



Hon'ble Chief Minister of Gujarat, Shri Narendrabhai Modi, inaugurated Agri. Fair (Krushi Mela) at Jamjodhapur organized during May 25-26, 2013 under Krushi Mahotsav-2013.



Visit of Agri. Minister Shri Babubhai Bokhiria at Bull Mother Farm on April 05, 2013



Hon'ble Agri. Minister Shri Babubhai Bokhiria's visit of JAU on December 01, 2013.

Junagadh Agricultural University
Junagadh-362001 (Gujarat)

Website : www.jau.in

RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS 2014



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

Citation:

Research Accomplishments and Recommendations-2014
Junagadh Agricultural University, Junagadh (Gujarat)

Edited & Published by:

Director of Research & Dean, PG Studies

"University Bhavan"

Junagadh Agricultural University,

Junagadh-362001(Gujarat)

Phone: (0285) 2670131

Fax: (0285) 2674064

E-mail: dr@jau.in

Compiled by:

Dr. C. J. Dangaria

Dr. I. U. Dhruj

Dr. Pramod Mohnot

Dr. S. T. Sanandia

Dr. K. B. Parmar

Dr. S. P. Kachhadiya

Year of publication:

November-2014

Copies : 500

Printed at :

Dot Megic Graphics Design
Junagadh - 362 001
Mo. : 99 13 50 96 25



Junagadh Agricultural University
Junagadh - 362 001 (Gujarat)

**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 agribusiness management. The research findings are generated through healthy discussion among the scientists and officers of line department 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-2014**" provides numerous recommendations and technologies for farmers and scientific community emerged from various scientific groups of Junagadh Agricultural University, Junagadh during the year 2014. I hope that this compiled information will be greatly useful to the scientists, extension officers, farmers, students and stakeholders for their future course of application.

I congratulate and appreciate the scientists/teachers and staff 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

October 28, 2014

(A. R. PÁTHAK)

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 during 2013-14 in the University. The contents of recommendations and new technical programmes were critically discussed and approved in respective 10th AGRESCO meeting of various subcommittees of Junagadh Agricultural University. These were presented in 10th Combined Joint AGRESCO meeting be held at Junagadh Agricultural University, Junagadh during April 09-11, 2014.

The Junagadh Agricultural University represents 10 districts and about 32.74 per cent area of the state. There are six colleges, five 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 subcommittees have successfully completed their job. The University has also arranged 11th Research Council meeting on November 12, 2013 and 2nd circulation Research Council meeting on March 06, 2014 for approval of new research projects and research activities during this year.

Total 31 new projects worth of Rs. 461.8 lakh were sanctioned from ICAR, Govt. of India, Govt. of Gujarat and Private sectors in the University. The main sanctioned projects are:

1. Aflatoxin and its management in groundnut in Saurashtra region of Gujarat.
2. Molecular mapping of important traits and their transfer through marker assisted selection in groundnut and cotton.
3. Studies on effect of climate change on fruit crops of Saurashtra region.
4. Mapping and marine fish biodiversity along the Veraval coast using mtDNA barcoding.
5. Effect of optically active substances on diversity in phytoplankton

- community structure of Gujarat.
6. Ocean state forecast validation and research (off Okha and Veraval coasts of Gujarat).
7. Network project on market intelligence.
8. National surveillance programme for aquatic animal diseases.

The University has signed five MoUs with following institutions /organization for collaborative Research & Education as well as seed production during 2013-14.


1. Punjab Agricultural University, Ludhiyana.
2. Gujarat Technology University, Gandhinagar.
3. Aspee Agricultural Research & Development Foundation, Mumbai.
4. Maharana Pratap University of Agriculture and Technology, Udaipur.
5. Ronak Seeds Pvt. Ltd., Ahmedabad.

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, 123 scientist/teachers were deputed to attend winter/summer school training, 333 attended different seminar/ symposium/ conference at state and national level and 186 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 10th Combined Joint AGRESCO Meeting, three varieties viz., Gram, Gujarat Gram-5 (GG-5); Pigeonpea, Gujarat Junagadh Pigeonpea-1 (GJP-1) and Garlic, Gujarat Junagadh Garlic-5 (GJG-5) were recommended for release in the state. Besides, 39 technologies/ recommendations were made for farmers and 16 recommendations were made for Scientific Community. In addition, as many as 85 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 45th meeting of State Seed Sub-Committee held on May 22, 2014 at Gandhinagar.

October, 2014


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

Summary of new released varieties and developed agro technologies during the 2013-14

Sub-Committee	No. of Recommendations finalized for		Approved New Technical Programmes
	Farmers	Scientific Community	
Crop Improvement	03*	-	02
Crop Production	15	05	27
Plant Protection	06	-	14
Horticulture & Agro Forestry	02	01	03
Agricultural Engineering	08	02	10
Basic Science	02	-	05
Social Science	-	-	05
Animal Science	02	03	14
Fisheries Science	04	05	05
Total:	3*+39	16	85

* Varieties released

Recommendations for Farmers

I. CROP IMPROVEMENT

Three varieties *viz.*, Gram (GG-5), Pigeonpea (GJP-1) and Garlic (GJG-5) were recommended for farmers of the state during 2013-14.

Gram: Gujarat Gram-5 (GG-5)

This variety of chickpea has produced 27.61 and 12.25 per cent higher seed yield over check varieties Dahod Yellow and Gujarat Gram 1, respectively under irrigated condition in Gujarat. Seeds of this variety are of medium size and brown in colour. This variety is resistant to wilt and stunt diseases. This variety is approved for release in Gujarat state.



(Pulses Research Station, JAU, Junagadh)

Pigeonpea: Gujarat Junagadh Pigeonpea-1 (GJP-1)

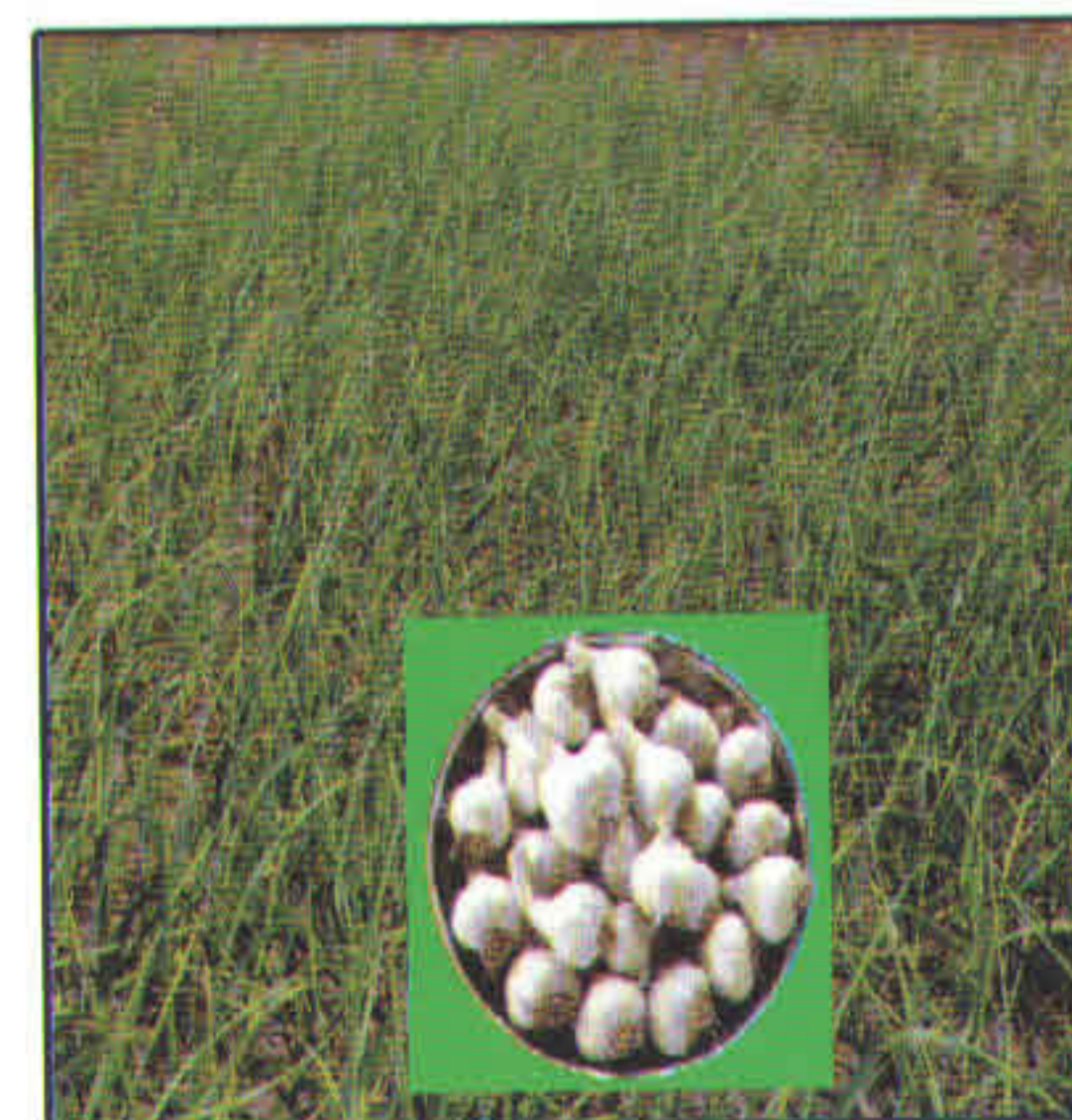
This Pigeonpea variety has produced 71.14, 2.82, 29.12 and 25.23 per cent higher seed yield over check varieties, BDN 2, ICPL 87119, Vaishali and AGT 2, respectively during *kharif* season in South Saurashtra. This variety is medium late (176 days) in maturity. GJP 1 is also found moderately resistant to wilt and Sterility Mosaic Disease (SMD). The seed of this variety is bold in size with white colour.



