRESCO meeting of SAUs.

The Junagadh Agricultural University represents eleven districts and about 32.82 per cent area of the state. There are six colleges, four polytechnic colleges and 30 research stations, which include multidisciplinary main research stations, sub research stations for various crops as well as testing centers in the University. The eight different sub-committees have been constituted and conveners were nominated to plan and monitor the research work. All the sub-committees have successfully completed their job. The University has also arranged 9th and 10th Research Council meeting on June 15, 2012 and December 30, 2012, respectively for approval of new research projects and research activities during this year.

Total 34 new projects worth of ₹ 558.35 lakh were sanctioned from ICAR, Govt. of Gujarat and Private sectors in the University. The main sanctioned projects are:

1. Feed testing laboratory at Cattle Breeding Farm, JAU, Junagadh.
2. Survey of coconut orchards in Gujarat.
3. Strengthening of Dry Farming Research at Jamkhambhalia and Vallabhipur.
4. Establishment of Mega Seed Center for quality seed production and distribution at Junagadh.
5. Micronutrients and sulphur research in soils and plants in Saurashtra region at Junagadh.
6. Center of remote sensing and geoinformatics in Agriculture at Junagadh.

Four RKVY projects worth of ₹ 208.15 lakhs were also sanctioned during the financial year 2012-13:

1. Farm field school at KVKs of the University.
2. Construction of educational building of agro ITI, JAU, Mahuva.
3. Improving facilities for shrimp and finfish seed production at Fisheries Research Station, JAU, Okha.
4. Production of quality planting materials for horticultural crops.

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

Under the HRD component of the University, 95 scientist/ teachers were deputed to attend winter/summer school training, 84 attended different seminar/ symposium/ conference at state and national level and 147 attended the workshops and group meet of their respective projects. The University has also organized four national level programmes like scientists' meets and workshops as well as seven state level seminars/training/workshops.

In the 9th Combined Joint AGRESCO Meeting of SAUs, two varieties *viz.*, Cotton, Gujarat Junagadh Cotton 101 (GJC-101) and Sugarcane, Gujarat Sugarcane 5 (GS-5 endorsed for Saurashtra region) were recommended for release in the state. Besides, 44 technologies/recommendations were made for farmers and 15 recommendations were made for Scientific Community. In addition, as many as 112 new technical programmes were formulated to initiate the new research programmes for the solutions of the applied and basic problems of agriculture and allied fields.

November, 2013

(C. J. Dangaria)
DIRECTOR OF RESEARCH & DEAN
FACULTY OF P.G. STUDIES

Summary of new released varieties and developed agro technologies during the 2012-13.

Name of the Sub-Committee	No. of Recommendations Emerged for		New Technical Programmes
	Farmers	Scientific Community	
Crop Improvement	02*	01	02
Crop Production	19	-	27
Plant Protection	09	01	18
Agricultural Engineering	06	02	14
Horticulture & Agro Forestry	05	-	09
Animal Science	03	01	18
Fisheries Science	01	02	05
Social Science	-	01	07
Basic Science	01	07	12
Total...	**2*+44**	**15**	**112**

* Varieties released

Recommendations for Farmers

I. CROP IMPROVEMENT

Two varieties *viz.*, Cotton (GJC-101) and Sugarcane (GS-5 endorsed) were recommended for farmers of the state during 2012-13.

Cotton: Gujarat Junagadh Cotton-101 (GJC-101)

The farmers of non Bt cotton (*Gossypium hirsutum*) growing areas of Gujarat state are advised to grow variety GJ. 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 obtained by GJ. 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.

(Cotton Research Station, JAU, Junagadh)

Sugarcane: Gujarat Sugarcane-5 (GS-5)

The farmers of South Saurashtra Agro-climatic Zone growing sugarcane crop are advised to grow sugarcane variety CoN 05071

(Gujarat Sugarcane 5) 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

(Main Sugarcane Research Station, JAU, Kodinar)

II. CROP PRODUCTION

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.

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

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.

(Department of Agronomy, JAU, Junagadh)

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.

(Vegetable Research Station, JAU, Junagadh)

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.

(Vegetable Research Station, JAU, Junagadh)

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.

(Dry Farming Research Station, JAU, Targhadia)

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.

(Department of Seed Science & Technology, JAU, Junagadh and Main Millet Research Station, JAU, Jamnagar)

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 recommended dose of fertilizer (120:60 N:P_2O_5 kg/ha) to get higher yield and net return.

(Department of Agril. Chemistry & Soil Sci., and Wheat Research Station, JAU, Junagadh)

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.

(Department of Agril. Chemistry & Soil Sci., and Main Oilseeds Research Station, JAU, Junagadh)

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.

