RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS

2017

DIRECTORATE OF RESEARCH
JUNAGADH AGRICULTURAL UNIVERSITY
JUNAGADH-362 001(Gujarat)

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MESSAGE

Junagadh Agricultural University is extending its excellence in planning, execution, monitoring and evaluation of research and its application in agriculture, horticulture, agricultural engineering, animal husbandry, dairy and fishery sciences. The scientists of University are excelling their duties in developing suitable technologies to enhance productivity and improve quality of produce for the betterment of farmers. Simultaneously, basic research is also being carried out for updating knowledge of scientists for their future courses of study.

The scientists have developed new varieties, technologies like drip irrigation, fertigation, mulching, protected cultivation etc., which will be helpful to sustain the crop against climate change. The research on weed management, nutrient management and pest & disease management technology for the major crops of Saurashtra and efforts of the scientists in Horticulture, Forestry, Animal Husbandry and Fisheries fields are noteworthy.

It is my proud privilege to provide useful information published in **"Research Accomplishment and Recommendations-2017"** for farmers, scientists, extension functionaries, planners, students and entrepreneurs.

I heartily congratulate scientists, teachers and supporting staff for their distinguish contribution in bringing such recommendations as an outcome of their efforts in laboratory as well as in field. I also compliment the entire team of Directorate of Research for nicely compilation and publication of this booklet. I am sure that with wide spread of this booklet will significantly contribute to uplift economic and social condition of the farmers.

Junagadh
September 18, 2017

(A. R. PATHAK)
VICE CHANCELLOR

Dr. V. P. CHOVATIA

Junagadh Agricultural University
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PREFACE

It is a matter of great pleasure for me to highlight the research work carried out during 2016-17 in the University. The contents of recommendations and new technical programmes were critically discussed and approved in respective 13th AGRESCO meeting of various sub-committees of Junagadh Agricultural University. They were also presented and approved in 13th Combined Joint AGRESCO meeting held at Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, during April 05-07, 2017.

The Junagadh Agricultural University represents ten districts and about 32.74 per cent area of the state. There are eight colleges, six polytechnic colleges and 31 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 14th Research Council meeting on January 13, 2017 for approval of new research projects and research activities during this year.

Total 33 new projects worth of Rs. 658.29 lakh were sanctioned from ICAR, Government of India, Government of Gujarat and Private sectors in the University. The main sanctioned projects are:

1. Creation of Seed-Hubs for increasing indigenous production of pulses in India.
2. Establishment of model organic farm.
3. Genome and trancriptome sequencing of coriander (*Coriandrum sativum*) to reveal insight of its genomic architecture and breeding targets.

4. Evaluation of fish meal substitution with plant proteins in formulation feed in rohu (*Labeo rohita*) through nutrigenomics approach.
5. Technical assistance for wildlife health care, diseases diagnosis and therapeutic management.
6. Use of molecular markers in testing genetic purity of dwarf and tall coconut population at Mangrol and Mahuva sub-centers of JAU.
7. Centre for entrepreneurship development on agriculture and allied sciences.

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, 127 scientists/teachers were deputed to attend winter/summer school training, 194 attended different seminars/symposium / conference at state and national level, 141 attended the workshops & group meet of their respective projects and 159 scientists/teachers were deputed to attend monitoring, academic work, visit etc. The University has also organized five national level programmes like short course & workshops as well as four state level training & workshops.

In the 13th Combined Joint AGRESCO Meeting, three varieties *viz.*, Groundnut [Gujarat Junagadh Groundnut 32 (GJG 32)], Castor [Gujarat Castor Hybrid 9 (GCH 9)] and Papaya [Gujarat Junagadh Papaya 1 (GJP 1)] were recommended for release in the state. Besides 39 technologies / recommendations were made for farmers and 25 recommendations were made for Scientific Community. In addition, as many as 120 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. The new varieties were also released in 48th meeting of State Seed Sub-Committee held on September 26, 2017 at Gandhinagar.

Junagadh
September, 2017

(V. P. CHOVATIA)
DIRECTOR OF RESEARCH &
DEAN P. G. STUDIES

Summary of new released varieties and developed agro technologies during the year 2016-17

Sub-Committee	No. of Recommendations finalized for		Approved New Technical Programmes
	Farmers	Scientific Community	
Crop Improvement	03*	-	02
Crop Production	13	04	23
Plant Protection	04	08	25
Horticulture & Agro Forestry	06	01	12
Agricultural Engineering	08	01	13
Basic Science	02	02	15
Social Science	-	02	16
Animal Science	01	06	07
Fisheries Science	05	01	07
Total:	3*+39	25	120

* Varieties released

RECOMMENDATIONS FOR FARMERS

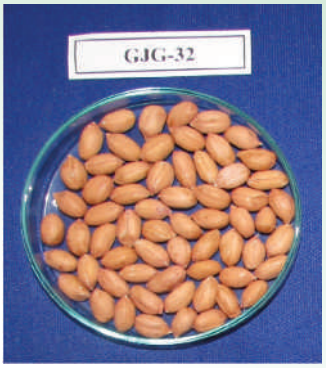
I. CROP IMPROVEMENT

Three varieties *viz.*, Groundnut [Gujarat Junagadh Groundnut 32 (GJG 32)], Castor [Gujarat Castor Hybrid 9 (GCH 9)] and Papaya [Gujarat Junagadh Papaya 1 (GJP 1)] were recommended for farmers of the state during the year 2016-17.

Groundnut: Gujarat Junagadh Groundnut 32 (GJG 32)

The Spanish bunch groundnut variety, Gujarat Junagadh Groundnut 32 (GJG 32) recorded mean pod yield of 3392 kg/ha, which was 22.6, 22.6 and 15.4 per cent higher than the check varieties GG 7 (2766 kg/ha), GJG 9 (2765 kg/ha) and TG 37A (2816 kg/ha), respectively. It has higher oil content (53.9 %), oil yield (1253 kg/ha) and protein content (27.5 %)

as compared to the check varieties GG 7 (48.9 %, 945 kg/ha and 24.5 %), GJG 9 (49.3 %, 978 kg/ha and 24.5 %) and TG 37A (49.9 %, 993 kg/ha and 26.4 %), respectively. It is more resistant to tikka and rust diseases than the check varieties. The variety is recommended for release in *kharif* season in Gujarat.