(Pulses Research Station, JAU, Junagadh)

Garlic: Gujarat Junagadh Garlic-5 (GJG-5)

This variety of garlic recorded 23.34 and 26.93 per cent higher bulb yield over check varieties GG 4 and G 282, respectively during *rabi* season in Saurashtra and Middle Gujarat. The bulbs of this variety are medium in size, compact and white in colour. This variety is approved for release in Saurashtra and Middle Gujarat.



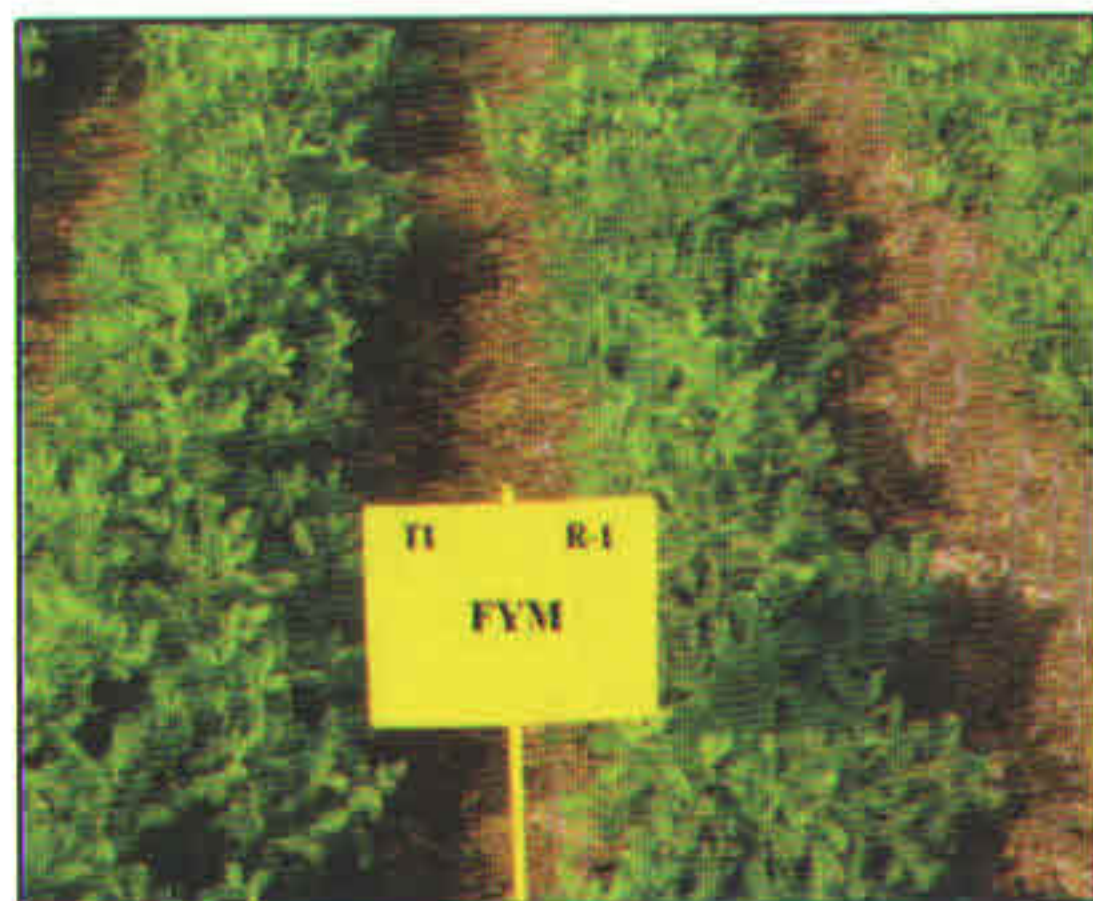
(Vegetable Research Station, JAU, Junagadh)

II. CROP PRODUCTION

Nutrient Management

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

The farmers of South Saurashtra Agro-climatic Zone adopting groundnut (*kharif*)-wheat (*rabi*) cropping sequence under organic farming are advised to apply FYM @ 2.5 t/ha to groundnut and 24 t/ha to wheat for obtaining higher yield and net return along with maintaining soil fertility.



(Department of Agronomy, JAU, Junagadh)

Nutrients requirement for bold seeded summer groundnut

The farmers of South Saurashtra Agro-climatic Zone growing bold seeded summer groundnut are advised to fertilize the crop with 50 kg N, 25 kg K_2O and 20 kg S (120 kg gypsum) per hectare with recommended dose of P_2O_5 (50 kg/ha) for securing higher yield and net realization.



(Main Oilseeds Research Station, JAU, Junagadh)

Yield maximization in groundnut through nutrient management practices during *kharif* season

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are advised to apply FYM 7.5 t/ha + recommended dose of fertilizer (12.5:25 kg N: P_2O_5 /ha) + 25 kg $ZnSO_4$ /ha as basal for obtaining higher yield and net return.



(Main Oilseeds Research Station, JAU, Junagadh)

Effect of biofertilizer along with Molybdenum application on yield of chickpea

The farmers of South Saurashtra Agro-climatic Zone growing irrigated chickpea are advised to treat seeds with *Rhizobium* culture @ 25 g/kg seed + phosphate solubilizing bacterial culture (*Bacillus subtilis*) 30 g/kg seed along with recommended dose of fertilizers (20:40 N: P_2O_5 kg/ha) for securing higher yield and net return. Application of Molybdenum in chickpea was not found advantageous.



(Pulses Research Station, JAU, Junagadh)

Effect of different organic, inorganic and bio-fertilizers on groundnut-pigeonpea relay cropping system

The farmers of South Saurashtra Agro-climatic Zone following groundnut + pigeonpea (2:1) relay cropping system are advised to apply recommended dose of fertilizers to both the crops to obtain higher yield and net returns or 50% RDF + FYM 5 t/ha along with seed treatment of *Rhizobium* and phosphate solubilizing bacteria (each 25-30 g/kg seed) to groundnut only to reduce the dose of chemical fertilizers.



(Pulses Research Station, JAU, Junagadh)

Integrated nutrient management in rainfed cotton

The farmers of North Saurashtra Agro-climatic Zone (AES-VI) growing rainfed Bt. cotton are advised to apply 80 kg N + 10 t compost + 500 kg castor cake/ha along with bio-fertilizer (*Azotobacter* + PSB) for obtaining higher yield and net return beside improving soil fertility.



(Main Dry Farming Research Station, JAU, Targhadia)

Effect of K application on yield of summer groundnut in calcareous soil

The farmers of South Saurashtra Agro-climatic Zone growing summer groundnut in medium black calcareous soil are advised to apply potassium @ 50 kg/ha as basal in addition to recommended dose of fertilizer (25:50 N:P₂O₅ kg/ha) for securing higher yield and net return.



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

Potassium fertilization to kharif groundnut in calcareous soil

The farmers of South Saurashtra Agro-climatic Zone growing kharif groundnut in medium black calcareous soil are advised to apply potassium @ 50 kg/ha as basal in addition to recommended dose of fertilizer (12.5:25 N:P₂O₅ kg/ha) for securing higher yield and net return.

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

Package of Practices

Impact of tillage practices and sowing pattern on Bt cotton

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton are advised to prepare the field by ploughing followed by blade harrowing & planking and sow the crop on ridges (120 cm apart) for achieving higher seed cotton yield and net realization.



(Department of Agronomy, JAU, Junagadh)

Relay cropping of castor in soybean

The farmers of South Saurashtra Agro-climatic Zone growing soybean are advised to adopt relay intercropping system with castor by sowing castor 30 days after sowing of soybean with row ratio of 1 : 2 (castor : soybean) for securing higher yield and net return.



(Main Oilseeds Research Station, JAU, Junagadh)

Optimization of *kharif* groundnut production under resource constraints

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are advised to follow recommended practices of weed control, plant protection and fertilizer management for obtaining higher yield and net return. However, under the situation of resource constraints, farmers are advised to prioritize their resources in order of weed control > plant protection > fertilizer management.