(Department of Agril. Chemistry & Soil Sci., and Pulses Research Station, JAU, Junagadh)

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

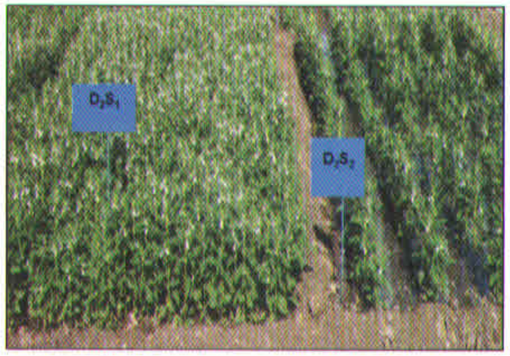
The farmers of South Saurashtra Agro-climatic Zone -VII adopting groundnut (*kharif*)-wheat (*rabi*) cropping sequence are advised to apply FYM @ 10 t/ha + 6.25:12.5 N:P_2O_5 kg/ha through fertilizer to groundnut and 120:60:60 N:P_2O_5:K_2O kg/ha through fertilizer only to wheat for securing higher net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

(Department of Agril. Chemistry & Soil Sci., and Department of Agronomy, JAU, Junagadh)

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.



(Department of Agronomy, JAU, Junagadh)

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 cultivatio

followed by blade harrowing and subsoiling between two rows to get higher yield and net realization.

(Department of Agronomy, JAU, Junagadh)

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.

(Agril. Research Station, JAU, Amreli)

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 Gujarat Sugarcane 5 (CoN 05071) at 90 cm distance or in paired rows (30:150 cm) to get higher cane yield and net return.

(Main Sugarcane Research Station, JAU, Kodinar)

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.

(Dry Farming Research Station, JAU, Targhadia)

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 for effective weed management.

(Department of Agronomy, JAU, Junagadh)

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 return.

(Main Oilseeds Research Station, JAU, Junagadh)

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

(Department of Agronomy, JAU, Junagadh)

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

(Department of Agronomy, JAU, Junagadh)

III. PLANT PROTECTION

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-limatic Zone, two sprays of abamectin 1.9 EC @ 0.003 % (16 ml / 10 litre water) or carbosulfan 25 EC @ 0.05 % (20 ml/ 10 litre water) or difenthiuron 50 WP @ 0.07 % (14 g /10 litre 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.

(Department of Entomology, JAU, Junagadh)

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.

(Department of Entomology, JAU, Junagadh)

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 litre water) or buprofezin 25 EC @ 0.025% (10 ml/ 10 litre 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.

(Department of Entomology, JAU, Junagadh)

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.

(Department of Entomology, JAU, Junagadh)

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 litre water) or novaluron 10 EC @ 0.01 % (10 ml /10 litre water) or spinosad 45 SC @ 0.015 % (3 ml /10 litre water) or quinalphos 25 EC @ 0.05 % (20 ml /10 litre water) or carbaryl 50 WP @ 0.2 % (40 g/10 litre water) at 15 days interval starting from leaf webber infestation are recommended.

(Department of Entomology, JAU, Junagadh)

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.

(Main Dry Farming Research Station, JAU, Targhadia)

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 litre water) or thiamethoxam 25 WG @ 25 g a.i./ha (2 g/ 10 litre water) or acephate 75 SP @ 750 g a.i./ha (20 g / 10 litre 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.

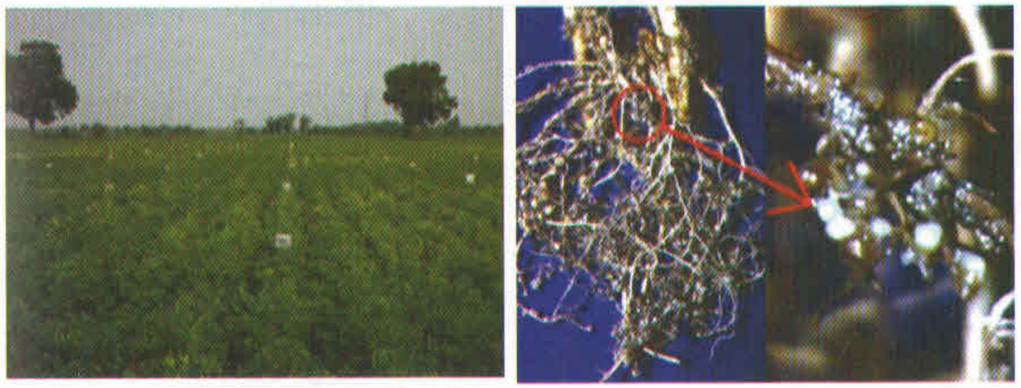
The pre-harvest interval of 104 days is recommended for imidacloprid, thiamethoxam and acephate.

(Cotton Research Station, JAU, Junagadh)

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.



(Main Oilseed Research Station, JAU, Junagadh)

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.

(Vegetable Research Station, JAU, Junagadh)

IV. HORTICULTURE & AGRO-FORESTRY

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.

