

**RESEARCH ACCOMPLISHMENTS  
AND  
RECOMMENDATIONS  
2021**



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

## **Citation:**

Research Accomplishments and Recommendations - 2021  
Junagadh Agricultural University, Junagadh (Gujarat)

## **Published by:**

Directorate of Research  
"University Bhavan"  
Junagadh Agricultural University,  
Junagadh -362001(Gujarat)  
Phone: (0285) 2670131  
Fax: (0285) 2674064  
E-mail: dr@jau.in

## **Editors:**

Dr. K. B. Parmar  
Er. D. B. Barad  
Sh. S. J. Vekariya

## **Publication No.:**

3-1-16

## **Year of Publication:**

2022

## **Copies:**

300

## **Printed at:**

Student Xerox  
99744 31231



**Junagadh Agricultural University**  
**Junagadh - 362 001 (Gujarat)**



**Prof (Dr.) N. K. Gontia**  
Vice Chancellor (I/c)

## MESSAGE

The Junagadh Agricultural University (JAU) is bestowed with an excellent infrastructure and support system to perform the mandate of teaching, research and extension (TRE) in the Saurashtra region of Gujarat state with its jurisdiction extending over ten districts encompassing four agro-climatic zones. Though the University is empowered with 31 research stations to take up research tasks all-round the year, its research profile is also strengthened with the proactive contribution from its seven KVKs and six colleges. Research, being continuous process, is accorded a special place in the University system. Akin to a central pillar of a weighing scale, the stronger the research component is the stronger can be the balance maintained in teaching and extension. Not only the research outputs are ploughed back to teaching for developing competent human resources but are also channelized during extension and training for the betterment of the farming community and other stakeholders.

Understandably, like other SAUs in the state, JAU adopts a three-tier research process viz. ZREAC, AGRESCO and Combined AGRESCO by which the research works are discussed in depth by the members of the house drawn from all the faculties. The recommendations emerging out of the studies, upon being accepted by the house, are categorized separately for farmers and scientific community/policymakers.

It is my pleasure as well as honour to release this compilation entitled **“Research Accomplishment and Recommendations- 2021”** of the University which features the research recommendations from crop improvement, crop production, plant protection, horticulture, mechanization, value addition, social science among others in the form of seven new crop varieties, 67 technologies developed for farmers and 40 technologies for scientific community. I congratulate the Director of Research and his team for this timely compilation and appreciate the scientists, researchers and extensionists of the University for coming up with research outputs. I sincerely wish that the farmers of the region as well as the state and the nation would immensely benefit from this publication.

**Junagadh**  
**March 14, 2022**

**(N. K. Gontia)**



**Director of Research & Dean, PG Studies**  
**Junagadh Agricultural University**  
**Junagadh - 362 001 (Gujarat)**  
**Phone (O): +91 (0285) 2670131**  
**Fax: +91 (0285) 2674064**  
**Email: dr@jau.in**



**Dr. D. R. Mehta**

## **PREFACE**

It is a matter of great pleasure for me to highlight the research outcome carried out during the year 2020-21 in the University. The recommendations and new technical programmes were critically discussed and approved in respective 17<sup>th</sup> AGRESKO meetings of various sub-committees of Junagadh Agricultural University. Same was presented in 17<sup>th</sup> Combined AGRESKO meeting of SAUs held at Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar through virtual mode during April 27 to July 15, 2021.

The Junagadh Agricultural University represents ten districts and about 32.74 per cent area of the state. There 31 research stations, which include multidisciplinary main research stations, sub research stations for various crops as well as testing centers in the University. The nine 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 responsibilities. The University arranged 18<sup>th</sup> Research Council meeting on January 21, 2021 for approval of new research projects and research activities to be under taken during this year. The university has also signed six MoU for research activities like PG Research, HRD and production and marketing of crop varieties. Total 38 new projects worth of Rs. 342.00 lakh were sanctioned from ICAR and Private sectors in the University during the year 2020-21.

During the year 2020-21, total 4136 quintal of breeder/ nucleus seeds of different crops were produced successfully to fulfill the demand of private and public sectors as per the national and state indents. Through the megaseed, University has also produced 7286 quintal of truthful/ foundation/ certified seeds of different crops and supplied to the farmers with subsidy with "Gir Sawaj" brand under ICAR seed and seedhub project. Apart from these, 2,04,224 planting material of different fruit crop grafts, saplings, seedlings, ornamental and medicinal plants were produced and supplied to the farmers at cheaper rates.

In the 17th Combined AGRESCO meeting, seven varieties viz., two varieties of Groundnut [Gujarat Groundnut-37 (GG-37) and Gujarat Groundnut-38 (GG-38)]; two varieties of Chickpea [Gujarat Gram-7 (GG-7) and Gujarat Kabuli-1]; two varieties of Pearl millet [Endorsement of Gujarat Hybrid Bajra-1231 (GHB-1231) and EDV variety Gujarat Hybrid Bajra-538 (GHB-538)] and cotton [Gujarat Cotton Hybrid-24 BG-II (G.Cot.Hy.24 BG II)] were recommended for release in the state. Besides, 67 technologies/ implements/ recommendations were made for the farmers and 40 recommendations were made for Scientific Community. In addition, as many as 84 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.

Sub Committee	No. of Recommendations		New Technical Programs
	Farmers	Scientific	
Crop Improvement	7*	02	01
Crop Production	20	15	14
Plant Protection	15	03	25
Horticulture & Forestry	07	-	16
Agricultural Engineering	10	-	10
Animal Health	01	06	-
Animal Production & Fisheries Science	13	04	-
Basic Science	01	07	06
Social Science	-	03	12
<b>Total</b>	<b>7*+67</b>	<b>40</b>	<b>84</b>

\* No. of Varieties released.

Junagadh  
March 15, 2022

  
(D. R. Mehta)

## RECOMMENDATIONS FOR FARMERS

### I. CROP IMPROVEMENT

Seven new crop varieties viz. Groundnut (GG 37 and GG-38), Pearl millet (GHB-1231 and GHB-538 (EDV-DM)), Chickpea (GG 7 and GKG-1) and Cotton (G.Cot.Hy.24-BG-II) were recommended for farmers during the year 2020-21.

#### VARIETIES RELEASED

##### Groundnut Variety: Gujarat Groundnut 37 [GG 37: Sorath Gaurav]

The farmers of Gujarat state growing groundnut during summer season are recommended to grow Spanish bunch groundnut variety Gujarat Groundnut 37 [GG 37: Sorath Gaurav]. This variety has recorded mean pod yield of 3218 kg/ha, which was 20.77, 19.11 and 14.33 *per cent* higher over the check varieties, GG 6 (2398 kg/ha), GJG 31 (2702 kg/ha) and TG 37A (2815 kg/ha), respectively. This variety has also recorded high kernel yield (2350 kg/ha), oil yield (1148 kg/ha) and number of pods per plant over the check varieties. This variety was found comparable to the check varieties against tikka, stem rot and collar rot diseases. The damage due to thrips in GG 37 was also comparable to the check varieties.



[Main Oilseeds Research Station, JAU, Junagadh]

##### Groundnut variety: Gujarat Groundnut 38 [GG 38: Sorath Navin]

The farmers of Gujarat state growing groundnut during *khari*fseason are recommended to grow Spanish bunch groundnut variety Gujarat Groundnut 38 (GG 38: Sorath Navin). This variety has recorded mean pod yield of 2966 kg/ha, which was 31.53, 33.12 and 10.87 *per cent* higher over the check varieties, GG 7 (2255 kg/ha), GJG 9 (2228 kg/ha) and TG 37A (2675 kg/ha), respectively. This variety has also recorded high kernel yield (2146 kg/ha) and high oil yield (1050 kg/ha) over the check varieties. This variety was found comparable to the check varieties against tikka, rust, stem rot and collar rot diseases. The damage due to leaf defoliators in GG 38 was also comparable to the check varieties.