(Main Oilseeds Research Station, JAU, Junagadh)

Effect of time of sowing and hybrids on productivity of summer pearl millet

The farmers of North Saurashtra Agro-climatic Zone growing hybrid pearl millet during summer are recommended to sow the crop during second fortnight of February (30 °C average maximum temperature) to obtain higher yield and net return.

(Main Pearl Millet Research Station, JAU, Jamnagar)

Time of planting and harvesting for early and midlate varieties of sugarcane

The farmers of South Saurashtra Agro-climatic Zone growing sugarcane (CoC 671 and CoN 91132) are advised to plant the crop during last week of October to last week of November. The early maturing variety CoC 671 should be harvested between 11 to 12 months of planting and midlate maturing variety CoN 91132 should be harvested between 12 to 14 months of planting for securing higher cane yield and net return.



(Main Sugarcane Research Station, JAU, Kodinar)

Evaluation of chickpea varieties under different dates of sowing under irrigated condition

The farmers of South Saurashtra Agro-climatic Zone growing irrigated chickpea are advised to sow the crop during first fortnight of November (mean minimum temperature 19.9 °C and mean maximum temperature 34.7 °C) for securing higher yield and net return.



(Pulses Research Station, JAU, Junagadh)

Response of fennel to plant geometry under North Saurashtra Agro-climatic Zone

The farmers of North Saurashtra Agro-climatic Zone (AES-XV) growing *rabi* fennel are advised to sow the crop at 60 cm x 20-30 cm spacing for securing higher yield and net return.



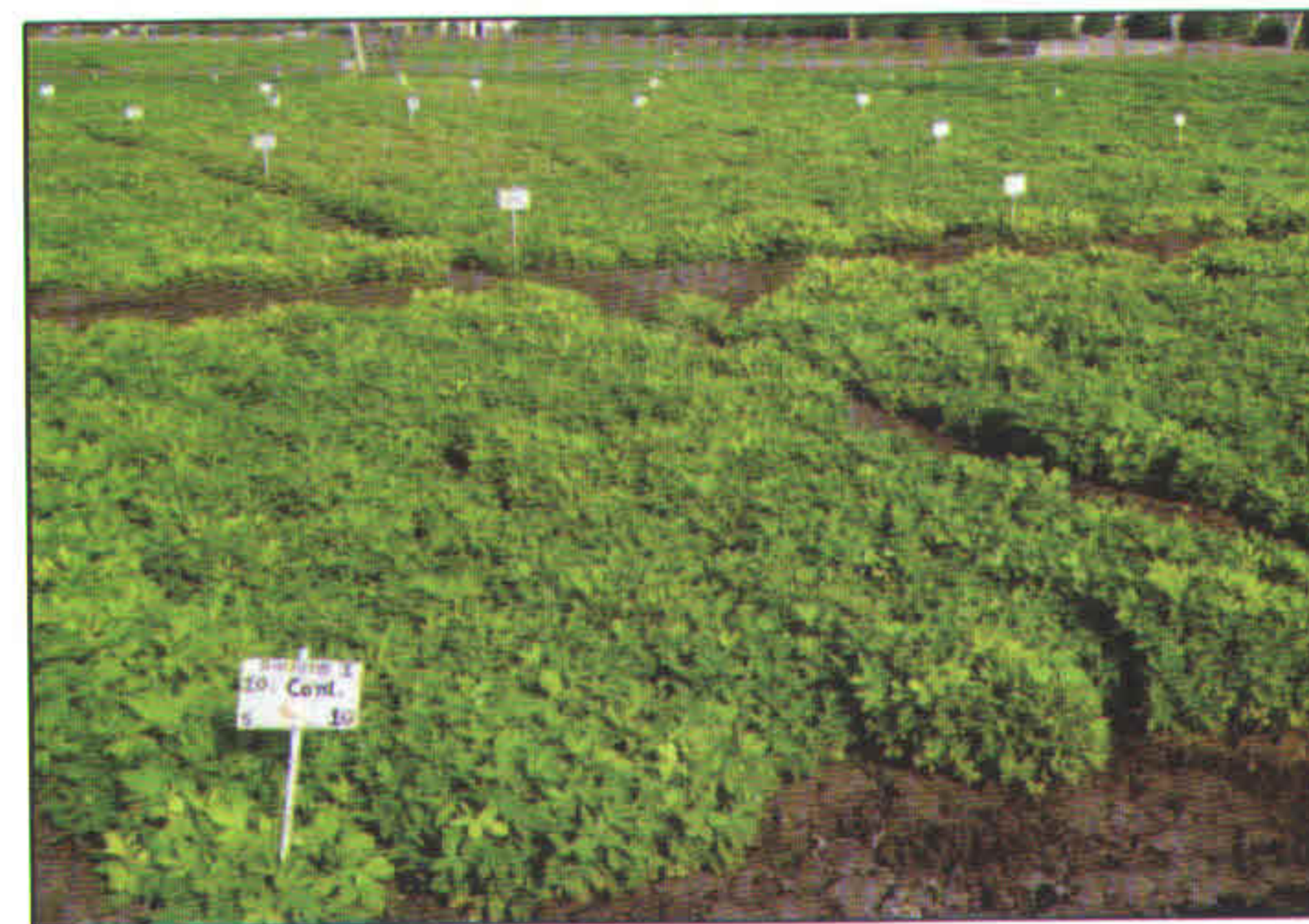
(Main Dry Farming Research Station, JAU, Targhadia)

III. PLANT PROTECTION

Agricultural Entomology

Testing Bio-efficacy of insecticides against sucking pest in summer groundnut

The farmers of South Saurashtra Agro-climatic Zone growing summer groundnut are advised to spray imidacloprid 17.8 SL 0.005 % (3 ml/ 10 litre water; 25 g a.i./ha) twice at 15 days interval starting after initiation of pest for effective and economical management of sucking pests in groundnut. The Pre Harvest Interval (PHI) of this insecticide is 40 days.



(Main Oilseed Research Station, JAU, Junagadh)

Management of shoot fly and stem borer in bajra crop

The farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet are advised to treat the seeds with thiamethoxam 35 FS @ 9.0 ml/kg (3.15 g a.i./kg) or imidacloprid 600 FS @ 8.75 ml/kg (5.25 g a.i./kg) seed at the time of sowing followed by spray of either profenophos 40% + cypermethrin 4.0%, 44 EC 0.044% (10 ml/10 litre water; 220 g a.i./ha) or cartap hydrochloride 50 SP 0.05% (10 g/ 10 litre water; 250 g a.i./ha) or thiodicarb 75 WP 0.015% (2 g/10 litre water; 75 g a.i./ha) at 30 days after germination of the crop for the effective management of shoot fly and stem borer. The PHI for these insecticides is 61 days.

(Main Pearl Millet Research Station, JAU, Jamnagar)

Chemical control of thrips (*Thrips tabaci* L.) in onion through newer insecticides

For effective and economical management of thrips in onion, two sprays of spinosad 45 SC 0.009% (2 ml / 10 litre water; 45 g a.i./ha) or chlorfenapyr 10 EC 0.008% (7.5 ml /10 litre water; 37.5 g a.i./ha) or fipronil 5 SC 0.007% (14 ml / 10 litre water; 35 g a.i./ha) at 10 days interval starting from thrips infestation are recommended under North Saurashtra Agro-climatic Zone. The PHI for spinosad, chlorfenapyr and fipronil is 34 days.

(Grassland Research Station, JAU, Dhari)

Management of sucking pests of *kharif* groundnut through newer insecticides

For effective and economical management of sucking pests in *kharif* groundnut, two sprays of imidacloprid 17.8 SL 0.005% (2.8 ml/10 litre water; 25 g a.i./ha) or fipronil 5 SC 0.007% (14 ml / 10 litre water; 35 g a.i./ha) or difenthiuron 50 SP 0.05% (10 g/10 litre water; 250 g a.i./ha) at 15 days interval starting from the pest infestation are recommended under North Saurashtra Agro-climatic Zone . The PHI for imidacloprid, fipronil and difenthiuron is 27 days.



(Grassland Research Station, JAU, Dhari)

Efficacy of new molecules against *Helicoverpa armigera* in chickpea

For effective and economic control of pod borer (*Helicoverpa armigera*) in chickpea crop, farmers of South Saurashtra Agro-climatic Zone are advised to apply two sprays of chlorantraniliprole 20 SC 0.003% (1.5 ml/ 10 liter water; 15 g a.i./ha) or emamectin benzoate 5 SG 0.001% (2 g/ 10 liter water; 5 g a.i./ha) or profenophos 50 EC 0.1% (20 ml/ 10 liter water 500 g a.i./ha). First spray should be applied at 50 per cent flowering and second at 15 days after first spray. The PHI for these insecticides is 27 days.