(Main Oilseeds Research Station, JAU, Junagadh)

Castor: Gujarat Castor Hybrid 9 (GCH 9)

Gujarat Castor Hybrid 9 (GCH 9) gave seed yield of 3820 kg/ha, which was 9.0 per cent higher than check GCH-7 (3503 kg/ha). It is resistant to *Fusarium* wilt and *Macrophomina* root rot and tolerant to sucking pests. It is a medium duration hybrid having profuse branching habit and shallow cup shape leaves with medium plant stature and 48.3 per cent seed oil content. The variety is recommended for release under irrigated condition in Gujarat.

(Main Oilseeds Research Station, JAU, Junagadh)

Papaya: Gujarat Junagadh Papaya 1 (GJP-1)

Gujarat Junagadh Papaya 1 (GJP 1) recorded fruit yield of 84.5

t/ha, which was 59.1 per cent higher than the check variety Pusa Dwarf (53.1 t/ha). It is early in flowering with more number of fruits per plant. The fruits are medium in size (1.650 kg) with pyriform shape. The fruit possesses higher pulp to seed ratio, pulp and sugar content and better organoleptic characters than check Pusa Dwarf. The variety is recommended for release in Saurashtra region.



(Department of Horticulture, JAU, Junagadh)

II. CROP PRODUCTION

Nutrient Management

Response of castor to potash at varying crop geometry


The farmers of South Saurashtra Agro-climatic Zone growing irrigated castor in soil having medium status of potash are advised to sow castor at spacing of 150 cm x 60 cm with an application of potash @ 40 kg/ha along with recommended dose of nitrogen and phosphorus (120:50 kg NP/ha) for obtaining higher seed yield and net return.

(Main Oilseeds Research Station, JAU, Junagadh)

Phosphorus management in sesame under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone growing rainfed sesame are advised to fertilize the crop with 25 kg P_2O_5/ha as basal through Single Super Phosphate (SSP) along with recommended dose of nitrogen (50 kg N/ha) for getting higher yield and net return.

(Main Dry Farming Research Station, JAU, Targhadia)

Effect of foliar fertilizer in Bt. cotton. G. Cot. Hy. 8 (BG-II)

The farmers of South Saurashtra Agro-climatic Zone growing Bt. cotton under irrigated condition are advised to apply recommended dose of fertilizer (240:50:150 NPK kg/ha) and spray water soluble fertilizer 1 % (19:19:19 NPK) at flowering, boll formation and boll development stage of the cotton to obtain higher seed cotton yield and net return.

(Cotton Research Station, JAU, Junagadh)

Effect of multi-micronutrient formulations on tomato

The farmers of South Saurashtra Agro-climatic Zone growing tomato in medium black calcareous soil are recommended to apply micronutrients as per soil test value as basal in addition to recommended dose of fertilizers (75:37.5:62.5 N:P_2O_5:K_2O kg/ha) to tomato for getting higher yield and net return. OR Foliar spraying of multi-micronutrient formulation Grade IV (Fe-Mn-Zn-Cu-B, 4.0-1.0-6.0-0.5-0.5 %) is recommended @ 1% at 45, 60 and 75 DAS in addition to recommended dose of fertilizers (75:37.5:62.5 N:P_2O_5:K_2O kg/ha) to tomato for getting higher yield and net return.

(Department of Agril. Chem. & Soil Sci. and Vegetable Research Station, JAU, Junagadh)

Effect of multi-micronutrient formulations on garlic

The farmers of South Saurashtra Agro-climatic Zone growing garlic in medium black calcareous soil are advised to apply micronutrients as per soil test value as basal in addition to

recommended dose of fertilizers (50:50:50 N:P_2O_5:K_2O kg/ha) for getting higher yield and net return. OR Soil application of multi-micronutrient formulation Grade V (Fe-Mn-Zn-Cu-B, 2.0-0.5-5.0-0.2-0.5 %) is recommended @ 40 kg/ha in addition to recommended of fertilizers (50:50:50 N:P_2O_5:K_2O kg/ha) to garlic for getting higher yield and net return. OR Apply foliar spray of multi-micronutrient formulation Grade IV (Fe-Mn-Zn-Cu-B, 4.0-1.0-6.0-0.5-0.5 %) @ 1% at 60, 75 and 90 DAS in addition to recommended dose of fertilizers (50:50:50 N:P_2O_5:K_2O kg/ha) to garlic for getting higher yield and net return.

(Department of Agril. Chem. & Soil Sci. and Vegetable Research Station, JAU, Junagadh)

Package of Practices

Optimizing spacing for medium duration pigeon pea varieties under pigeon pea + Uradbean inter cropping system

The farmers of South Saurashtra Agro-climatic Zone adopting pigeon pea + uradbean (without fertilizer) inter cropping system are advised to sow pigeon pea at 120 cm x 30 cm spacing and two rows of uradbean in between two rows of pigeon pea for getting higher yield and net return.

(Pulses Research Station, JAU, Junagadh)

Suitability of pearl millet hybrids under varying time of sowing during semi *rabi* season

The farmers of North Saurashtra Agro-climatic Zone growing hybrid pearl millet during semi *rabi* season are recommended to sow the pearl millet early maturing variety GHB 538 during first week of October to obtain higher yield and net return.

(Main Pearl Millet Research Station, JAU, Jamnagar)

Weed management

Integrated weed management in organically grown groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut under organic farming are advised to adopt stale

seedbed technique (pre-sowing irrigation + killing of weed flush by harrowing) and kept weed free condition throughout the crop growth period or carry out hand weeding and interculturing at 15, 30 and 45 days after sowing for effective control of weeds and securing higher net realization.


(Department of Agronomy, CoA, JAU, Junagadh)

Weed management practices in spring planted sugarcane–based intercropping system

The farmers of South Saurashtra Agro-climatic Zone interested to grow spring–planted sugarcane with intercropping system are advised to grow one row of sesame or green gram or black gram as intercrop without fertilizer application in sugarcane planted at 90 cm row spacing for securing higher yield and net return. Weed control should be done with two hand weeding at 20 and 40 days after sowing of intercrop.