[Main Oilseeds Research Station, JAU, Junagadh]

### **Chickpea variety: Gujarat Gram 7 [GG 7: Sorath Suraj]**

Farmers of Gujarat state growing chickpea under conserved moisture (un-irrigated) condition are recommended to grow Gujarat Gram 7 (GG 7: Sorath Suraj) variety. This variety has produced 1859 kg/ha seed yield which was 43.3, 30.3, 18.4 and 9.0 *per cent* higher over check varieties Gujarat Gram 1 (1297 kg/ha), Gujarat Gram 2 (1427 kg/ha), Gujarat Junagadh Gram 3 (1570 kg/ha) and Gujarat Junagadh Gram 6 (1706 kg/ha), respectively. Seeds of this variety are large size and brown in colour. This variety is resistant to stunt disease and resistant to moderately resistant against wilt disease. It showed low pod borer damage. This variety has higher protein (23.65 %) and zinc (33.50 ppm) content as compared to the check varieties.



*[Pulses Research Station, JAU, Junagadh]*

### **Chickpea variety: Gujarat Kabuli Gram 1 [GKG 1: Sorath Kabuli]**

Farmers of Gujarat state growing kabuli chickpea are recommended to cultivate early maturing variety Gujarat Kabuli Gram 1 (GKG 1: Sorath Kabuli). In South Saurashtra, it recorded 2790 kg/ha seed yield, which is 14.7, 22.8 and 42.6 *per cent* higher over check varieties KAK 2, JGK 1 and PG 0517, respectively under irrigated condition. In North Saurashtra, it produced 1875 kg/ha seed yield, which is 29.8 and 20.7 *per cent* higher over KAK 2 and JGK 1, respectively and in Middle Gujarat, it recorded 1751 kg/ha seed yield which is 2.2 and 8.6 *per cent* higher over KAK 2 and PG 0517, respectively under irrigated condition.



In Bhal and Coastal areas, this variety has produced seed yield 1219 kg/ha which is 8.2, 7.9 and 50.1 *per cent* higher over check varieties KAK 2, JGK 1 and PG 0517, respectively under un-irrigated condition, where in south Gujarat, it gave 963 kg/ha seed yield, which is 5.4, 7.6 and 6.9 *per cent* higher over check varieties KAK 2, JGK 1 and PG 0517, respectively under un-irrigated condition. As seeds of this variety are of extra-large size (43.5 g/100 seeds), it is suitable for export purpose. This variety has good level of resistance against stunt disease with low pod borer damage. It has higher dal recovery (67.45 %), protein (23.60 %), iron (63.78 ppm) and zinc (35.40 ppm) content.

*[Pulses Research Station, JAU, Junagadh]*

### **Pearl millet variety: Gujarat Hybrid Bajra 1231 [GHB 1231: Sawaj Shakti]**

The summer pearl millet growing farmers of Gujarat state and semi *rabi* pearl millet growing farmers of Saurashtra region are recommended to grow Gujarat Hybrid Bajra (GHB 1231: Sawaj Shakti) as a dual purpose (grain and dry fodder) biofortified hybrid. During summer, this hybrid recorded average 5737 kg/ha grain yield, which was 48.4 and 12.4 *per cent* higher than check hybrids GHB 558 and GHB 732, respectively. It has also recorded average 8193 kg/ha dry fodder yield, which was 27.1 and 7.5 *per cent* higher than check hybrids GHB 558 and GHB 732, respectively.



During semi *rabi*, this hybrid recorded average 4485 kg/ha grain and 8212 kg/ha dry fodder yield, which was 30.9 and 16.1 *per cent* higher than check hybrid GHB 538 in Saurashtra region. The proposed hybrid is resistant against major pearl millet diseases like downy mildew, blast and rust and pest like shoot fly and stem borer. The grains of this hybrid possess higher content of Fe (> 70 ppm) and Zn (> 40 ppm) which is additional benefit to the farming and consumer community of pearl millet for their nutritional security.

[Main Pearl millet Research Station, JAU, Jamnagar]

**Pearl millet variety: Essentially Derived Gujarat Hybrid Bajra 538 for Downey Mildew [GHB 538 (EDV for DM): Maru Sona]**

The farmers of Gujarat state growing pearl millet during *kharif* season are recommended to grow Gujarat Hybrid Bajra 538 (EDV for DM) [GHB 538 (EDV for DM): Maru Sona] as a Downey mildew resistant and early maturing hybrid. This hybrid recorded average grain yield of 2589 kg/ha which is 3.5 *per cent* higher than check hybrid GHB 538. It has also recorded 6320 kg/ha dry fodder yield which is 10.8 *per cent* higher than check hybrid GHB 538. The proposed hybrid is resistant against pearl millet diseases like blast and rust and pests like shoot fly and stem borer.



[Main Pearl millet Research Station, JAU, Jamnagar]

**Cotton variety: Gujarat Cotton Hybrid-24 BG-II [G.Cot.Hy-24 BG-II: Sorath Swet Kanak]**

The farmers of Gujarat state growing Bt cotton hybrid (*Gossypium hirsutum* L.) are recommended to grow cotton hybrid Gujarat Cotton Hybrid-24 BG-II (G.Cot.Hy-24 BG-II: Sorath Swet Kanak) under irrigated condition. This hybrid has recorded 3070 kg/ha seed cotton yield, which was 45.4, 53.3, 45.1 and 20.9 *per cent* higher over BG-II check hybrids *viz.*, G.Cot.Hy-12 (1943 kg/ha), RCH-2 (1843 kg/ha), MRC-7351 (2285 kg/ha) and PCH-4599 (2741 kg/ha), respectively. This hybrid gave lint yield of 1076 kg/ha, which was 55.7, 61.1, 60.2 and 29.3 *per cent* higher over BG- II check hybrids G.Cot.Hy-12 (635 kg/ha), RCH-2 (614 kg/ha), MRC-7351 (726 kg/ha) and PCH-4599 (899 kg/ha), respectively. It possesses 33.9 % ginning outturn. This hybrid is medium in maturity. It is found resistant to alternaria leaf spot and bacterial leaf blight disease and found moderately resistant against sucking pests.





[Cotton Research Station, JAU, Junagadh]

## II. CROP PRODUCTION

### (A) Nutrient Management

#### Integrated nutrient management in soybean

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* soybean are recommended to apply either Biocompost 2 t/ha + FYM 2.5 t/ha + *Rhizobium* 2 L/ha + PSB 2 L/ha or Biocompost 4 t/ha or FYM 5 t/ha as soil application to obtain higher yield and net realization along with maintenance of soil fertility.



(Department of Agronomy, CoA, JAU, Junagadh)

#### Effect of tillage and post-emergence herbicides on growth and yield of soybean

The farmers of Gujarat growing *kharif* soybean are recommended to prepare the field by rotavator and apply pendimethalin 0.9 kg/ha (30% EC @ 60 ml/10 L water) as pre-emergence fb pre-mix



sodium acifluorfen + clodinafop propargyl 245 g/ha (16.5 % + 8 % EC @ 20 ml/10 L water) as post-emergence at 30 DAS for effective weed management and to obtain higher seed yield and net realization.