(Pulse Research Station, JAU, Junagadh)

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

Farmers of South Saurashtra Agro-climatic Zone are advised to apply two sprays of spinosad 45 SC 0.009% (2 ml/ 10 litre water; 45 g a.i./ha) or thiodicarb 75 WP 0.075% (10 g/ 10 litre water; 375 g a.i./ha) or flubendiamide 48 SC 0.0096% (2 ml/ 10 litre water; 48 g a.i./ha) or chlorantraniliprole 20 SC 0.003% (1.5 ml/ 10 liter water; 15 g a.i./ha) starting from 50 per cent flowering and second spray at 15 days after first spray for the control of pod borer complex in pigeonpea. The PHI for these insecticides is 30 days.



(Pulse Research Station, JAU, Junagadh)

IV. HORTICULTURE & AGRO-FORESTRY

Effect of green manuring on yield of coconut cv. T x D and soil properties

Coconut growers of South Saurashtra Agro-climatic Zone are advised to grow sunhemp or dhaincha as green manuring crop in adult coconut plantation (T x D hybrid) for improving soil fertility and to get more yield and net return.



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

Effect of different concentration of ethephon application on gum production from *Acacia senegal* (L.) Willd (Gorad)

The farmers of North Saurashtra Agro-climatic Zone are recommended to apply 5 ml of 900 ppm ethephon [2.25 ml Ethrel (40%) in 1 liter of water] by drilling 5 cm hole of 1 cm diameter on stem at 1 m height above the ground of about five year age of *Acacia senegal* (Gorad) during first week of March for getting higher gum production and maximum net return.



(Grassland Research Station, JAU, Dhari)

V. AGRICULTURAL ENGINEERING

Standardization of packaging technology of fresh guava fruits

The farmers, processors and exporters are recommended to adopt packaging technique developed by Junagadh Agricultural University for increasing the shelf life of guava fruit up to 18 days at room temperature by packing in 50 μ polyethylene bag at a vacuum level of 700 mm Hg.



(Department of Processing & Food Engineering, CAET, JAU, Junagadh)

Standardization of packaging technology of processed guava fruits

The farmers, processors and exporters are recommended to adopt hot air drying technique developed by Junagadh Agricultural University for preparing of guava powder by drying of fresh guava slices (3 mm thick) pretreated with 1 % CaCl_2 + 2 % Potassium Meta bisulphate solution (KMS)

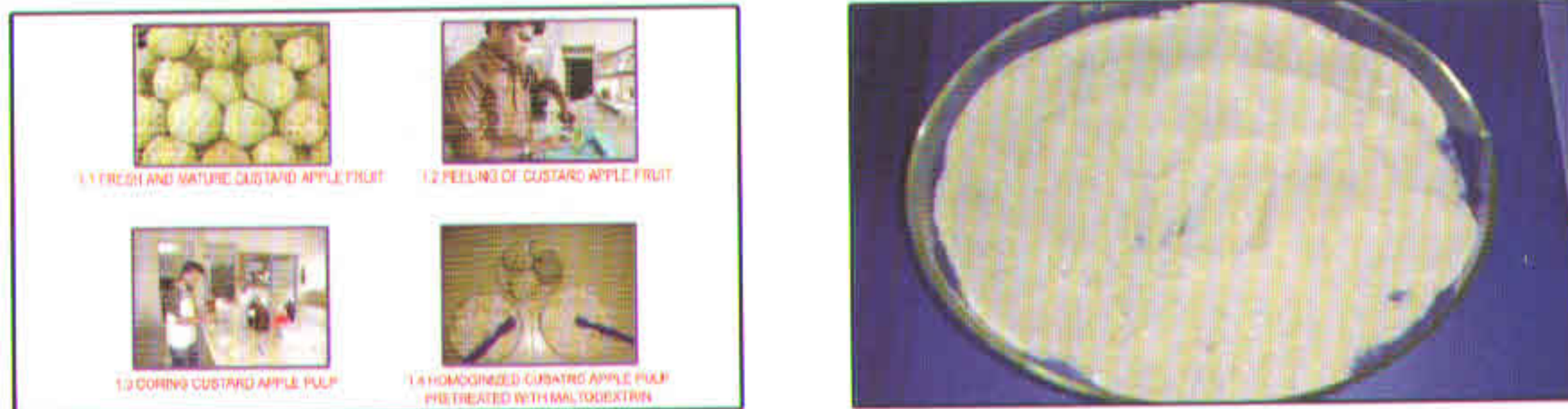


for 10 minutes at 60 °C drying air temperature and 1.25 m/s air velocity in drying period of 17 hours. The powder prepared by this method can be stored up to 80 days at room temperature by packing in 50µ polyethylene bag at a vacuum level of 700 mm Hg.

(Department of Processing & Food Engineering, CAET, JAU, Junagadh)

Preparation of custard apple powder by freeze drying methods

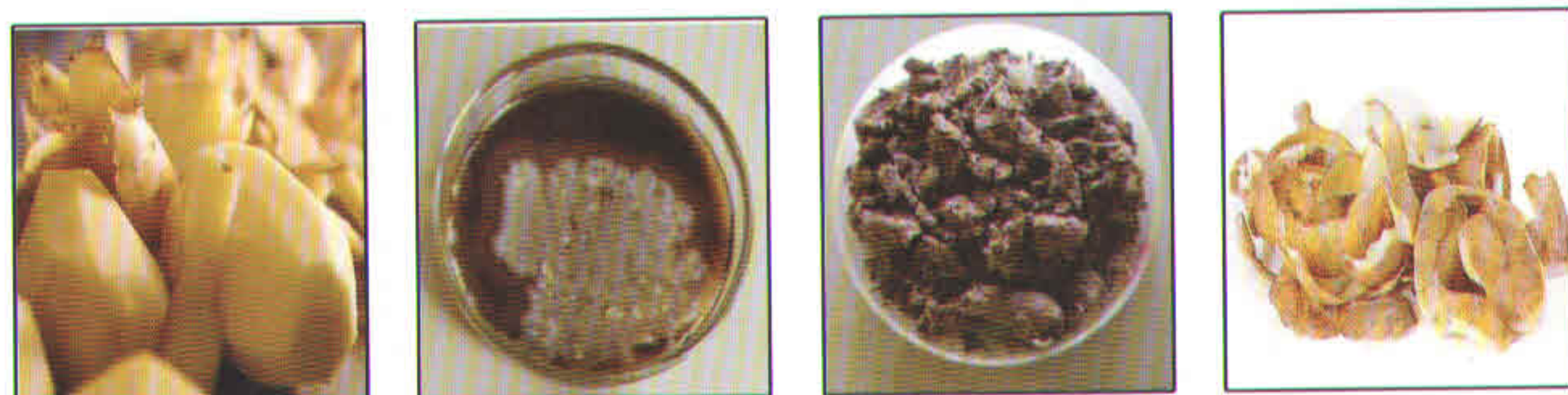
The processors and exporters are recommended to adopt freeze drying technique developed by Junagadh Agricultural University for preparing custard apple powder by freeze drying of fresh custard apple pulp (1.5 kg) pretreated with 5 % maltodextrine at -40 °C temperature with a drying period of 41 hours. The custard apple powder obtained by this method has better product quality and could be stored up to 90 days at room temperature when packed in 50 µ polyethylene bag at a vacuum level of 700 mm Hg.



(Department of Processing & Food Engineering, CAET, JAU, Junagadh)