(Main Sugarcane Research Station, JAU, Kodinar)

Water management

Response of cumin to drip irrigation and integrated nutrient management

The farmers of South Saurashtra Agro-climatic Zone growing

cumin are advised to irrigate the crop with drip system at 0.6 PEF for getting higher yield and net realization which saves 12.4 % water. Farmers are also advised to apply 75% recommended dose of fertilizer (22.5:11.2:0 kg NPK/ha) along with FYM @ 5 t/ha for getting maximum yield and net return.

The system details as under:

Details
Lateral spacing: 60 cm
Dripper spacing: 45 cm
Dripper discharge rate: 4 lph
Operating pressure: 1.2 kg/cm^2
Operating frequency: Alternate day

Operating time	
Month	**Minutes**
Dec.-Jan.	20
Feb.-March	30

(Department of Agronomy, CoA, JAU, Junagadh)

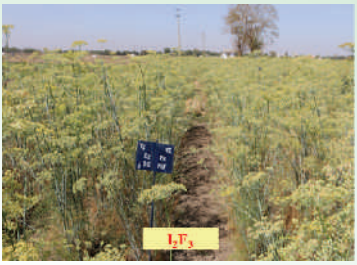
Drip irrigation and fertilizer in drilled *rabi* fennel

The farmers of South Saurashtra Agro-climatic Zone growing *rabi* drilled fennel are advised to irrigate the crop with drip system at 0.8 PEF and apply 120:45:0 NPK kg/ha out of which full dose of phosphorus and 25 % nitrogen as basal and remaining 75% nitrogen in three equal splits start at 20 DAS in 20 days interval through drip for getting higher yield and net return.

The system details as under:

Details
Lateral spacing: 120 cm (45-75-45 cm paired row)
Dripper spacing: 45 cm
Dripper discharge rate: 4 lph
Operating pressure: 1.2 kg/cm^2
Operating frequency: Alternate day

Operating time	
Month	**Minutes**
December	58
January	62
February	75
March	95
April	120

(Department of Agronomy, CoA, JAU, Junagadh)

Evaluation of drip fertigation on castor productivity

The farmers of South Saurashtra Agro-climatic Zone growing castor are advised to irrigate the crop at 0.8 PEF through drip irrigation and apply nitrogen @ 90 kg/ha (20 kg N/ha as a basal and remaining 70 kg N/ha through drip in form of urea in five equal splits at an interval of 12 days starting after cessation of monsoon) along with recommended dose of phosphorus (50 kg/ha) as basal for obtaining higher yield and net return.

The system details are as under:

Details	Operating time	
	Month	Minutes
Lateral spacing : 120 cm	October	110-125
Dripper spacing : 60 cm	November	100-110
Dripper discharge rate : 4 lph	Dec.-Jan.	95-105
Operation pressure : 1.2 kg/cm^2	-	-
Operation frequency: Every 3rd day irrigation	-	-


(Main Oilseeds Research Station, JAU, Junagadh)

Response of summer groundnut to fertilizer dose and plant population under drip and check basin method

The farmers of South Saurashtra Agro-climatic Zone growing

summer groundnut are advised to apply initially two normal irrigations and remaining through drip at 0.8 PEF (20 DAS) and apply water soluble fertilizer (N:P:K: 17:44:0) @ 75 % of RDF (18.75:37.5 kg NP/ha) in five equal splits through fertigation at an interval of 8 days starting from 20 DAS and maintain spacing 20 cm x 10 cm (plant population @ 5.00 lakh/ha) for higher yield and net return which save 23 per cent water and 25 per cent fertilizer.

The system details are as under:

Details
Lateral spacing : 60 cm
Dripper spacing : 45 cm
Dripper discharge rate : 4 lph
Operation pressure : 1.2 kg/cm^2
Operation frequency : Alternate day

Operating time	
Month	**Minutes**
February	75-80
March	100-110
April	120-125
May	130-135
-	-

(Main Oilseeds Research Station, JAU, Junagadh)

III. PLANT PROTECTION

Agricultural Entomology

Field efficacy of different insecticides against citrus pests

The farmers of South Saurashtra Agro-climatic Zone growing citrus



are advised to apply two sprays of imidacloprid 17.8 SL 0.0072 % (4 ml/10 lit. water), first spray at starting of pests infestation and second15 days after the first spray for effective management of leaf miner and black fly.

(Department of Entomology, JAU, Junagadh)

Evaluation of botanicals, bio-pesticides and insecticides against gram pod borer

The farmers of South Saurashtra Agro-climatic Zone growing chickpea are advised to apply alternate spray of HaNPV 2 x 10^9 POBs/ml (5 ml/10 lit. water) and chlorantraniliprole 18.5 SC 0.004 % (2 ml/10 lit. water) for effective and economic control of pod borer (*Helicoverpa armigera*) in chickpea crop. First spray to be started at 50 % flowering and second at 15 days after first spray.

The PHI for chlorantraniliprole 18.5 SC is 11 days.



(Pulses Research Station, JAU, Junagadh)

Integrated cotton crop management with emphasis on biotic stress

The farmers of South Saurashtra Agro-climatic Zone growing cotton are advised to apply the following Integrated Pest Management module for control of mealy bug and conservation of lady bird beetle. However, IPM module also reduced the

population of aphids, jassid, thrips, whitefly, mite, mirid bug and maintain population of predators i.e. chrysopa and spider as compared to CFP module but they were non-significant.

1. Seed treatment with Pseudomonas fluorescens @ 10g / kg of seed.
2. Sowing of castor as a trap and maize as a border crop (10:1).
3. Sowing of black gram as intercrop.
4. Fertilizer application of FYM 10 t/ha + 180:37.50:112.50 NPK kg/ha in three split at basal, 30 DAS and 60 DAS.
5. Need based application of insecticides in sequence *viz.*, acephate 75 SP (0.113%) 750 g a.i/ha (20 g /10 lit. water), flonicamid 50 WG (0.015%) 75 g a.i/ha (3 g /10 lit. water), fipronil 5 SC (0.008%) 40 g a.i/ ha (16 ml /10 lit. water) and buprofezin 25 SC (0.05%) 250 g a.i/ha (20 ml /10 lit. water).
6. Pre-emergence application of pendimethalin 30 EC (0.20%) @ 1000 g a. i./ha (67 ml/10 lit. water) and quizalofop ethyl 5 EC (0.01%) @ 50g a. i./ha (20 ml/10 lit. water) 30 DAS for weed control.
7. Installation of yellow sticky trap @ 5 traps/ha for monitoring of white fly.
8. Installation of pheromone traps @ 5 traps/ha for monitoring of all bollworms.
9. Need based application of copper oxychloride 50 % WP 0.2 % (40 g/10 lit. water) and carbendazim 50 % WP (0.05 %) (10 g /10 lit. water) for disease control.