(Department of Agronomy, CoA, JAU, Junagadh)

#### Application of bio-formulations in summer groundnut production

The farmers of South Saurashtra Agro-climatic Zone growing groundnut during summer season are recommended to apply 75 % RDF (18.75-37.5-37.5 kg N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O /ha) with seed treatment of NPK liquid biofertilizer (2 ml + 3 ml water/kg seed) and Zn solubilizing bacteria (1 ml + 4 ml water/kg seed) or 50 % RDF (12.5-25-25 kg N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O /ha) with seed treatment of bio-grow biofertilizer (1 ml + 4 ml water/kg seed) for obtaining higher yield and net return.



(Department of Agronomy, CoA, JAU, Junagadh)

### **Effect of foliar application of water soluble fertilizer on growth, yield and nutrient uptake of summer groundnut**

The farmers of South Saurashtra Agro-climatic Zone growing groundnut during summer season are recommended to apply 75 % RDF (18.75-37.5-37.5 kg N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O /ha) as basal and spray 1.5 % water soluble fertilizer (19-19-19 % N-P-K) at 45, 60 and 75 DAS for obtaining higher yield and net return.



*(Main Oilseeds Research Station, JAU, Junagadh)*

### **Effect of multi-micronutrient formulations on chickpea**

The farmers of South Saurashtra Agro-climatic Zone growing chickpea in medium black calcareous soil are recommended to apply micronutrients as per soil test value or multi micronutrients



formulation Grade-V 40 kg/ha as basal in addition to recommended dose of fertilizers (20-40-0 N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O kg/ha) to chickpea for obtaining higher yield and net return.

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

### **Effect of foliar application of various fertilizers on growth, yield and nutrients uptake by onion**

The farmers of South Saurashtra Agro-climatic Zone growing onion in medium black calcareous soil are recommended to apply 75 % RDF (56-45-37.5-15 kg N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O-S /ha) + 1 % (100



g/10 L water) foliar spray of water soluble fertilizer (19-19-19 % N-P-K) and 1 % Novel organic liquid nutrient at 45 and 60 day after transplanting for getting higher yield and net return.

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

### **Effect of foliar application of water soluble fertilizer on growth, yield and nutrients uptake by Bt cotton**

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton in medium black calcareous soil are recommended to apply 75 % RDF (180-37.5-112.5 N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O kg/ha) + two sprays of 2 % water soluble fertilizer (19-19-19 % N-P-K) at 50 and 75



DAS for getting higher yield and net return.

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

### Effect of NP fertilization on yield of sorghum under conserved soil moisture in Ghed area

The farmers of South Saurashtra Agro-climatic Zone (Ghed area) growing sorghum under conserved soil moisture are recommended to apply 40 kg N and 20 kg P<sub>2</sub>O<sub>5</sub>/ha for obtaining



higher yield and net return as well as sustaining soil fertility. The nitrogen should be applied in two equal splits *i.e.* 50 % as basal at the time of sowing and 50 % as top dressing by drilling in 10 cm soil depth at 45-50 days after sowing.

*(Main Dry Farming Res. Station, JAU, Targhadia and Dry Farming Res. Station, JAU, Ratia)*

### (B) Cultural Practices

#### Evaluation of various green manure crops under different time of sowing

The farmers of South Saurashtra Agro-climatic Zone interested in green manuring are recommended to sow sunnhemp or dhaincha during June-July and incorporate in soil at initiation of flowering for adding higher quantity of green biomass, N, P and K in soil.



*(Department of Agronomy, CoA, JAU, Junagadh)*

#### Identification of remunerative groundnut based cropping systems under rainfed situation in India

The farmers of South Saurashtra region adopting intercropping system in semi-spreading groundnut during *kharif* season are recommend to grow groundnut + sesame (2:1) intercropping during *kharif* season and onion during *rabi* season for obtaining higher groundnut equivalent yield and net return.



*(Main Oilseeds Research Station, JAU, Junagadh)*

#### *In-situ* moisture conservation in rainfed sesame for higher resource use efficiency, productivity and profitability

The farmers of North Saurashtra Agro-climatic Zone growing sesame during *kharif* season under rainfed condition are recommended to sow sesame by broad bed and furrow system (40 cm width and 15 cm depth of furrow and 140 cm bed between two furrows) and apply wheat straw mulch 5 t/ha on broad bed at 15 days after sowing for getting higher seed yield and net return.



*(Agricultural Research Station, JAU, Amreli)*

## Performance of sesame genotypes differing in maturity and plant types and their response to plant geometry in summer season

The farmers of North Saurashtra Agro-climatic Zone growing summer sesame are recommended to prefer sesame varieties differing in maturity and plant type for higher seed yield and net return with different plant spacing as shown below.

- Variety with profuse branches and late maturity (G.Til 10) at 30 cm x 10 cm spacing.
- Variety with few branches and mid late (G.Til 3 and GJT 5) as well as late maturity (AT 308) at 15 cm x 10 cm or 30 cm x 10 cm spacing.

(Agricultural Research Station, JAU, Amreli)

## (C) Irrigation Management

### Standardization of potash levels and apportioning time in summer groundnut under drip irrigation

The farmers of South Saurashtra Agro-climatic Zone growing groundnut during summer season are recommended to apply potash @ 40 kg/ha through fertigation in 6 equal splits at 8 days interval (1<sup>st</sup> split at 20 DAS) along with recommended dose of N and P (25-50 kg N-P<sub>2</sub>O<sub>5</sub> /ha) as basal for obtaining higher yield and net return.



### Details of drip irrigation system are as under

Details	Operating time	
	Month	Minutes
Lateral spacing : 60 cm	February	75-80
Dripper spacing : 45 cm	March	100-110
Dripper discharge rate : 4 lph	April	120-125
Operating pressure : 1.2 kg/cm <sup>2</sup>	May	130-135
Operating frequency : Alternate day		

(Department of Agronomy, CoA, JAU, Junagadh)

### Effect of land configuration and drip irrigation on productivity of wheat

The farmers of South Saurashtra Agro-climatic Zone growing wheat are recommended to adopt drip irrigation at 0.8 ETc in flat bed for acquiring higher yield, higher net return and save irrigation water over broad bed furrow and flood irrigation.



Drip irrigation system details are as under.

Details of drip system	Operating time
Lateral spacing : 90 cm	a) November : 1 hour
Inline dripper spacing : 40 cm	b) December : 1 hour 30 min
Dripper discharge : 2 lph	c) January : 2 hours
Operating pressure : 1.2 kg/cm <sup>2</sup>	d) February : 2 hours 15 min
Operating frequency : Alternate day	

(Wheat Res. Station, JAU, Junagadh and Res., Testing & Training Centre, JAU, Junagadh)

## (D) Weed Management

### Weed management in coriander

The farmers of Gujarat growing coriander are recommended to keep weed free condition up to 45 DAS by hand weeding as and when required for effective weed management and to obtain higher seed yield and net realization.



(Department of Agronomy, CoA, JAU, Junagadh)

### Weed management in chickpea

The farmers of Gujarat growing irrigated chickpea are recommended to keep weed free condition up to 45 DAS by interculturing and hand weeding as and when required for effective weed management and to obtain higher seed yield and net realization.



(Department of Agronomy, CoA, JAU, Junagadh)

### Weed management in summer guar

The farmers of Gujarat growing summer guar are recommended to keep weed free condition up to 45 DAS by interculturing and hand weeding as and when required for effective weed management and to obtain higher seed yield and net realization.