Extraction of enzymes from potato peels substrate using 1 talk group of bacteria

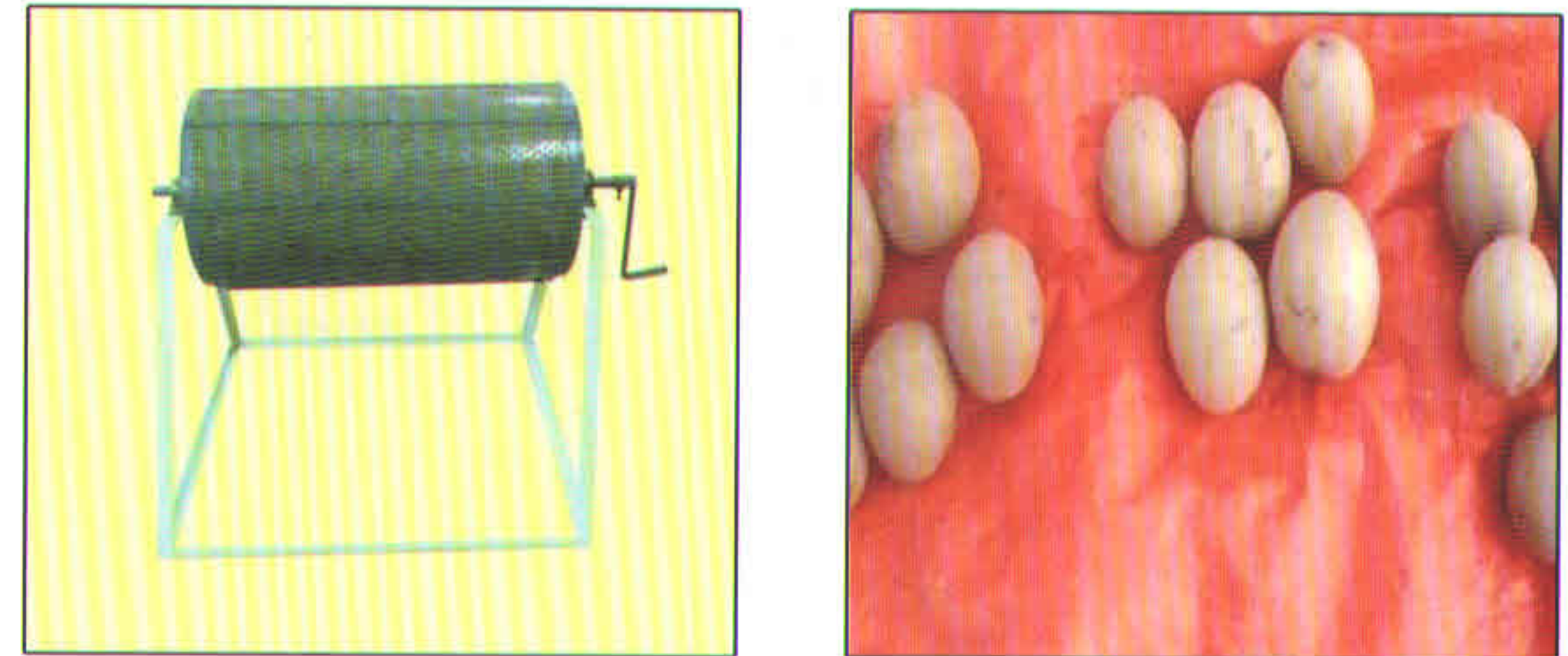
Potato processors and entrepreneurs are recommended to adopt a process technology developed by Junagadh Agricultural University for the production of alpha-amylase and protease enzymes through microbial and biochemical methods from bio waste (potato peel) using *Bacillus subtilis* bacteria. This process is beneficial (BCR 7.54:1) as compared to readymade available enzymes in market.



(Department of Processing & Food Engineering, CAET, JAU, Junagadh)

Development of manually operated sapota cleaner

The farmers growing sapota are recommended to use hand operated Junagadh Agricultural University developed sapota cleaner (capacity: 120 kg/h) having perforated metal sheet drum (45 cm diameter and 90.5cm length) lined with jute cloth on inner surface and be operated at 65 rpm for 90 seconds with 66% free space (in batch) for cleaning and shining the sapota surface after harvesting to reduce human drudgery.



(Department of Processing & Food Engineering, CAET, JAU, Junagadh)

Development of tractor drawn plant thinning device for row crops

The farmers and manufacturers are recommended to use JAU developed mini tractor drawn two row plant thinning device for maintaining plant spacing of 10 to 12 cm for small seed crops like pearl millet and sesamum. High thinning efficiency can be achieved using this device. As compared to manual thinning, approximately 70 % man-hours/ha can be saved.



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

Study on watershed development activities conducted in dark zone area of Junagadh district

The Planners, Designers, NGOs, Field Officers, and Government Departments of Junagadh district are recommended to use daily rainfall-runoff prediction equations for estimating daily runoff which are derived by JAU Junagadh using practically derived SCS Curve number (73.03) and adopting Remote Sensing approach. The groundwater contribution for the district can be taken as 12.67% of the above estimated runoff for efficient watershed planning. Additionally the updated Land Capability Classification for Ozat catchment in Junagadh can be taken as provided in the below table.

A) Rainfall – Runoff Relationships for Ozat Catchments (Daily basis)

S.N	Catchment Name	Rainfall (x) - Runoff (y) Equation*	R ²
1	Ambajal Catchment	$y = 0.6403x - 11.459$	0.9237
2	Motagujariya Catchment	$y = 0.4599x - 5.9043$	0.8317
3	Zanjeshri Catchment	$y = 0.5525x - 7.7979$	0.8971
4	Dhrafad Catchment	$y = 0.5748x - 8.2758$	0.8706
5	Ozat Weir-2 Catchment	$y = 0.366x - 3.4271$	0.7299
6	Ozat Weir-Shapur Catchment	$y = 0.4994x - 5.9403$	0.8571
7	Ozat Weir-Vanthli Catchment	$y = 0.459x - 5.1273$	0.8493
8	Ozat River Catchment	$y = 0.5366x - 7.3009$	0.8591

* Rainfall and Runoff are in mm

B) Updated Land Capability Classification for Ozat Catchment

Sr. No	Particular	Area, km ²	Percent (%)	Remark
1	CLASS - I	975.34	69.22	Cultivable land
2	CLASS - II	7.67	0.54	
3	CLASS - IV	131.16	9.31	
4	CLASS - V	14.42	1.02	Uncultivable land
5	CLASS - VI	233.12	16.54	
6	Village	20.52	1.46	
7	River, Reservoir	26.93	1.91	
	Total	1409.16	100.00	

(Department of Soil & Water Engineering, CAET, JAU, Junagadh)

Geometry of wetting pattern under trickle irrigation

The following three models developed by JAU can be used to decide the lateral and emitter spacing in drip irrigation design for a particular emitter discharge in loamy soil.

Case: a) If moisture data before irrigation is not monitored

Planners Designers, NGO's, Field officers and Govt. Departments are recommended to use the following expression for determining the wetting dimensions if moisture information is not available

$$W = 0.516 V^{0.393} (K_s / q)^{0.062} \quad (R^2 = 0.983)$$

$$Z = 0.069 V^{0.303} (K_s / q)^{-0.060} \quad (R^2 = 0.965)$$

Where W = Diameter of wetted spread on the ground surface, *m*; q = emitter discharge in lph; V = volume of water application, *l*, and K_s = saturated hydraulic conductivity, *m/sec*; and Z = depth of wetting front below the emitter, *m*.

Case: b) If moisture data before irrigation is monitored then

The Planners Designers, NGO's, Field officers and Govt. Departments are recommended to use the following expression for determining the wetting dimensions if moisture information is available

$$R = \Delta\theta^{-452.978} V^{0.393} q^{0.062} K_s^{-17352.497} \quad (R^2 = 0.983)$$

$$Z = \Delta\theta^{-439.643} V^{0.303} q^{0.060} K_s^{-16840.965} \quad (R^2 = 0.965)$$

Where R = Radius of wetted spread on the ground surface, *cm*; q = emitter discharge in ml/h; V = volume of water application *ml*; and K_s = saturated hydraulic conductivity, *cm/h*; and Z = depth of wetting front below the emitter, *cm*.

Case: c) If time of application is mentioned

The Planners Designers, NGO's, Field officers and Govt. Departments are recommended to use revised Debral (2012) model for greater accuracy for determining the wetting dimensions if time of irrigation is known:

$$W = 15.081 t^{0.418} q^{0.448} K_s^{0.091} \quad (R^2 = 0.960)$$

$$Z = 27.185 t^{0.303} q^{0.363} K_s^{0.174} \quad (R^2 = 0.965)$$

Where W = Diameter (*m*); q = emitter discharge cumec; t = time of application sec; K_s = saturated hydraulic conductivity, *m/sec*; Z = depth of wetting front below the emitter (*m*).

(Research Testing & Training Center, JAU, Junagadh)