(Cotton Research Station, JAU, Junagadh)

Plant Pathology

Biological control of soil borne diseases of sesame

The farmers of North Saurashta Agro-climatic Zone growing sesame are advised to treat seed with *Trichoderma harzianum* 1 % WP 5 g/kg seed or *Pseudomonas fluorescens* 1 % WP 5 g/kg along with soil application of *Trichoderma harzianum* 1 % WP 2.5 kg/ha

with 300 kg FYM or castor cake at the time of sowing were found effective and economical for management of soil borne diseases (*Macrophomina* stem rot and *Phytophthora* blight) of sesame.

(Agricultural Research Station, JAU, Amreli)

IV. HORTICULTURE & AGRO-FORESTRY

Varietal evaluation of strawberry under polyhouse

Farmers of South Saurashtra Agro-climate Zone, interested in strawberry cultivation, are advised to grow cv. Winter Queen under protected structure (Fan-pad Cooling Poly House) for getting higher yield and net return.

(Department of Horticulture, JAU, Junagadh)

Evaluation of small to medium sized varieties of Mango

Farmers of Saurashtra region growing small to medium size mango (150 to 250 g) are advised to grow variety Kesar and as alternate of Kesar variety, hybrid variety Amrapali for better yield from thirteen years old tree. Both varieties possess medium sized fruits with attractive colour, flavor, aroma and good taste.



(Department of Horticulture, JAU, Junagadh)

Evaluation of medium to large sized varieties of Mango

Farmers of Saurashtra region growing medium to large sized mango (250 to 500 g) varieties for getting higher yield are advised to grow mango hybrid Sonpari or Rajapuri. The variety possesses good quality with attractive and large sized fruits.

(Department of Horticulture, JAU, Junagadh)

Performance of leafy vegetables purpose coriander under different shed net in summer season

The farmers of Saurashtra region interested to grow coriander for green coriander purpose in summer season are advised to use 75 % white shed net in low cost shed net house for securing higher yield and net return.

(Agricultural Research Station, JAU, Mahuva and Department of Horticulture, JAU, Junagadh)

Performance of leafy vegetables purpose fenugreek under different shed net in summer season

The farmers of Saurashtra region interested in green vegetable purpose fenugreek in summer season are advised to use 75 % white shed net in low cost shed net house for securing higher yield and net return.

(Agricultural Research Station (Fruit Crops), JAU, Mahuva and Department of Horticulture, JAU, Junagadh)

Integrated nutrient management in mango cv. Jamadar

The farmers of South Saurashtra Agro-climatic Zone interested to grow mango cv. Jamadar are recommended to apply fertilizers as per following schedule for securing higher yield and net return.

Age of tree (Year)	Poultry manure (kg/plant)	N (g/plant)	P (g/plant)	K (g/plant)
4th year	20	160	64	232
5th year	25	200	80	290
6th year	30	240	96	348
7th year	35	280	112	406

(Agricultural Research Station (Fruit Crops), JAU, Mahuva and Department of Horticulture, JAU, Junagadh)

V. AGRICULTURAL ENGINEERING

Design and development of a tractor mounted rural transporter

Farmers are recommended to use tractor mounted "JAU Rural Transporter" for carrying up to 500 kg live/dead load for better safety and fatigue reduction as compared to carrying on tractor mudguard or trailer. Rural transporter is also released for commercial exploitation.

(Department of Farm Machinery & Power, CAET, JAU, Junagadh)

Effect of protected environment on off-season seedling raising of Papaya

The farmers of South Saurashtra Agro-climatic Zone interested to raise papaya seedling in protected structure are advised to use poly-cum-shade net

house covered with 50 % white shade net on periphery and roof covered with 200 micron UVS polyethylene sheet.

(Department of Renewable Energy & Rural Engg., CAET, JAU, Junagadh)

Evolvement of mulching technology for bunch type groundnut crop

The farmers of South Saurashtra Agro-climatic Zone are advised to use silver black plastic mulch (20 µm) with drip irrigation and raised bed for water saving and to achieve higher yield of bunch type groundnut in summer season.

	Details of mulching technology
1	Mulch film: 20 µm silver black plastic
2	Bed size: (a) Top width: 75 cm (b) Bottom width: 90 cm (c) Height: 20 cm
3	No. of rows per bed : 3
4	Spacing: (a) Bed spacing :120 cm (b) Row spacing: 20 cm (c) Plant spacing: 20 cm

	Details of drip system
1	No. of laterals / bed : 2
2	Lateral spacing: 20 cm
3	Dripper spacing: 40 cm
4	Dripper discharge: 2 lph
5	Irrigation scheduling : a. Feb.: 10 to 15 min/day b. March: 30 to 35 min/day c. April: 40 to 45 min/day d. May: 55 to 60 min/day

(Department of Renewable Energy & Rural Engg., CAET, JAU, Junagadh)

Aquifer mapping of Uben river basin

The farmers, NGOs and line department's people are advised to construct ground water recharge structures and shaft recharging technique for augmenting ground water resources around the area starting from Sakkarbaugh, Vadal, Choki, Makhiyala up to Fareni. Keeping and view the higher horizontal, vertical hydraulic conductivity and transmissibility of unconfined/ confined aquifer.

The surface water harvesting structures should be encouraged for augmenting the surface water resources in rest parts of the Uben basin.

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

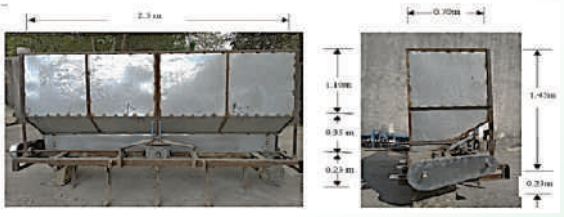
Conjunctive effect of emitter configuration and irrigation regimes on productivity of cumin

Farmers of South Saurashtra Agro-climatic Zone growing cumin are advised to adopt drip irrigation with triangular geometry having 0.6 m lateral spacing and 2 lph emitter discharge and to irrigate at 4 days interval with 0.8 IW/ETc (2 hours) for acquiring higher yield (38 %), water use efficiency (60.95 %), water productivity (61 %) and net return (38.87 %) as compared to farmers' practices.