(Department of Agronomy, CoA, JAU, Junagadh)

### Weed management in green gram

The farmers of Gujarat growing *kharif* green gram are recommended to do interculturing and hand weeding at 20 and 40 days after sowing for effective weed management and to obtain higher seed yield and net realization.



(Department of Agronomy, CoA, JAU, Junagadh)

### Weed management in black gram

The farmers of Gujarat growing *kharif* black gram are recommended to do interculturing and hand weeding at 20 and 40 days after sowing for effective weed management and to obtain higher seed yield and net realization.



(Department of Agronomy, CoA, JAU, Junagadh)

### Performance of different weed management practices on pearl millet productivity

The farmers of Gujarat growing pearl millet in *kharif* season are recommended to do hand weeding at 3<sup>rd</sup> and 5<sup>th</sup> weeks after sowing for effective weed management and achieving higher grain yield and net realization.



(Main Pearl millet Research Station, JAU, Jamnagar)

## III. PLANT PROTECTION

### (A) Entomology

#### Comparison of different colour sticky traps for monitoring of sucking pests in brinjal

The farmers of Gujarat are recommended to install yellow (RGB-255, 255, 0) or dark green (RGB-0, 128, 0) sticky traps (15 cm x 21 cm) @ 25/ha at crop height for the effective monitoring of jassid and whitefly in brinjal. The sticky trap is to be installed at one week after transplanting and it should be changed at weekly interval. Grease should be used as an adhesive material.



(Department of Entomology, CoA, JAU, Junagadh)

#### Comparison of different colour sticky traps for monitoring of sucking pests in seed spices

The farmers of Gujarat growing seed spices are recommended to install yellow (RGB-255, 255, 0) or dark green (RGB-0, 128, 0) sticky traps (15 cm x 21 cm) @ 25 traps/ha at crop height for the effective monitoring of aphids in coriander, cumin, fenugreek and fennel, while dark blue (RGB-0, 0, 255) and yellow (RGB-255, 255, 0) sticky traps (15 cm x 21 cm) @ 25 traps/ha at crop height for the effective monitoring of thrips in cumin, fennel and ajwain. The sticky trap is to be installed at at one week after transplanting and it should be changed at weekly interval. Grease should be used as an adhesive material.



(Department of Entomology, CoA, JAU, Junagadh)

### Bio-efficacy of different biopesticides against *rugose spiralling whitefly* in coconut (Adhoc recommendation)

The farmers of Gujarat having coconut orchards are recommended to apply three sprays of *Beauveria bassiana* 1.15 WP (Min.  $1 \times 10^8$  cfu/g) 0.009 % (80 g/10 litre of water) or *Isaria fumosorosea* 1.15 WP (Min.  $1 \times 10^8$  cfu/g) 0.009 % (80 g/10 litre of water) along with starch 1 % (10 g/lit), first spray at initiation of pest infestation, second and third spray at 10 days interval after first spray for effective management of rugose spiralling whitefly.



#### As per CIBRC format:

Year	Crop	Target	Pesticides with formulation	Dosage				Total Qty. of Chemical suspension required/ha	Application schedule
				g.a.i./ha	Qty. of formulation/ha	Conc. (%)	Dilution in water (10 lit.)		
2020-21	Coconut	<i>Rugose Spiralling White fly</i>	<i>Beauveria bassiana</i> 1.15 WP	46	4 kg	0.009 %	80 g	500 lit.	First spray at initiation of pest infestation, second and third spray at 10 days interval after first spray
			<i>Isaria fumosorosea</i> 1.15 WP	46	4 kg	0.009 %	80 g		

(Department of Entomology, CoA, JAU, Junagadh)

### Bio-efficacy of different insecticides against *rugose spiralling whitefly* in coconut (Adhoc recommendation)

The farmers of Gujarat having coconut orchards (1 to 3 year old palms) are recommended to apply three sprays of pyriproxyfen 10 % + bifenthrin 10 % EC 0.02 % (10 ml/10 litre of water) or spiromesifen 22.9 SC 0.027 % (12 ml/10 litre of water) or diafenthiuron 50 WP 0.05 % (10 g/10 litre of water) along with 1 % starch (10 g/ litre of water), first spray at initiation of pest infestation, second and third spray at 10 days interval after first spray for effective management of rugose spiralling whitefly.

#### As per CIBRC format:

Year	Crop	Target	Pesticides with formulation	Dosage				Total Qty. of Chemical suspension required/ha	Application schedule
				g.a.i./ha	Qty. of formulation/ha	Conc. (%)	Dilution in water (10 lit.)		
2020-21	Coconut	<i>Rugose Spiralling White fly</i>	Pyriproxyfen 10 % + Bifenthrin 10 % EC	100	0.50 lit.	0.02	10 ml	500 lit.	First spray at initiation of pest infestation, second and third spray at 10 days interval after first spray
			Spiromesifen 22.9 SC	137	0.60 lit.	0.027	12 ml		
			Diafenthiuron 50 WP	250	0.50 kg	0.05	10 g		

(Department of Entomology, CoA, JAU, Junagadh)

## Management of rugose spiralling whitefly through root feeding of insecticides in coconut (Adhoc recommendation)

The farmers of Gujarat having coconut orchards (>5 year old palms) are recommended to give root feeding (pencil size root) application of monocrotophos 36 SL @ 10 ml with 10 ml of water per palm, first at initiation of pest infestation and second at one month after first application for management of rugose spiralling whitefly. The interval between root feeding and harvesting of coconut should be 30 days.

### As per CIB-RC format:

Year	Crop	Target	Pesticides with formulation	Dosage		Application schedule	Waiting period/ PHI (days)
				g.a.i./ ha	Qty. of formulation/ ha		
2020-21	Coconut	Rugose Spiralling White fly	Monocrotophos 36 SL	0.637	1.77 lit.	First root feeding at initiation of pest infestation, and second at 1 month interval after first root feeding	30

(Department of Entomology, CoA, JAU, Junagadh)

## Effect of different schedule based insecticides and biopesticides spray against fall army worm *Spodoptera frugiperda* (J. E. Smith) infesting maize

The farmers of Gujarat growing maize are recommended to apply schedule spraying of chlorantraniliprole 18.5 SC 0.005 % (3 ml/10 litre of water), emamectin benzoate 5 SG 0.0025 % (5 g/10 litre of water) and thiodicarb 75 SP 0.09 % (10 g/10 litre of water) at ten days interval after pest crosses ETL (5 egg masses or 1 mass of first instar larvae/20 plants) for the effective management of fall armyworm in maize. The interval between last spraying and harvesting of cobs should be 30 days. The farmers interested in organic maize are recommended to apply schedule spraying of *Beauveria bassiana* 1.15 WP (1 x 10<sup>8</sup> cfu/g) 0.007 % (60 g/10 l of water), first at ETL and subsequent two sprays at 10 days interval for the effective management of fall armyworm in maize.