VI. BASIC SCIENCE

Effect of NAA on seed cotton (*Gossypium hirsutum* L.) yield

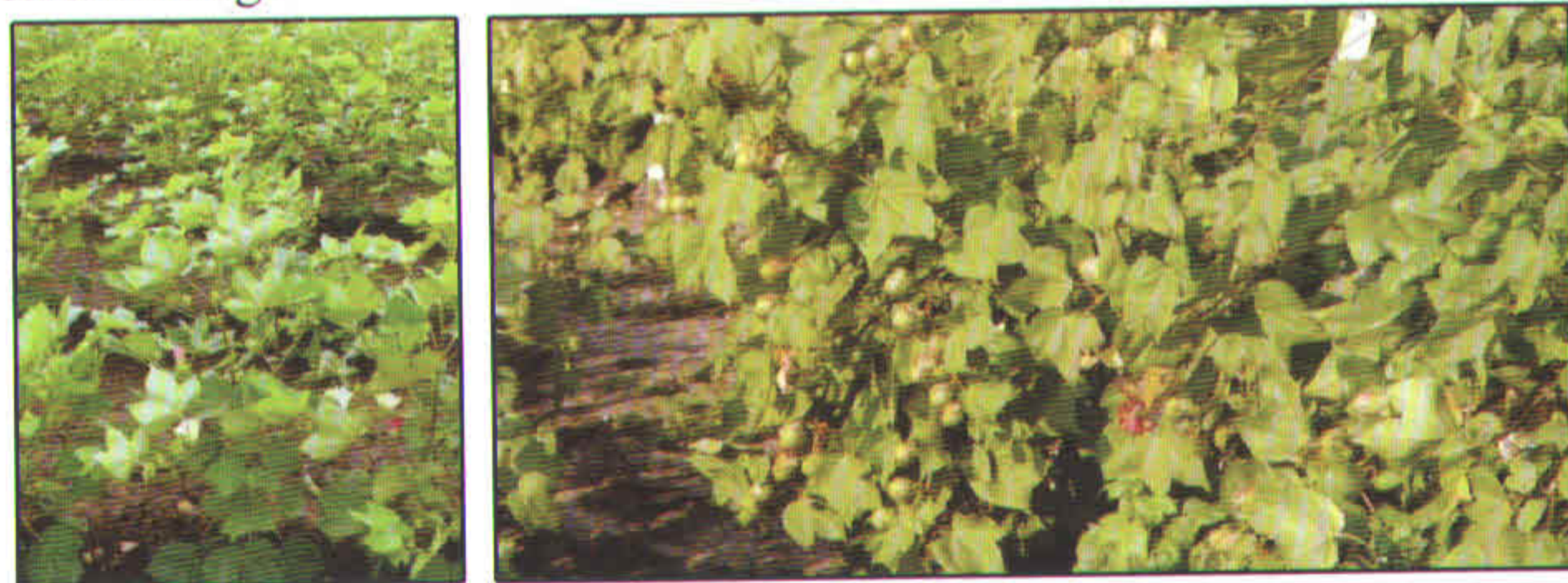
The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton under irrigated condition are advised to spray growth promoter Naphthalene Acetic Acid (NAA) @ 30 ppm (300 mg / 10 lit. water) at 50 DAS & 70 DAS for better growth to obtain higher seed cotton yield and net return. This is due to high chlorophyll content, increase in plant height, thickness of leaves, length of sympodia, number of squares and number of bolls.



(Cotton Research Station, JAU, Junagadh)

Effects of plant growth regulators on buds and bolls shedding in cotton (*Gossypium hirsutum* L.)

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton under irrigated condition are advised to spray growth inhibitor Cycocel/Chlormequat Chloride (CCC) @ 40 ppm at 90 DAS (400 mg / 10 lit. water) for minimizing buds and bolls shedding to obtain higher seed cotton yield and net return. This is due to high chlorophyll content, increase in thickness of leaves, number of squares, number of bolls and minimum boll shedding.



(Cotton Research Station, JAU, Junagadh)

VI. ANIMAL HEALTH & ANIMAL PRODUCTION

Morbidity and mortality in Gir cattle herd

In South Saurashtra region, in an organized dairy farm of Gir cattle:

1. Overall annual mortality averages around 6 per cent in the herd. Higher mortality occurs from birth to 1 month of age especially, during November–December months on account of colibacillosis and pneumonia.
2. Mastitis, colibacillosis, fever and pneumonia are major health disorders in Gir cattle.

Therefore, dairy farmers of Gir cattle are advised to take all possible care and precautions during first month of calthood especially during November-December months to keep incidence of diseases and mortality at the minimum.

(Cattle Breeding Farm, JAU, Junagadh & Dept. LPM, Vet. Coll., JAU, Junagadh)

Morbidity and mortality in Jaffrabadi buffalo herd

In South Saurashtra region, in large dairy farm of Jaffrabadi buffaloes:

1. Overall annual mortality averages around 11 per cent in the herd. Higher mortality occurs from birth to 1 month of age group especially, during September-October months on account of colibacillosis and pneumonia.
2. Colibacillosis, fever, mastitis and gastroenteritis are major health disorders in Jaffrabadi buffaloes.

Therefore, dairy farmers of Jaffrabadi buffalo are advised to take all possible care and precautions during first month of calthood especially during September-October to keep incidence of diseases and mortality at the minimum.

(Cattle Breeding Farm, JAU, Junagadh & Dept. LPM, Vet. Coll., JAU, Junagadh)

VII. FISHERIES SCIENCE

Evaluation of stocking density of carp fry in rearing pond

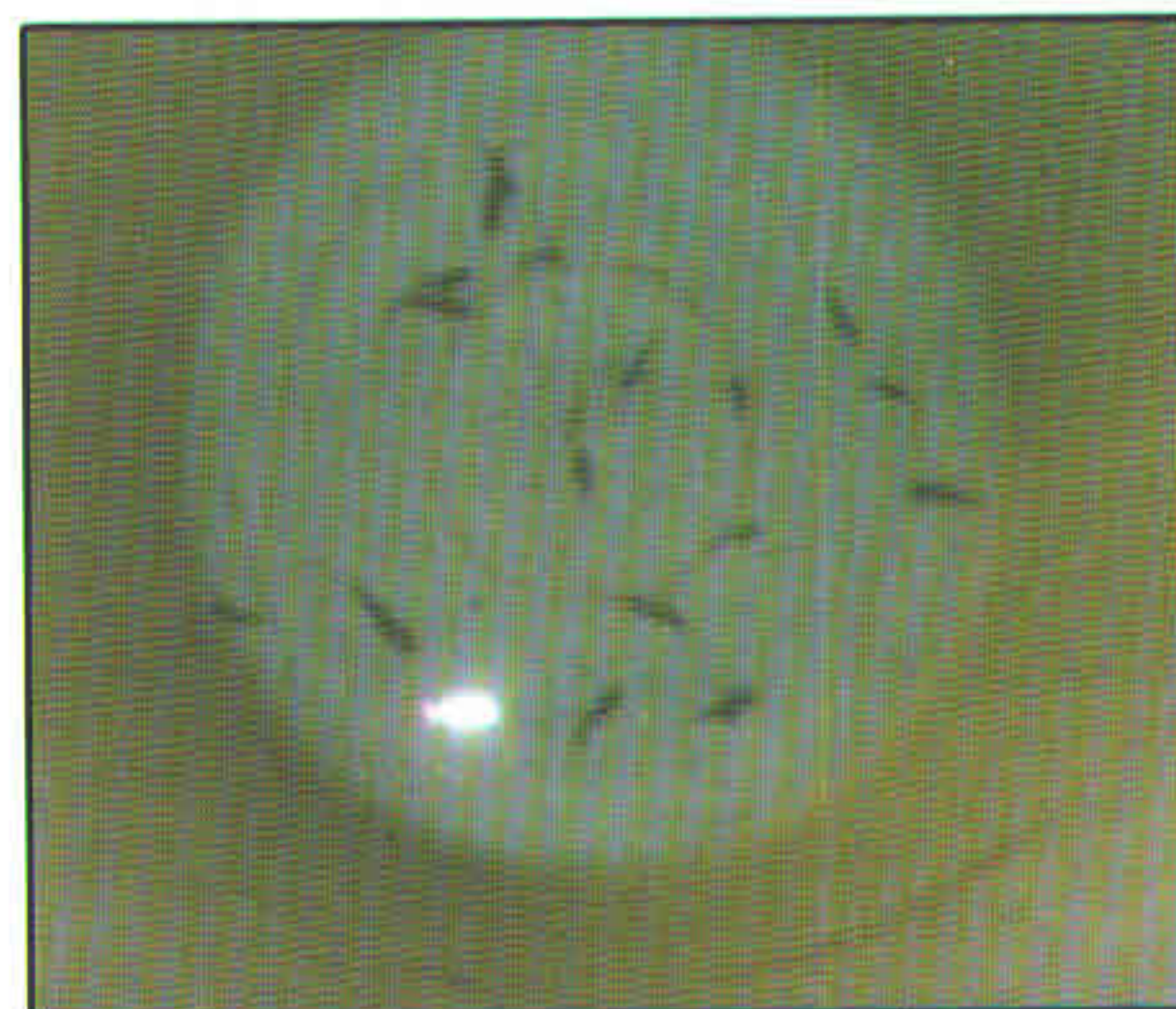
Fish farmers of Saurashtra region are recommended to stock rohu fry @ 1.00 lakh per hectare in rearing ponds for obtaining better growth and survival rate.



(College of Fisheries Science, JAU, Veraval)

Effect of different levels of protein diet on the growth and survival of *Mugil cephalus* (Linnaeus) fry

Fish farmers of Saurashtra are recommended to feed gray mullet *Mugil cephalus* fry reared in seawater with 35% protein incorporated diet in first 45 days for obtaining higher growth and survival.



(Fisheries Research Station, JAU, Okha)

Effect of different salinities on density of *Chaetoceros calcitrans*

Hatchery owners of Saurashtra region are recommended to use 30 PPT saline water to grow *Chaetoceros calcitrans* for higher yield.

(Fisheries Research Station, JAU, Sikka)

Effect of monospecies and mixed species' diet on growth and survival of pearl oyster (*Pinctada fucata*)

Hatchery entrepreneurs of Saurashtra region are recommended to use 50% *Isochrysis galbana* and 50% *Chaetoceros calcitrans* as a feed for pearl oyster rearing for better growth and profit.