(Research, Training & Testing Center, JAU, Junagadh)

Design and development of tractor operated FYM applicator

Tractor operated Farm Yard Manure applicator developed by Junagadh Agricultural University is recommended for farmers' use and for commercial exploitation to apply FYM at desired row spacing within furrow as per requirement. It saves time and economical as compared to manual FYM application.



(Research, Training & Testing Center, JAU, Junagadh)

Rain water management for sustaining cotton productivity in medium black soils under dry farming conditions

The farmers of North Saurashtra Agro-climatic Zone growing Bt. cotton are advised to apply FYM @ 10 t/ha and kaolin @ 4 %

spray (400 g/10 liter water) at dry spell for obtaining higher productivity and maximum net returns as well as for getting maximum rain and crop water use efficiency under dry farming conditions.

(Main Dry Farming Research Station, JAU, Targhadia)

Rainwater management for sustaining groundnut productivity in medium black soils under dry farming conditions

The farmers of North Saurashtra Agro-climatic Zone growing groundnut (GG 20) are advised to apply FYM @ 10 t/ha and kaolin @ 4 % spray (400 g/10 liter water) at dry spell for obtaining higher productivity and net returns as well as maximum rain and crop water use efficiency under dry farming conditions.

(Main Dry Farming Research Station, JAU, Targhadia)

VI. BASIC SCIENCE

Effect of brassinolide on physiological and yield related traits of chickpea and their relationship with yield

The farmers of South Saurashtra Agro-climatic Zone growing chickpea under irrigated condition are advised to use growth regulator Brassinolide (BS) as a seed treatment for 2 hrs @ 0.50 mg/lit. (0.04 % i.e. 12.5 ml BS and make up 10 liter solution) to obtain higher seed yield and net return.

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

Efficiency of foliar spray of growth regulating substances for enhancing seed yield of pearl millet under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet are advised to go for foliar application of

potassium chloride 1.5 % (7.5 kgha^{-1} in 500 liter water) at 30-35 and 50-55 DAS for higher vegetative growth, seed yield and net return.

(Main Pearl Millet Research Station, JAU, Jamnagar)

VII. ANIMAL HEALTH & ANIMAL PRODUCTION

Hydrocyanic concentration during different stages of growth in Gundri jowar (*Sorgum vulgare*) and Baru (*Sorgum halepense*)

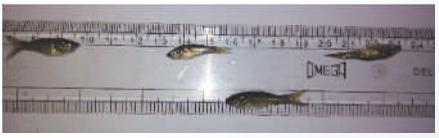
Sorgum vulgare (jowar) and *Sorgum halepense* (baru) fed at 25 per cent flowering stage is safe for ruminants as the HCN content is below the toxic level.

(Cattle Breeding Farm, JAU, Junagadh)

VIII. FISHERIES SCIENCE

Effects of Pro-biotics on survival, growth and biochemical changes in Labeo- rohita fry

Fish farmers are recommended to incorporate three probiotics *Lactobacillus subtilis* (15 x 10^7 cfu/g), *Bacillus subtilis* (10 x 10^7 cfu/g) and *Saccharomyces cerevisiae* (10 x 10^7 cfu/g) in the ratio of 4:3:4 @ 3 % in fish feed to obtain higher growth, nutritive value and survival rate of *Labeo rohita* in rearing pond.



(Inland Fisheries Research Station, JAU, Junagadh)

Effect of dressing on quality and shelf life of dried bombay duck (*Harpodon nehereus*) during storage

It is recommended to fish processors that removal of gill and

gut in bombay duck (*Harpodon nehereus*) before sun drying may be adopted for better quality and storage period up to six months.


(Department of Fish Processing Tech., College of Fisheries Sci., JAU, Veraval)

Effects of different salinities on growth and survival of juvenile Pacific white shrimp, *Litopenaeus vannamei* (Boone, 1931)


Shrimp farmers are recommended to use 30 ppt salinity water or select areas having such salinity water for higher growth and survival of shrimp *Litopenaeus vannamei*.

(Fisheries Research Station, JAU, Okha)

Effects of gamma irradiation on the quality of sun-dried croaker (*Johnius dussumieri*)

The dry fish processors/exporters are recommended to apply dose of 5 kGy gamma irradiation to dry salted croaker (*Johnius dussumieri*) fish for better quality and nine months shelf life.


(Fisheries Research Station, JAU, Okha)

Effect of bottom sediments on moulting to *Fenneropenaeus merguiensis* in circular cement tank

Shrimp farmers are recommended to culture *Fenneropenaeus merguiensis* (Banana shrimp) with pond bottom of sea sand + mud (50:50) mixture of 6 inch sediment thickness, for better growth and survival rate.

(Fisheries Research & Training Centre, JAU, Mahuva)

RECOMMENDATIONS FOR SCIENTIFIC COMMUNITY

I. CROP PRODUCTION

Weed management practices in spring planted sugarcane–based intercropping system

It is for the knowledge of the scientific community that application of pendimethalin @ 0.90 kg/ha as pre-emergence followed by hand weeding at 30 days after sowing of sesame or green gram or black gram as intercrop in sugarcane planted at 90 cm row spacing gives higher yield and net return as well as it gives effective weed management.

(Main Sugarcane Research Station, JAU, Kodinar)

Yield maximization in medium duration pigeon pea crop

It is for the knowledge of the scientific community that grow pigeon pea by adopting full package of practices [INM (FYM 5 t/ha + RDF (N:P:S:Zn : 25:50:20:15 kg/ha + IWM (Pendimethalin 30% EC @ 0.75 kg a.i./ha at 3 DAS + Imazethapyr @ 100 g a.i./ha at 10-15 DAE of weeds + 1 HW at 50 DAS) + IPM (Indoxacarb

15.8% EC at flowering @ 375 ml/ha + Chloramiliprole 18.5 SC at 15 days after 1st spray @ 100 ml/ha)]. Among the production factors, maximum contribution was shown by INM (54.75 %) followed by IWM (43.83 %) and IPM (35.74 %).