### As per CIB-RC format:

Year	Crop	Target	Pesticides with formulation	Dosage				Total Qty. of Chemical suspension required/ha	Application schedule	Waiting period/ PHI (days)
				g.a.i./ ha	Qty. of formulation/	Conc. (%)	Dilution in water (10 lit.)			
2020-21	Maize	Fall army worm	Chlorantraniliprole 18.5 SC	28	0.150 lit.	0.005%	3 ml	500 lit.	First spray at initiation of pest infestation, subsequent second and third at 10 day interval	30
			Emamectin benzoate 5 SG	13	0.250 kg	0.0025%	5 g			30
			Thiodicarb 75 SP	375	0.5 kg	0.09%	10 g			30
			<i>Beauveria bassiana</i> 1.15 WP (1 x 10 <sup>8</sup> cfu/g)	35	3.0 kg	0.007%	60 g			-

(Department of Entomology, CoA, JAU, Junagadh)



## Validation of IPM module for pink bollworm on cotton

The cotton growers of Gujarat are recommended to implement the following IPM module for management of pink bollworm.



1. Timely sowing (15<sup>th</sup> June to 15<sup>th</sup> July)
2. Installation of pheromone traps at 45 DAS @ 10/ha
3. Neem based formulation 1500 ppm (40 ml/10 lit. water) at 45 DAS
4. Release of *Trichogramma bactrae* 1.5 lakh/ha (thrice at weekly intervals) starting 50 DAS
5. ETL (10 % fruiting body damage) based application of recommended insecticides (Lambda cyhalothrin 2.5 EC @ 0.0025 % (10 ml/10 lit. of water) and Deltamethrin 2.8 EC @ 0.0028 % (10 ml/10 lit. of water))
6. Timely termination of crop at 180-190 DAS

### As per CIB-RC format:

Year	Crop	Target	Pesticides with formulation	Dosage				Total Qty. of Chemical suspension required/ ha	Application schedule	Waiting period/ PHI (days)
				g.a.i./ ha	Qty. of formulation/ ha	Conc. (%)	Dilution in water (10 lit.)			
2020-21	Cotton	Pink bollworm	Lambda cyhalothrin 2.5	12.5	500	0.0025	10 ml	500 l	First spray at pink bollworm cross the ETL (10 % damage in green boll) and second spray after 15 days of first spray for effective control of pink bollworm.	21
			EC Deltamethrin 2.8 EC	14	500	0.0028	10 ml			

(Cotton Research Station, JAU, Junagadh)

### Estimation of yield losses for cotton pink bollworm

The Bt cotton growers of Saurashtra are recommended to apply, thiodicarb 75 WP @ 0.015 % (2 g/10 lit. of water) at 60 days after sowing, chlorpyrifos 20 EC @ 0.04 % (20 ml/10 lit. of water) at 90 days after sowing and lambda cyhalothrin 2.5 EC @ 0.0025 % (10 ml/10 lit. of water) at 120 days after sowing to avoid the yield loss of 41.5 % from pink bollworm in cotton.



### As per CIBRC format:

Year	Crop	Target	Pesticides with formulation	Dosage				Total Qty. of Chemical required/ha	Application schedule	Waiting period/ PHI (days)
				g.a.i./ ha	Qty. of formulation /ha	Conc. (%)	Dilution in lit.)			
2020-21	Cotton	Pink Bollworm	Thiodicarb 75 WP	750	1000	0.015	02 g	500 litre	First spray at 60 days after sowing and second and third spray after 90 and 120 days of sowing for Effective control of pink bollworm.	30
			Chlorpyrifos 20 EC	250	1250	0.04	20 ml			-
			Lambda Cyhalothrin 2.5 EC	12.5	500	0.0025	10 ml			21

(Cotton Research Station, JAU, Junagadh)

## (B) Plant Pathology

### Efficacy of fluorescens producing *pseudomonas* against collar rot (*Aspergillus niger*) of groundnut

Farmers of Gujarat growing *kharif* groundnut are recommended to treat the seed with *Pseudomonas fluorescens* 0.5 % WP (TNAU Strain Accession No. ITCC BE 0005) (2 x 10<sup>6</sup>cfu/g) @ 20 g/kg seed and soil application of *P. fluorescens* 0.5 %



WP (2 x 10<sup>6</sup>cfu/g) @ 2.5 kg in 250 kg of castor cake/ha at the time of sowing and 250 kg sand at one month after germination for effective management of collar rot of groundnut.

#### As per CIBRC format:

Year	Crop	Target	Pesticides with formulation	Dosage			Application schedule
				g.a.i./ha	Qty. of formulation/ha	Conc. (%)	
2020	Groundnut	Collar rot	<i>Pseudomonas fluorescens</i> 0.5 % WP (TNAU Strain Accession No. ITCC BE 0005) (2 x 10 <sup>6</sup> cfu/g)	--	20 g/kg seed + 1.5 kg + 2.5 kg	2 x 10 <sup>6</sup> cfu/g	As a seed treatment and soil application with 250 kg castor cake at the time sowing and 2.5 kg sand at one month after sowing

(Department of Plant Pathology, CoA, JAU, Junagadh)

### Efficacy of fluorescens producing *pseudomonas* against foliar diseases (leaf spots and rust) of groundnut

The farmers of Gujarat growing *kharif* groundnut are recommended for foliar spray of hexaconazole 5 % SC (10 ml/10 lit water) at 40 DAS + foliar spray of talcum powder based *Pseudomonas fluorescens* 0.5 % WP (TNAU Strain Accession No. ITCC BE 0005) (2 x 10<sup>6</sup> cfu/g) (100 g/10 lit water) at 60 and 80 DAS OR foliar spray of hexaconazole 5 % SC



(10 ml/10 litre water) at 40, 60 and 80 DAS for effective management of leaf spots of groundnut

#### As per CIB-RC format:

Year	Crop	Target	Pesticides with formulation	Dosage				Qty. of Chemical suspension /ha	Application schedule	Waiting period/ PHI(days)
				g.a.i./ha	Qty. of formulation/ha	Conc. (%)	Dilution in water (10 lit.)			
2020	Groundnut	Leaf spot of groundnut	Hexaconazole 5 % SC	25	0.5 l	0.005	10 ml	500 l	Foliar spray at 40 DAS	30
			<i>Pseudomonas fluorescens</i> 0.5 % WP (TNAU Strain Accession No. ITCC BE 0005) (2 x 10 <sup>6</sup> cfu/g)	-	5 kg	2 x 10 <sup>6</sup> cfu/ml	100 g	500 l	Foliar spray at 60 and 80 DAS	-
			<b>OR</b>							
			Hexaconazole 5 % SC	25	0.5 l	0.005	10 ml	500 l	Foliar spray at 40, 60 and 80 DAS	30

(Department of Plant Pathology, CoA, JAU, Junagadh)

## Chemical control of early and late leaf spot and rust diseases of groundnut

The farmers of Gujarat growing *kharif* groundnut are recommended to spray pyraclostrobin 12.5 % + epoxiconazole 4.7 % SE 0.025 % (15 ml/10 litre of water) or carbendazim 12 % + mancozeb 63 % WP 0.15 % (20 g/10 litre of water), first spray at disease initiation and subsequent two at 20 days interval for managing the early and late leaf spot and rust diseases.



### As per CIB-RC format:

Year	Crop	Target	Pesticides with formulation	Dosage				Total Qty. of Chemical suspension required/ha	Application schedule	Waiting period/ PHI (days)	Remarks
				g.a.i./ ha	Qty. of formulation/ ha	Conc. (%)	Dilution in water (10 lit.)				
2021	Ground nut	Early and late leaf spot and rust	Carben-dazim 12% + Mancozeb 63 % WP	750.0	1.000 kg	0.15	20 g	500	First spray at 50 days after sowing and subsequent two sprays at 20 days interval.	-	These fungicides are registered in CIB & RC for groundnut crop for management of leaf spot diseases.
			Pyracl-ostrobin 12.5% + Epoxi-conazole 4.7% SE	129.0	0.750 l	0.025	15 ml			21	

(Department of Plant Pathology, CoA, JAU, Junagadh)

## Effect of biofertilizers on the yield of oyster mushroom (*Pleurotus sajor caju*)

The Oyster mushroom (*Pleurotus sajor-caju*) growers of Gujarat are recommended to treat wheat straw substrate with *Azotobacter* ( $1 \times 10^8$ cfu) and PSB ( $1 \times 10^8$ cfu) each at 0.2 per cent using spawn rate of three per cent in three kg of substrate for higher sporophore production and biological efficiency.