(Fisheries Research Station, JAU, Sikka)

Recommendations for Scientific Community

I. CROP PRODUCTION

Status of sulphur fractions in medium black soils of Rajkot district (Gujarat)

- In general, minimum and maximum values of various sulphur fractions were recorded in soils of Tankara and Upleta, respectively.
- The higher and lower values of various sulphur fractions were recorded with groundnut-groundnut mono sequence and cotton/groundnut-rabi crops sequences, respectively.
- The values of all the sulphur fractions were recorded higher with medium deep soil (>60 cm) in comparison to shallow soil (<60 cm).
- The higher and lower values of various fractions of sulphur were recorded with irrigated and unirrigated conditions, respectively.
- Value of organic sulphur was lower with irrigation applied through bore well in comparison to open or canal/river sources.
- District as whole 32.1 per cent soils fall under deficient category, while 44.6 per cent in medium and only 23.2 soils are in high range.

(Main Dry Farming Research Station, JAU, Targhadia)

Establishment of critical limit of sulphur under onion crop in medium black calcareous soils

For recommending sulphur application to onion crop grown on calcareous soils of Saurashtra, Soil Testing Labs (STLs) of Gujarat should consider critical limit of 10 ppm S in soil and 0.56 per cent in onion plant at 60 DAS.



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

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

For recommending sulphur application to garlic crop grown on calcareous soils of Saurashtra, Soil Testing Labs (STLs) of Gujarat should consider critical limit of 10 ppm S in soil and 0.45 per cent in garlic plant at 60 DAS.



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

Relative salinity tolerance of different wheat genotypes

The relative salt tolerant of wheat varieties was found in order of GW 322 > GW 366 > Lok 1 > GW 273 > GW 496 up to EC 4.0 dS/m of irrigation water.

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

Soil test based fertilizer application for targeted yields of Bt. cotton in Saurashtra region of Gujarat

The Soil Testing Labs (STLs) of Gujarat are advised to use following equation for achieving targeted yield (up to 30 q/ha) of Bt cotton grown in Saurashtra region.

$$FN = 20.80 \times T - 1.55 SN$$

$$FK_2O = 18.97 \times T - 1.47 SK$$

Where; FN = Fertilizer N to be applied (kg/ha)

SN = Available soil N (kg/ha)

T = Targetted yield (q/ha)

FK₂O = Fertilizer K₂O to be applied (kg/ha)

SK = Available soil K₂O (kg/ha)



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

II. HORTICULTURE & AGRO - FORESTRY

Effect of time of ethephon application and trunk diameter on gum production from *Acacia senegal* (L.) Willd Gorad

It is recommended that application of 5 ml ethephon @ 100 ppm [0.25 ml Ethrel (40%) in 1 liter of water] to *Acacia senegal* (Gorad) above one meter ground level having 51-70 cm trunk girth during first fortnight of March resulted in higher gum production and higher net return.



(Grassland Research Station, JAU, Dhari)

III. AGRICULTURAL ENGINEERING

Geometry of wetting pattern under trickle irrigation

The scientists of South Saurashtra Agro-climatic Zone are advised to keep the following suggestions while using the following developed equations by various scientists for predicting the wetting geometry in loamy soils.

- Healy and Warrick (1981) model predicted wetting geometry (width ($R^2 = 0.3141$) and depth ($R^2 = 0.1918$) at lower discharges with poor accuracy and failed to predict at higher emitter discharges (> 8 lph).
- Philips (1984) model predicted wetting geometry (both width and depth) at lower and higher emitter discharges with good accuracy.
- Accuracy of original Debral (2012) dimensional analysis model is low in predicting wetting geometry (both depth below the emitter ($R^2 = 0.845$) and width at the surface ($R^2 = 0.895$)).
- BEN-ASHER Hemi Spherical Model (1985) predicted both depth ($R^2 = 0.962$) and width ($R^2 = 0.9774$) with good accuracy.
- Steady state Wooding model (1968), Steady state Raats model and moment analysis approach predicted both steady width with low accuracy.

(Research Testing & Training Center, JAU, Junagadh)

Ambient temperature trend analysis for the North Saurashtra region in view of climate change

- Weekly maximum temperature showed significantly increasing trend in MSW 8, 14, 15 and 18 where as significantly decreasing trend was observed in MSW 28, 37 and 39. Generally 28th MSW (9th July to 15th July) is the initial stage of groundnut, cotton and other *kharif* crops. Whereas MSW 37 and 38th (10th Sept. to 23rd Sept.) is the pegging stage of groundnut.
- Weekly minimum temperature showed significantly increasing trend in MSW 3, 8, 9, 12, 13, 15, 19, 44, 45, 48, 51 and 52. The MSW 44-45th (Oct. 29 to 11th Nov.) is the mid season of cotton crop. MSW 48 (Nov. 26 to 2nd Dec) and MSW 51 and 52 (Dec. 17th to 30th Dec) is the germination and booting stage of wheat and growing and flowering stage of cumin, respectively.

(Main Dry Farming Research Station, JAU, Targadia)

IV. ANIMAL HEALTH & ANIMAL PRODUCTION

Estimation of bulk milk Somatic Cell Count (SCC) from the raw milk of Gir cattle and Jaffrabadi buffalo

The scientific community is informed that average bulk tank milk somatic cell count - BTMSCC/ml milk of Gir cows (720,278 SCC/ml) and Jaffrabadi Buffaloes (623,625 SCC/ml) were lower than the US standards for "Grade A" milk (750,000 SCC /ml) without significant effect of season and time of milking in organized dairy farm.

(Cattle Breeding Farm, JAU, Junagadh)

Incidence of parasitic infections in bovines in and around Junagadh city

The veterinary professionals are informed that cattle and buffalo in and around Junagadh region were found predominately infected with *Toxocara vitulorum*, *Fasciola* spp., strongyles, *Strongyloides papillosus*, amphistomes, coccidia (*Eimeria* spp. and *Cryptosporidium* spp.) and *Buxtonella sulcata* (ciliates) parasites.



(Dept. of Vet. Parasitology, College of Vet. Science & A. H., JAU, Junagadh)

Abattoir survey of reproductive abnormalities in Jaffrabadi buffaloes (*Bubalus bubalis*)

It is informed to scientific community that about half of the culled Jaffrabadi buffaloes have acquired cervical affections, which include kinked cervix (72.6%) and cervical ectropion (25.8%) as major abnormalities.

(Dept. Vet. Gyn. & Obst., College of Vet. Science & A. H., JAU, Junagadh)

V. FISHERIES SCIENCE

Qualitative and quantitative analysis of phytoplankton of Sikka region

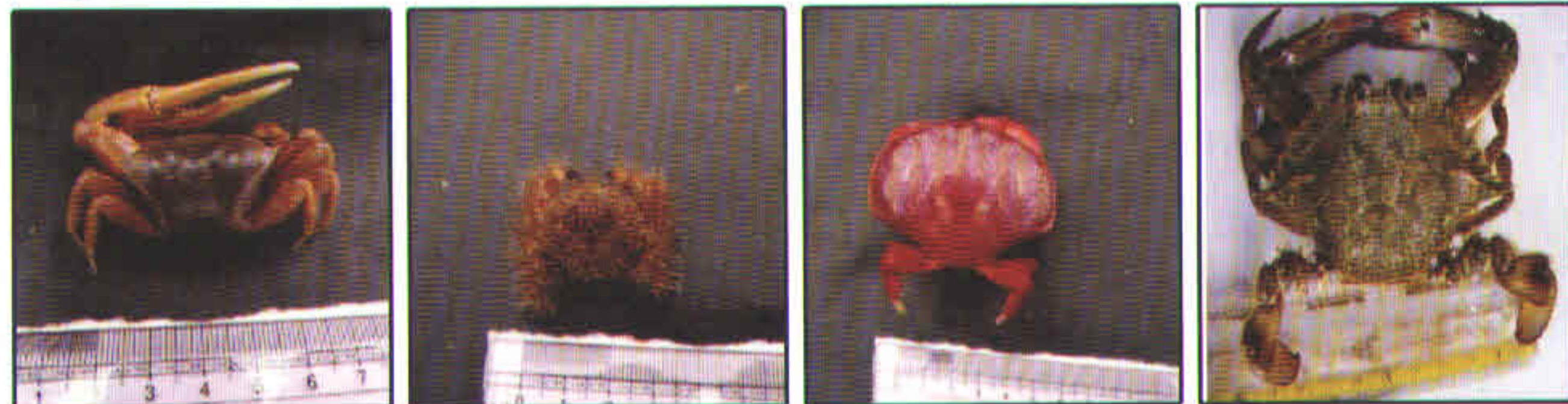
The Sikka coast, located in Gulf of Kachchh, Gujarat harbours 36 genera/species of phytoplankton, among which, *Amphora* spp., *Bacillaria paradoxa*, *Biddulphia mobilensis*, *Chaetoceros calcitrans*, *Chaetoceros curvisetus*, *Coscinodiscus granii*, *Ditylum sol*, *Gyrosigma* spp., *Nitzschia closterium*, *Pleurosigma* spp. and *Rhizosolenia* spp. were found abundant. Hence, it is recommended to scientific community to target these species for further biodiversity studies.