(Pulses Research Station, JAU, Junagadh)

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

The critical limit for sulphur application to pigeon pea crop grown on calcareous soils of Saurashtra has been fixed. The limit is noticed as 12.5 ppm (Heat soluble S) in soil and 0.455 per cent in pigeon pea plant at 60 DAS.

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

Effect of saline irrigation water on onion (*Allium cepa*) crop

It is for the information of scientific community especially for plant breeder that onion variety Talaja Red recorded value of different salt tolerance criteria like higher mean salinity index (53.8), higher mean bulb yield (109 g) minimum yield decline in high salinity level at EC 6.80 dSm^{-1} for 50 %, minimum yield reduction (59.3 %) at 8.0 dSm^{-1} as well as lower Na/K ratio in straw. Onion variety Talaja red is found more salt tolerant compared to GWO 1, Pilipatti and Agri Found Light Red on the basis of salinity indices.

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

II. PLANT PROTECTION

Agricultural Entomology

Field efficacy of different insecticides against citrus pests

Two sprays of spinosad 45 SC 0.0135 % (3 ml/10 lit. water)

and difenthiuron 50 WP 0.05 % (10 ml/10 lit. water) at 15 days interval starting from pests infestation was found effective for management of leaf miner and black fly in South Saurashtra Agro-climatic Zone.

(Department of Entomology, CoA, JAU, Junagadh)

Survey of various insect-pests of pomegranate in Saurashtra region

The incidence of anar butterfly and thrips were found enormous during the month of January to April and September to December, respectively. The maximum population of anar butterfly was noticed in Junagadh region, while thrips was found maximum in Kalawad area.

(Department of Entomology, CoA, JAU, Junagadh)

Evaluation of some newer insecticides against the leaf weber, *Antigastra catalaunalis* (Duponchal) infesting sesame under rainfed condition

Two sprays of insecticides i.e. indoxacarb 14.5 SC 0.007 % (4 ml/10 lit. water) or spinosad 45 SC 0.009 % (2 ml/ 10 lit. water) or emamectin benzoate 5 SG 0.002 % (4 g/10 lit water) or profenophos 50 EC 0.005 % (10 ml/ 10 lit. water) or chlorantraniliprole 20 EC 0.006 % (3 ml/ 10 lit water) (first at ETL of the pest 5 larvae/ 20 plant and second at 15 days after first spray) found effective for management of sesame leaf weber in North Saurashtra Agro-climatic Zone. There was no problem of residue of

all the insecticides in sesame seeds at 30 days after second (last) spray application.

(Main Dry Farming Research Station, JAU, Targhadia)

Initiation and development of aphid and jassid in relation to different weather parameters on groundnut crop under rainfed condition

The incidence of thirps on groundnut was commenced in 26th SW and reached to a peak in 33rd SW. The influence of wind speed was found significant on thrips population, while, other abiotic factors have no significant effect. All the abiotic factors had non-significant effect on aphid and jassid population in groundnut.

(Main Dry Farming Research Station, JAU, Targhadia)

Testing of insecticides against major pests of sesame

Two sprays of lamda cyhalothrin 5 EC 0.005 % (10 ml/10 lit. water) or emamectin benzoate 5 SG 0.0035 % (7 g/10 lit. water) (1st spray at ETL of 0.25 larva/plant and 2nd spray at 15 days after 1st spray) found effective and economic for management of leaf weber of sesame in *kharif* in North Saurashtra Agro-climatic Zone.

Two sprays of dicofol 18.5 EC 0.037 % (20 ml /10 lit. water), 1st spray at appearance of mite and 2nd spray at 15 days after 1st spray found effective and economical. Residues of above pesticides in sesame seed were not detected at 30 days after 2nd spray.

(Agricultural Research Station, JAU, Amreli)

Evaluation of botanicals, bio-pesticides and insecticides against gram pod borer

Two spray of profenofos 50 EC 0.13 % (26 ml/10 lit. water) and chlorantraniliprole 18.5 SC 0.004 % (2 ml/10 lit. water) were found effective and economic management of pod borer (*Helicoverpa armigera*) in chickpea crop. First spray should be started at 50 % flowering and second at 15 days after first spray. The PHI for chlorantraniliprole 18.5 SC and profenofos 50 EC are 11 and 27 days, respectively.

(Pulses Research Station, JAU, Junagadh)

Bioefficacy of different insecticides against castor shoot and capsule borer

Two sprays of spinosad 45 SC 0.009 % (2 ml/10 lit. water) or chlorantraniliprole 18.5 SC 0.006 % (3.2 ml/10 lit. water) at 15 days interval starting from pest infestation found effective and economical for the management of castor shoot and capsule borer.

(Department of Entomology, CoA, JAU, Junagadh)

Plant Pathology

Wilt disease development in popular cultivars as influenced by different dates of sowing under changing climate in chickpea

The popular chickpea cultivars *viz.* JG 16, GG 1, GJG 3 and GG 5 exhibited low wilt incidence and high grain yield as compared to JG 62 (susceptible cultivar). The lowest wilt incidence was recorded in JG 16. In case of date of sowing, no significant differences in wilt incidence and grain yield were found. The low wilt incidence was recorded in normal date of sowing (5th November). Therefore; it was determined that popular cultivars possessed resistance against wilt disease till today.

(Pulses Research Station, JAU, Junagadh)

III. HORTICULTURE & AGRO-FORESTRY

Effects of climate change on flowering and yield of mango cv. Kesar

It is recommended to scientific community that the climatic parameters like temperature, humidity, rainfall, bright sun shine hours and wind velocity influenced the flowering, fruit setting, fruit dropping, number of fruit per plant and fruit yield. Higher day temperature with lower night temperature as well as more fluctuation in day & night temperature disturb the flowering, pollination and fruit setting process. Similarly, higher humidity, dew, late rain or off seasonal rain during flowering also affects adversely. Mango requires 25-30 ^{0}C day temperature & 15-18 ^{0}C night temperature, 40-45% humidity, no dew formation, lower late

rain (September), higher sun shine hours (8-9 hrs.) during floral bud initiation, flowering and fruit setting.