(Department of Plant Pathology, CoA, JAU, Junagadh)

## Effect of different substrates on nutritional and biochemical properties of oyster mushroom (*Pleurotus sajor caju*)

The Oyster mushroom growers of Gujarat are recommended to use wheat straw or chickpea substrate for higher production, better nutritional and biochemical properties.



(Department of Plant Pathology, CoA, JAU, Junagadh)

## Integrated management of foliar diseases in high density planting of cotton

The farmers of Gujarat growing high density (60 cm x 45 cm) Bt cotton are recommended to apply (Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC) + Streptocycline at 7.5 + 0.75 g/10 liter of water, first spray at initiation of diseases and second spray at 20 days after first spray for effective management of bacterial blight and fungal leaf spots. Maintain Pre harvest interval of 27 days.



### As per CIBRC format:

Year	Crop	Target	Pesticides with formulation	Dosage				Total Qty. of Chemical suspension required/ha	Application schedule	Waiting period/ PHI (days)	Remarks
				g.a.i./ ha	Qty. of formulation/ha	Conc. (%)	Dilution in water (10 lit.)				
2020	Cotton	Foliar diseases	Fluxapyroxad 167 g/l + Pyraclostrobin 333 g/l SC	187.5	0.375 lit.	0.0374	7.5 ml	500 lit	First spray at initiation of diseases & second spray after 20 days	27	Registered in CIB-RC
			Streptocycline	37.5	0.0375 kg	0.075	0.75 g				

(Cotton Research Station, JAU, Junagadh)

### Management of sooty mould in cotton

The farmers of Gujarat growing Bt cotton are recommended to spray flonicamid 50 WG 0.15 % (3 g/10 liter of water) or Flonicamid 50 WG and (fluxapyroxad 167 g/lit + pyraclostrobin 333 g/lit SC)



0.15 & 0.375 % (3 g and 7.5 ml/10 lit of water) when aphid crosses ETL (10 aphids/leaf) and second spray at 15 days interval after first spray for effective management of sooty mould. The secretion of honey dew like substances is medium for saprophytic fungi. Maintain Pre Harvest Interval of 25 and 27 days for flonicamid 50 WG and Flonicamid 50 WG + (fluxapyroxad 167 g/lit + pyraclostrobin 333 g/lit SC), respectively.

### As per CIB-RC format:

Year	Crop	Target	Pesticides with formulation	Dosage				Total Qty. of Chemical suspension required/ha	Application schedule	Waiting period/ PHI (days)
				g.a.i./ ha	Qty. of formulation/ ha	Conc. (%)	Dilution in water (10 lit.)			
2020	Cotton	Aphids, Jassids, Thrips & Whiteflies	Flonicamid 50WG	75 g	0.150 kg	0.15	3 g	500 lit	First spray at when aphid population is crossed ETL & next sprays at interval of 15 days	25
			Flonicamid 50 WG and (fluxapyroxad 167 g/lit + pyraclostrobin 333 g/lit SC)	75 g & 187.5 g	0.150 kg & 0.375 lit	0.15 & 0.375	3 g and 7.5 ml			27

(Cotton Research Station, JAU, Junagadh)

## IV. HORTICULTURE

### Effect of pinching methods on different varieties of carnation under protected condition

The farmers of Gujarat interested in flower cultivation under protected structure (Fan and Pad cooling polyhouse) are recommended to grow carnation with single and half pinching to get higher yield and net return.



(Dept. of Horticulture, CoA, JAU, Junagadh)

### Effect of different mulching and integrated liquid organic nutrients on growth, yield and quality in banana cv. Grand Naine

The farmers of Saurashtra growing organic banana Cv. Grand Naine are recommended to apply 25 micron silver mulch with drenching of Jivamrut @ 500 l/ha through fertigation ten times with one month interval plus spraying of sea weed extract @ 3 % (300 ml/10 lit. of water) in six time with two month interval starting from 2<sup>nd</sup> month after transplanting along with FYM @ 10 kg per plant for getting good quality, higher yield and net return.



(Dept. of Horticulture, CoA, JAU, Junagadh)

### Evaluation of different varieties of guava and its genotypes under HDP

The farmers of Saurashtra growing guava under high-density planting (3.0 m x 1.5 m) are recommended to grow variety L-49 or Lalit or Shweta for obtaining higher yield and net return.



(Dept. of Horticulture, CoA, JAU, Junagadh)

### Effect of bio stimulants and bio fertilizers on flowering, fruiting, yield and quality of pomegranate (*Punica granatum* L.) cv. Bhagva

The farmers of Saurashtra growing pomegranate are recommended to apply Humic acid 1 % (100 ml/10 lit. of water) in two spray at full bloom stage and at 15 days after fruit set stage with drenching of bio fertilizer *Azotobacter* + PSB + KSB each @ 5 ml/plant of full bloom stage in addition to RDF for getting higher yield and net return.



(Dept. of Horticulture, CoA, JAU, Junagadh)

## Effect of de-leaving and graded multi micronutrients on growth, flowering and flower yield of spider lily (*Hymenocallis litterolis* L.) cv. Local

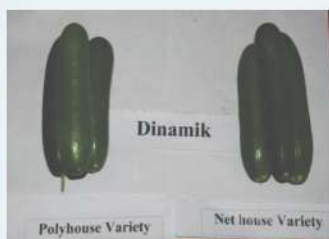
The farmers of Saurashtra growing spider lily are recommended to do de-leaving during *kharif* (at the end of June) with spray of multi-micronutrient grade IV @ 1 % (100 g/10 lit. water) in three equal splits at 15 days before de-leaving and 30 and 45 days after de-leaving to get higher yield and net return.



(Dept. of Horticulture, CoA, JAU, Junagadh)

## Evaluation of cucumber variety under net house and poly house condition

The farmers of Gujarat are cultivating cucumber under protected condition are recommended to grow cucumber in 50 % white shade net instead of polyhouse to get higher yield and net return.



(Dept. of Horticulture, CoA, JAU, Junagadh)

## Feasibility of organic farming in coconut (*Cocos nucifera*) under saline water irrigation condition

The farmers of Saurashtra are interested organic cultivation of coconut cv. West Coast Tall (WCT) are recommended to apply FYM @ 60 kg per plant or FYM at 15 kg + Castor cake at 2.25 kg + Vermicompost at 8 kg + Neem cake at 2.25 kg per plant to get higher nut yield and improved organic carbon and microbial status in soil under saline irrigation condition (EC 10-14 dSm<sup>-1</sup>).



(Fruit Research Station, JAU, Mangrol)

## V. AGRICULTURAL ENGINEERING

### Development and evaluation of manually operated Jamun harvesting device

The farmers are recommended to use the manually operated branch shaking type harvesting device for Jamun fruits developed by the Junagadh Agricultural University. The device has 228 % higher harvesting capacity, and reduction in harvesting cost and harvesting losses up to 49 % and 18 %, respectively as compared to manual picking method.