(Department of Horticulture, JAU, Junagadh)

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

The farmers of South Saurashtra Agro-climatic Zone who are 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.

(Department of Horticulture, JAU, Junagadh)

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.

(Department of Horticulture, JAU, Junagadh)

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.

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

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.

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

V. AGRICULTURAL ENGINEERING

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 exiting cropping pattern. The water table in the North East area (Talukas: Bhesan, Dhari, Part of Visavadar, part of Junagadh) usually goes down up to 20m 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.

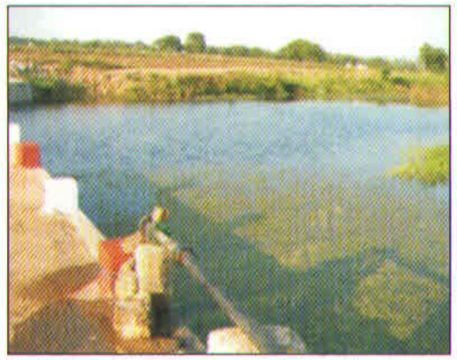
- The absolute head continuously falling from North-East upland to sea cost. Just near coastal line 20 m of head remains in pre monsoon. Under such head condition, water harvesting and conjunctive water use planning should be encouraged. The streams must be checked before 2 km from sea coast by Bandhara 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.

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

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.

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

Summer sesame response to irrigation under drip and mulching technology

The farmers of the South Saurashtra region sowing summer sesame (Guj. Til -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 2m lateral spacing) with mulch application (5 tone/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 above 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.

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

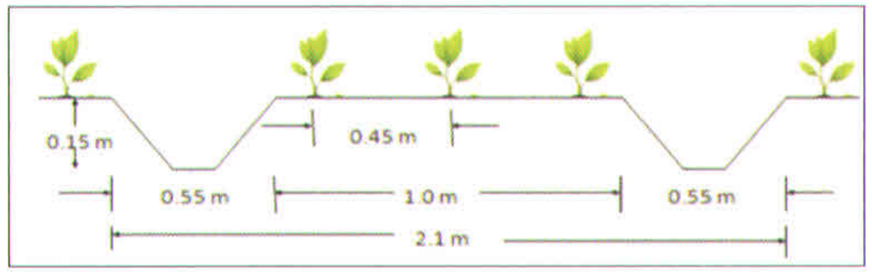
Drought investigation using Standardized Precipitation Index (SPI) for Junagadh

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

(Research Testing & Training Center, JAU, Junagadh)

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 15 cm depth of furrow and 100 cm bed width between two furrows) land configuration for getting more moisture retention and higher return under rainfed agriculture.



(Research Testing & Training Center, JAU, Junagadh)

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.

(Research Testing & Training Centre, JAU, Junagadh)

VI. ANIMAL HEALTH & ANIMAL PRODUCTION

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 off-set by over-all benefits in production performance of suckled cows.

(Cattle Breeding Farm, JAU, Junagadh)

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 gm/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.

(Cattle Breeding Farm, JAU, Junagadh)

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.

(Cattle Breeding Farm, JAU, Junagadh)

VII. FISHERIES SCIENCE

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.

(Fisheries Research Station, JAU, Okha)

VIII. BASIC SCIENCE

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.

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

Recommendations for Scientific Community

I. CROP IMPROVEMENT

Testing of fresh seed dormancy in bunch groundnut varieties

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

(Main Pearl Millet Research Station, JAU, Jamnagar)

II. PLANT PROTECTION

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.

(Pulse Research Station, JAU, Junagadh)

III. AGRICULTURAL ENGINEERING

Summer sesame response to irrigation under drip and mulching technology

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

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

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

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

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

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

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

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

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

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

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

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

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

(Research Testing & Training Center, JAU, Junagadh)

IV. ANIMAL HEALTH & ANIMAL PRODUCTION

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

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

(Cattle Breeding Farm, JAU, Junagadh)

V. FISHERIES SCIENCE

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

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

(College of Fisheries, JAU, Veraval)

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

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

(College of Fisheries, JAU, Veraval)

VI. BASIC SCIENCE

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

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

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

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

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

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

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

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

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

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

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

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

Physiological evaluation of some released varieties of bunch type of groundnut

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

(Dry Farming Research Station, JAU, Targhadia)

Quality differences in kesar mango of different location of Saurashtra

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

(Department of Biochemistry and Biotechnology, JAU, Junagadh)

Molecular characterization of indigenous mango cultivars through DNA finger printing

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

(Department of Biochemistry and Biotechnology, JAU, Junagadh)

VII. SOCIAL SCIENCE

Optimum plot size in field experiment on wheat crop

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

(Department of Agril. Statistics, JAU, Junagadh)

Production of Nucleus / Breeder seeds during year 2012-13

Sr. 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**