(Department of Horticulture, CoA, JAU, Junagadh)

IV. AGRICULTURAL ENGINEERING

Vibration study and its attenuation through coating on mini tractor seat

Mini tractor operators / manufacturers are recommended to use operator's seat coated on both sides by natural rubber [density-0.978 g/cc; thickness-10 mm & hardness-50], which resulted in significant attenuation of whole body vibration of operator along with enhanced operating time, as per BIS / ISO standards under all operating conditions with & without trailer on tar road, farm road and field.

(Department of Farm Machinery & Power, CAET, JAU, Junagadh)

V. BASIC SCIENCE

Effect of organic seed treatment on storability of wheat

It is informed to scientific community that wheat seed may be stored under ambient storage condition packed with cloth bag with seed treatment of neem leaf powder or sweet flag rhizome powder @ 2-5 g/kg of seed or neem seed kernel powder @ 2 g/kg seed for a period of 20 months without deterioration in germination and seedling vigour.

(Department of Seed Science and Technology, CoA, JAU, Junagadh)

Biochemical and molecular characterization of phosphate solubilizing bacteria from different soil rhizosphere

It is informed to scientific community that among 17 PSBs, isolate derived from chickpea rhizosphere exhibited highest phosphate solubilizing index followed by isolates from pigeon pea rhizosphere and poultry farms. The best PSBs were confirmed as *Pseudomonas putida* and *Pseudomonas fulva*.

(Department of Biochemistry and Biotechnology, CoA, JAU, Junagadh)

VI. SOCIAL SCIENCE

Path coefficient analysis tools for selection of genotype in wheat

It is advised to scientific community, that the productive tillers per 3 meter, grain weight per spike and days to anthesis are the important biometric characters for selecting genotype for improving grain yield of timely shown wheat under South Saurashtra Agro-climatic Zone.

(Department of Agril. Statistics, CoA, JAU, Junagadh)

Total factor productivity of major crops and contribution of research investment to agricultural growth in Gujarat

The major crops of Gujarat have experienced a strong technological growth during last two decades, except bajra and sesamum. The internal rate of return to public investment in agricultural research ranged from 26.80 % in case of mustard to about 74.90 % (i.e. 75 %) for cumin with the overall average of 42 % for major crops of Gujarat. Sesamum needs more efficient technological breakthrough to increase productivity by evolving varieties which sustain in adverse monsoon conditions. Proper management of agronomical practices to keep low production cost and proper price incentive to keep pace with other crops in the state are equally important.

To attain targeted agricultural growth, investments on

agricultural research and extension education need to be increased at the rate of 5 per cent per annum to achieve an additional one per cent growth in TFP.

(Department of Agril. Economies, CoA, JAU, Junagadh)

VII. ANIMAL HEALTH & ANIMAL PRODUCTION

Preliminary evaluation of antibacterial activity of extracts of selected medicinal plants

Methanolic and chloroform extracts of leaves of *Aristolochia longa* (Kidamari), *Adansonia digitata* (Gorakhamli), *Solanum xanthocarpum* (Bhoi-ringani), *Moringa oleifera* (Saragavo) and *Syzygium cuminii* (Kala-jambu) were found to have significant in-vitro antibacterial activity.

Adansonia digitata

Aristolochia longa

(Department of Vet. Pharmacology & Toxicology, College of Vet. Sci. & A.H., JAU, Junagadh)

In-vitro anti-inflammatory activity of selected medicinal plants

Extracts from *Argyreia speciosa* leaves (Avali-savali), *Adansonia digitata* leaves (Gorakh ambli), *Flueggea leucopyrus* leaves, *Peltophorum pterocarpum* bark (Pilo gulmohor), *Solanum xanthocarpum* aerial part (Bhoi-ringani) and *Vitex negundo* leaves (Nagod) showed significant *in-vitro* anti-inflammatory activity.

Argyreia speciosa

Vitex negundo

(Department of Vet. Pharmacology & Toxicology, College of Vet. Sci. & A.H., JAU, Junagadh)

In-vitro antioxidant activity of extracts of selected medicinal plants

Opuntia elatior (Hathlothor) fruit extracts of *Peltophorum pterocarpum* (Pilo gulmohor) leaves and bark, *Syzygium cuminii* (Kala-jambu) leaves and *Tridax procumbens* (Ghaburi) leaves showed significant *in-vitro* antioxidant activity.

Opunita elatior

Syzygium cumini

(Department of Vet. Pharmacology & Toxicology, College of Vet. Sci. & A.H., JAU, Junagadh)

In-vitro anti-diabetic activity of extracts of selected medicinal plants

Extracts of *Gymnema sylvestre* (Madhu nashini), *Lepidium sativum* seed (Sheliyo), *Moringa oleifera* (Saragavo) leaves and *Pueraria tuberosa* (Fagiyo) tuber showed significant *in-vitro* anti-diabetic activity by inhibition of α–amylase and α-glucosidase enzyme activity.

Gymnema sylvestre

Lepidium sativum

(Department of Vet. Pharmacology & Toxicology, College of Vet. Sci. & A.H., JAU, Junagadh)

Effect of various levels of some herbal feed additives in total mixed ration on *in-vitro* nutrient utilization and rumen fermentation

Garlic bulb powder, fenugreek seed powder and *ashwagandha* root powder can be incorporated at 0.5 % level and ginger rhizome powder at 1 % level in total mixed rations to improve *in-vitro* degradability and rumen fermentation.