*[Dept. of Farm Machinery & Power Engg., CAET, JAU, Junagadh]*

### **Effect of packaging on storage behaviour of chickpea grain**

The farmers, entrepreneurs and large scale storage unit holder are recommended to pack chickpea (7.50 % moisture content, wb) in PP woven laminated bag or PICS bags. It retains food and seed quality of chickpea storage up to 12 months and reduces storage losses.



*[Dept. of Processing & Food Engg., CAET, JAU, Junagadh]*

### **Studies on biochar production and gaseous fuel for thermal purpose through open-core gasification of biomass**

The farmers and entrepreneurs are recommended to use the gasifier designed by the Junagadh Agricultural University having thermal capacity 80 MJ/h for production of biochar and thermal energy. The maximum gasification efficiency -75.59 % and biochar - 24.91% are obtained at gas flow rate 22 Cu. m/h by using shredded cotton stalk as feed stalk.



*[Dept. of Renewable Energy Engg., CAET, JAU, Junagadh]*

### **Studies on crop cultivation under solar photo voltaic power plant panels**

The farmers of Gujarat state are recommended to use JAU model Agrivoltaic system designed by Junagadh Agricultural University for cultivation of *rabi* tomato to get an additional income along-with electricity generation.



*[Dept. of Renewable Energy Engg., CAET, JAU, Junagadh]*

### **Design and development of pomegranate juice extractor**

The farmers and entrepreneurs are recommended to use pomegranate juice extractor developed by Junagadh Agricultural University to reduce the cost of juice extraction with quality juice.

*[Dept. of Processing & Food Engg., CAET, JAU, Junagadh]*

### Low temperature grinding of spices (Fenugreek)

The processors are recommended to grind fenugreek seed feed at low temperature ( $-10\pm 2$  °C) and using coolant (propylene glycol) circulation (15 lpm) through jacketed grinding mill for better recovery of biochemical compounds, volatile oil and volatile compounds.



*[Dept. of Processing & Food Engg., CAET, JAU, Junagadh]*

### Design and development of low cost on -farm sesame dehuller

The sesame producers and processors are recommended to use a low cost sesame dehuller developed by Junagadh Agricultural University for dehulling of sesame seed. The sesame seeds are required to be soaked in water for 120 min. and then dehulling to be carried out for 6 min in developed machine at 150 rpm dehulling speed for getting maximum efficiency (79.29 %). The estimated sesame dehulling benefit cost ratio by this machine is 1.95.



*[Agricultural Research Station, JAU, Amreli]*

### Development of online screen - gravel filter for groundwater recharge

The farmers, NGOs, line department of Government of Gujarat are recommended to adopt online screen cum sand groundwater recharge filter developed by the Junagadh Agricultural University. The developed filter consists of sand filtration layer placed in between two composite screens viz. macro screen and micro screen. It avoids excavation and construction work. It is portable, easy to clean and auto flushing requiring to wash or change a sand layer in every year. It has a filtration efficiency of more than 80 %.



Filter Specifications:

- Bottom composite screen : Macro screen is underlain micro screen
- Thickness sand filtration bed 15 cm and size of sand 1mm
- Top composite screen : Micro screen is underlain macro screen
- Macro screen : 18 gauge GI having 40 % perforation of 12 mm circular holes
- Micro screen: S.S. 304 grade having 0.75 mm screen size.

*[Dept. of Soil & Water Conservation Engg., CAET, JAU, Junagadh]*



## Effect of drip lateral geometry on productivity of wheat

The farmers' of South Saurashtra Agro climatic Zone growing wheat are advised to adopt drip irrigation for acquiring higher yield (up to 29 %), higher net return (upto 51 %) and saving upto 18 % irrigation water over control.



Details of drip system	Irrigation scheduling
Lateral spacing : 67.5 cm	At alternate days interval a) November: 30 min b) December: 50 min c) January: 1 hour d) February: 1 hour 10 minute
Dripper spacing: 60 cm	
Dripper discharge: 4 lph	
(16-4-60, 3 rows of wheat per lateral)	
Operating pressure : 1.2 kg/cm <sup>2</sup>	

[Research, Testing & Training Centre, JAU, Junagadh]

## Adaption to climate change: Effect of hydrogel and organic manures to mitigate abiotic stress in groundnut

The farmers of North Saurashtra Agro-climatic Zone growing groundnut under dry farming conditions are recommended to apply hydrogel @ 2.5 kg/ha before sowing (1:10 mixture of



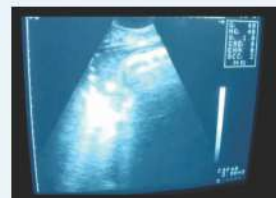
hydrogel and sand through drilling in the furrow) and FYM @10 t/ha for mitigating moisture stress during dry spells and obtaining maximum rain water use efficiency, higher productivity and net returns.

[Main Dry Farming Res. Station, JAU, Targhadia]

## VI. ANIMAL HEALTH

### Clinical studies on physical, ultrasonographic and radiographic assessment of suspected cases of diaphragmatic hernia in buffaloes

Buffaloes showing chronic recurrent tympany, which are not responding to common therapeutic management with progressive reduction in appetite, tendency of regurgitation and presence of hard scanty feces are suggestive of diaphragmatic hernia. Presently, surgical management of diaphragmatic hernia is possible at veterinary hospitals, buffalo owners are recommended to visit the nearby veterinary hospital or contact a veterinary surgeon.



[Department of Veterinary Clinic Complex, College of Veterinary Science & A. H., JAU, Junagadh].

## VII. ANIMAL PRODUCTION AND FISHERIES SCIENCE

### Association of body weight and biometric measurements with egg production and quality performance in white Leghorn layers

Poultry farmers are recommended to select white leghorn pullets with higher body weight and shank length at 14<sup>th</sup>, 16<sup>th</sup> and 18<sup>th</sup> week to get higher egg weight at 25<sup>th</sup> week of age.



(Dept. of Instructional Livestock Farm Complex, College of Vet. Sci. & A.H., Junagadh)

### Test-day recording as a tool to predict lactation milk yield in Gir cows

Livestock owners are recommended to predict lactation milk yield of Gir cows with precision of 99 % by sum-up of milk yield records at weekly interval, till the cow dries, using the equation  $3.09+6.96\times\text{Sum}$  and even sum-up of milk yield records at fortnightly interval, till the cow dries, using the equation  $11.74+14.87\times\text{Sum}$ .

(Bull Mother Farm, JAU, Amreli)

### Test-day recording as a tool to predict lactation milk yield in Jaffarabadi buffaloes

Livestock owners are recommended to predict lactation milk yield of Jaffarabadi buffalo with precision of 98 % by sum-up of milk yield records at weekly interval, till the buffalo dries, using the equation  $12.36+6.92\times\text{Sum}$  and even sum-up of milk yield records at fortnightly interval, till the buffalo dries, using the equation  $21.32+14.69\times\text{Sum}$ .

(Bull Mother Farm, JAU, Amreli)

### Effect of replacing concentrate mixture with moringa (*moringa oleifera*) leaf meal on growth performance and blood biochemical profiles in Gir calves

It is recommended to Gir cow owners to feed Moringa (*Moringa oleifera*) leaf meal by replacing 75 % (1.125-1.150 kg) of protein requirement (from concentrate) for noticeable increase in growth rate in Gir calves.