(Fisheries Research Station, JAU, Sikka)

Diversity and distribution of brachyuran crab at off shore Sikka

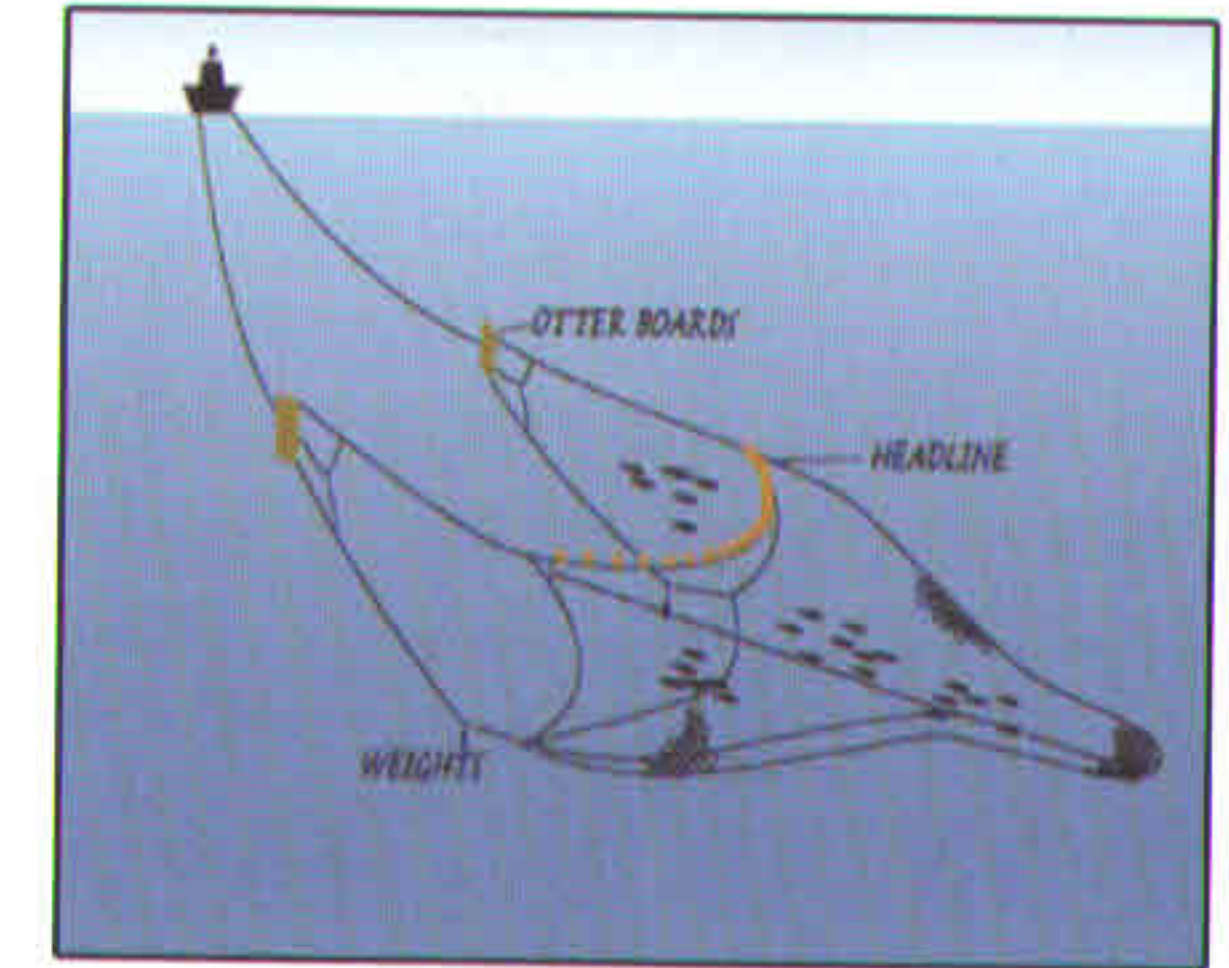
The Sikka Coast, located in Gulf of Kachchh, Gujarat harbours 22 species of Brachyuran crab, among which, *Pilumnus vespertilio*, *Atergatis integerrimus*, *Scylla serrata*, *Charybdis acutifrons*, *Parasesarma pictum*, *Menippe rumphii*, *Ocypode ceratophthalmus* and *Portunus pelagicus* were found abundant. Hence, it is recommended to scientific community to target these species for further biodiversity studies.



(Fisheries Research Station, JAU, Sikka)

Study of catch composition of trawl net operated along the Veraval coast, Gujarat

A total of 90 marine species (70 finfish and 20 shell fish) were recorded in the trawl net fishery. Ribbon fish, thread fin bream, squid, lizard fish and cuttle fish forms a major proportion of catch. Hence, it is recommended to scientific community to consider these species for further catch spectrum analysis.



(College of Fisheries, JAU, Veraval)

Analysis of plankton in brackish water shrimp culture pond

Ten genera of phytoplankton viz., *Chaetoceros*, *Skeletonema*, *Pleurosigma*, *Gyrosigma*, *Scenedesmus*, *Oscillatoria*, *Navicula*, *Nitzschia*, *Coscinodiscus* and *Chlamydomonas* and four genera of zooplankton viz., *Moina*, *Brachionus*, *Keratella* and *Pseudodiaptomus* are commonly observed in brackish water shrimp culture ponds of the Saurashtra region. Hence, it is recommended to scientific community to consider these species as feed in shrimp culture.



(College of Fisheries, JAU, Veraval)

Survey for cultivable sea water shrimps seed along Jafrabad and Mahuva coast

The fisheries scientists are recommended that cultivable shrimp seeds of *Metapenaeus kutchensis*, *Fenneropenaeus merguensis*, *Fenneropenaeus indicus* and *Penaeus monodon* are available during month of September to January at Mahuva, while at Jafrabad coast during April to May for shrimp farming purpose.



(Agricultural Research Station (FC), JAU, Mahuva)

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

SN	Name of Product	2013 - 14
1	Nucleus/ Breeder Seed (q)	2420
2	Truthful Seeds (q)	8150
3	Fruit crop grafts(No.)	125121
4	Fruit crop Sapling(No.)	19151
5	Tricoderma(kg)	53236
6	Rhizobium(Bottle -500 ml)	189
7	Azotobacter(Bottle -500 ml)	889
8	PSM(Bottle -500 ml)	513
9	Beaveria(kg)	2020
10	HNPV(Bottle -250 ml)	24
11	SNPV(Bottle -250 ml)	86
12	Tricocard (No.)	570

Production of Nucleus / Breeder seeds during year 2013-14

S.N.	Crop	Variety	Nucleus Seed	Breeder Seed (q)		Total (q)
				National	State	
1	Groundnut	GG-2	0.17	-	79.12	79.29
		GG-5	0.19	-	65.05	65.24
		GG-7	0.05	3.00	22.70	25.75
		GG-8	0.36	8.10	-	8.46
		GG-9	0.81	1.00	45.70	47.51
		GAUG-10	-	-	15.00	15.00
		GG-11	0.08	-	58.65	58.73
		GG-16	0.08	29.80	-	29.80
		GG-20	0.56	50.00	1226.00	1276.56
		GG-21	-	2.00	11.80	13.80
		GJG-22	0.09	-	18.65	18.74
		GJG-31	-	21.00	16.50	37.50
		GJGHPS-1	0.15	-	48.30	48.45
		Sub Total	2.68	114.90	1649.67	1767.25
2	Pearl millet	GHB-538	-	-	1.57	1.57
		GHB-757	-	-	0.39	0.39
		GHB-715	0.01	-	0.11	0.12
		GHB-558	-	-	0.08	0.08
		GHB-905	-	-	2.48	2.48
		Sub Total	0.01	-	4.63	4.64
3	Sesame	G.Til-1	0.07	0.50	1.70	2.27
		G.Til-2	0.52	2.90	6.30	9.22
		G.Til-3	0.33	-	5.40	5.73
		G.Til-4	0.06	-	0.80	0.86
		G.Til-10	0.10	1.72	1.75	3.52
		Purva-1	0.02	-	0.08	0.10
		Sub Total	1.10	5.12	16.03	22.25
4	Chickpea	GG-1	4.00	-	31.50	35.50
		GG-2	6.00	29.00	49.25	84.25
		GG-3	6.06	61.25	36.90	104.21
		GG-4	3.02	22.00	-	25.02
		Sub Total	19.08	112.25	117.65	248.98
5	Wheat	GW-366	7.00	145.70	74.30	227.00
		GW-496	-	-	73.20	73.20
		Lok-1	-	-	75.60	75.60
		Sub Total	7.00	145.70	223.10	375.80
6	Castor	GC-3	-	-	1.40	1.40
Grand Total...			29.87	377.97	2012.48	2420.32