(Department of Animal Nutrition, Coll. of Vet. Sci. & A.H., JAU, Junagadh)

Study of acaricidal resistance status and species of ticks infesting animals presented at TVCC, Junagadh

In Saurashtra region, major ticks of cattle, buffaloes and horses is *Rhipicephalus*

microplus (>85 %) and of dog *R. sanguineus* (≈ 100 %); where in *R. microplus* shows moderate resistance (level II) against deltamethrin and against ivermectin, but susceptibility to cypermethrin. Moderate resistance against ivermectin is also recorded in *R. sanguineus.*

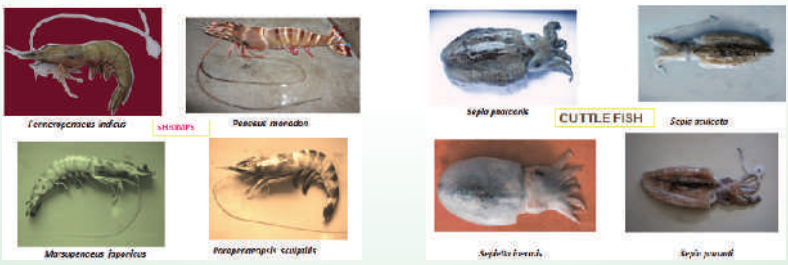
(Department of Vet. Parasitology, Coll. of Vet. Sci. & A.H., JAU, Junagadh)

VIII. FISHERIES SCIENCE

Documentation and seasonal availability of commercially important shellfish species at Veraval fishing harbor

Twenty two shellfish species including shrimps, crabs, lobsters, squids, cuttlefish and octopus of different genera were recorded during October 2012 to May 2016 at fishing harbor of Veraval, Gujarat.

Group	Availability			
	2012-13	2013-14	2014-15	2015-16
Shrimps	Throughout the year. Less number in January and May.	September to February. Less number in March to May.	September to mid-December. Less number in January to May.	Less number throughout the year except November, December and March.
Crabs	Throughout the year except December.	Throughout the year exce pt November, December and March.	Throughout the year.	Throughout the year except December and May.
Lobsters	Throughout the year.	Throughout the year.	Throughout the year.	Throughout the year.
Cephalopods (Cuttle fish, Octopus and Squid)	Throughout the year except May.	Throughout the year except after mid-April.	Throughout the year except May.	Throughout the year.



(Department of Fish Resource Mgmt., College of Fisheries Sci., JAU, Veraval)

Production of nucleus/ breeder/ truthful seeds, planting materials, bio-agent and bio-fertilizer (SAWAJ BRAND)

SN	Name of Product	2016-17
1	Nucleus/Breeder Seed (q)	3099
2	Truthful/ Foundation/ Certified Seeds (q)	7087
3	Fruit crop grafts (Nos.)	25149
4	Fruit crop sapling (Nos.)	14861
5	Seedlings (Nos.)	64662
6	Ornamentals & Medicinal plants (Nos.)	43987
7	*Trichoderma* (tonne)	105
8	*Rhizobium* (Bottle-500 ml)	3255
9	*Azotobacter* (Bottle-500 ml)	2991
10	PSB (Bottle-500 ml)	4902
11	*Beauveria* (tonne)	145
12	HNPV(Bottle-250 ml)	689
13	SNPV(Bottle-250 ml)	394
14	Trichocard (Nos.)	450
15	Fruit fly traps (Nos.)	1574
16	Fruit fly lure (For fruit and Vegetable crops) (Nos.)	1952
17	Pheromone Trap (Nos.)	1,24,804
18	Pheromone Lure (Pink bollworm) (Nos.)	1,49,588
19	Pheromone Lure (Heliothis) (Nos.)	1462
20	Pheromone Lure (Prodenia) (Nos.)	65
21	Pheromone Lure (Brinjal shoot and fruit borer) (Nos.)	134

Products of Junagadh Agricultural University

SAWAJ Rhizobium

SAWAJ Kesar Mango Pulp

Seaweed

SAWAJ Beauveria

SAWAJ H-NPV & S-NPV

SAWAJ Trichoderma

Production of Nucleus / Breeder seeds during the year 2016-17

Sr. No.	Crop	Variety	Nucleus Seed (q)	Breeder Seed (q)		Total (q)
				National	State	
1	Groundnut	GG-2	-	-	57.60	57.60
		GG-5	1.75	-	21.00	22.75
		GG-7	0.83	-	29.10	29.93
		GJG-9	1.07	15.00	106.80	122.87
		GJG-31	-	16.80	-	16.80
		GG-8	-	17.40	-	17.40
		GG-20	2.10	-	1623.90	1626.00
		GJG-22	0.50	-	95.10	95.60
		GJGHPS-1	0.90	-	15.00	15.90
		GG-11	2.10	-	94.50	96.60
		GJG-17	2.65	-	94.50	97.15
		GAUG-10	-	-	24.60	24.60
		GJG-19	0.26	25.00	-	25.26
		GJG-18	0.28	20.00	-	20.28
		GG-16	-	6.00	-	6.00
		GG-21	-	41.40	-	41.40
		Sub Total	**12.44**	**141.60**	**2162.10**	**2316.14**
2	Pearl millet	Pearl millet	0.04	7.81	3.36	11.21
3	Sesame	G.Til-1	0.07	0.20	2.65	2.92
		G.Til-2	0.50	3.20	9.30	13.00
		G.Til-3	0.30	2.00	10.91	13.21
		G.Til-4	0.22	0.40	2.10	2.72
		GJTil-5	0.03	-	0.15	0.18
		G.Til-10	0.07	2.00	1.30	3.37
		Sub Total	**1.19**	**7.80**	**26.41**	**35.4**
4	Chickpea	GG 1	2.18	-	19.90	22.08
		GG 2	2.25	-	26.50	28.75
		GJG 3	3.50	37.75	44.25	85.50
		GG 4	3.37	45.25	-	48.62
		GG 5	3.36	-	45.50	48.86
		Sub Total	**14.66**	**83**	**136.15**	**233.81**
5	Wheat	GW 366	12.60	282.40	33.20	328.20
		LOK-1	-	-	27.60	27.60
		GW-496	-	58.80	56.40	115.20
		Sub Total	**12.60**	**341.20**	**117.20**	**471.00**
6	Pigeon pea	GJP 1	0.32	1.50	30.00	31.82
		Grand Total	**41.25**	**582.91**	**2475.22**	**3099.38**

Shri Sanjay Prasad (IAS), Hon'ble Principal Secretary, Dept. of Agriculture, Farmer Welfare & Co-operation, GoG, Gandhinagar, Visited JAU, Junagadh on October 28, 2016

Dr. A. R. Pathak, Hon'ble Vice Chancellor, JAU, Junagadh addressing the participating farmers during the Pradhan Mantri Fasal Bima Yojana (PMFBY) program on April 07, 2016

Dr. A. R. Pathak, Hon'ble Vice Chancellor, JAU, Junagadh visited groundnut breeder seed production plot at KVK, Nanakandhasar on October 24, 2016

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