(Bull Mother Farm, JAU, Amreli)

### Studies on nutritive value and feeding levels of Hedge Lucerne (*Desmanthus virgatus*) on milk production and composition in Gir cattle

It is recommended to Gir cow owners of Saurashtra region that Hedge Lucerne grass can be used instead of concentrate for fulfilment of 50 % crude protein requirement of milch animals to maintain milk production and fat percentage with high returns.

(Cattle Breeding Farm, JAU, Junagadh)

## Composition and diversity of fish and shell fish catch of trawl net along the Mangrol coast, Gujarat

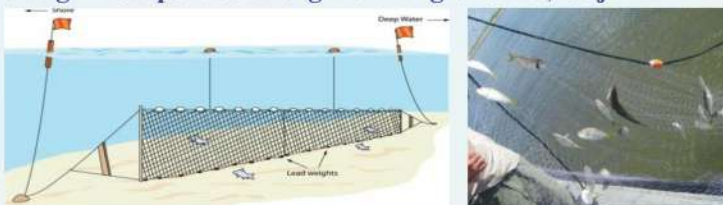
During year 2017-2020, total 85 marine species were recorded in catch composition of trawl net operated by the Mangrol fishermen which includes 68 fin fishes and 17 shellfish. Ribbonfish, Threadfin bream, Croaker, Cuttle fish and Squid form a major proportion of the catch. The maximum catch of Ribbonfish during February to April, Threadfin bream during September to November, Croaker during February to March and Cuttlefish during August month were recorded. Fishermen of Mangrol are recommended to fish the above- mentioned fish groups which are more available in the particular fishing ground.



(Dept. of Fisheries Engg., College of Fisheries Sci., JAU, Veraval)

## Catch composition of commercial gill net operated along the Mangrol coast, Gujarat

Fishermen fishing with gill nets on the Mangrol coast are recommended to target carangids, croaker, lizard fishes, clupeids and mackerels during post monsoon months, carangids, croaker, lizard fish and cephalopods during winter and carangids, clupeids, croaker and ribbon fish during summer for better catch. Total 41 marine species were recorded in catch composition gill net operated along the Mangrol coast which includes 38 finfishes and 3 shell fishes.



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

## Effect of Chitosan coating on the quality of Silver Pomfret (*Pampus argenteus*) steak in modified atmosphere packaging during chilled storage

It is recommended to fish processors to apply 1.0% Chitosan coating on Silver Pomfret (*Pampus argenteus*)

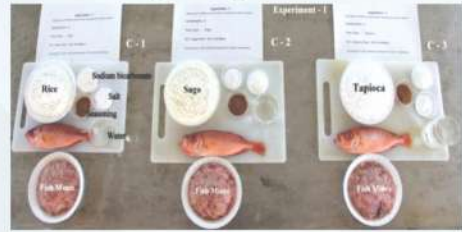


steaks before packing in modified atmosphere packaging (40 % CO<sub>2</sub>, 30 % N<sub>2</sub>, 30 % O<sub>2</sub>) for better quality as well as longer shelf life up to 32 days during chilled storage (2 °C to 4 °C temperature).

(Dept. of Harvest & Post Harvest Tech., College of Fisheries Sci., JAU, Veraval)

## Development of shelf stable, ready to fry fish crackers from bull eye fish (*Priacanthus hamrur*) meat and its quality characterization during storage

Seafood processors are recommended to use 40:60 ratio of bulls eye fish meat: tapioca starch flour along with addition of 1 % xanthan gum for the production of fish crackers with improved quality, lesser oil absorption, better utilization of fish meat and expanded shelf life up-to 150 days under ambient storage temperature in LDPE pouch packaging.



(Dept. of Harvest & Post Harvest Tech., College of Fisheries Sci., JAU, Veraval)

## Supplementation of selected marine macro algae in practical diets for Indian major carp, *Cirrhinus mrigala* fry

It is recommended to fish farmers to supplement the marine algae powder of *Porphyra tenera* 6 %, or *Gracilaria corticata* 8 % or *Ulva raticulata* 6 % in feed of Indian major carp *Cirrhinus mrigala* fry fed 10 % of bodyweight twice a day to enhance the growth.



(Dept. of Aquaculture, College of Fisheries Sci., JAU, Veraval)

## Survival and growth of Pearl oyster in cages in gulf of Kachchh at Sikka and Okha

The fish farmers interested to grow pearl oyster in Gujarat are recommended that the pearl oysters grow well in the Gulf of Kachchh with survival rate of 98.3 % for the duration of 47 days. The aqua farmers are advised to grow pearl oyster in cages having lesser water current and wave action.

(Fisheries Research Station, JAU, Sikka)

## Effect of different level of protein on the growth and survival of *Terapon jarbua* (Forsskal, 1775) fry

Fish farmers rearing *Terapon jarbua* fry (Crescent banded tiger fish) are recommended to utilize feed containing 40 % crude protein at the rate of 10 % of fish body weight, twice a day, for higher growth and survival rate for a period of 60 days.



(Fisheries Research & Training Center, JAU, Mahuva)

## Studies on sole feeding of Marvel (*Dicanthium annulatum*) grass on milk production and milk composition in lactating Gir cows

It is recommended to Gir cow owners that sole feeding of green jinjavo grass or green maize fodder is not advisable to milch animals, as it reduces milk production.



(Cattle Breeding Farm, JAU, Junagadh)

## VIII. BASIC SCIENCE

### Influence of plant growth retardants on morpho - physiological traits and yield in high density planting cotton (*Gossypium hirsutum* L.)

The farmers of Saurashtra region growing irrigated Bt cotton hybrids under HDPS (90 cm x 30 cm) are recommended to spray growth inhibitor Mepiquat Chloride (MC) @ 50 ppm (0.5 g a.i./10 litre water) at boll development stage for balanced growth, higher seed cotton yield and net return.



(Cotton Research Station, JAU, Junagadh)

## RECOMMENDATION FOR SCIENTIFIC COMMUNITY

### I. CROP IMPROVEMENT

#### Application of brassinolide to mitigate saline stress during germination and growth period in chickpea

It is recommended to scientific community that pre-soaking of chickpea seed with 0.25 ppm brassinolide (B2) for 2 hrs before sowing helps to mitigate salinity stress up to 6.0 dS/m with 50 % yield reduction as compared to control.

[Dept. of Genetics & Plant Breeding, CoA, JAU, Junagadh]

#### Micropropagation in Kankoda (*Momordica dioica* Roxb.)

Surface sterilization: Internodal explant of kankoda to be used after surface sterilization with carbendazim for 30 minutes followed by 0.1 % Mercuric chloride treatment for 15 minutes and washed with sterilized distilled water for four to five times for removing traces of the chemicals.  
Shoot multiplication: Low concentration of kinetin (MS + K1) is effective for getting early shoot initiation and maximum number of shoots.

*In-vitro* rooting: Half strength MS media supplemented with high concentration of IBA (IBA3) is effective for getting early root initiation.

Hardening: A pot mixture of soil: sand (1: 1 volume basis) is effective for getting 60-65 % and 90-95 % survival rate of plantlets for primary and secondary hardening, respectively under greenhouse condition.

[Dept. of Genetics & Plant Breeding, CoA, JAU, Junagadh]

### II. CROP PRODUCTION

#### Weed management in coriander

Under Saurashtra region, effective weed management along with higher seed yield of coriander can be achieved by application of tank-mix pendimethalin 450 g/ha + oxadiargyl 30 g/ha as pre-emergence *fb* HW at 30 DAS or paraquat 500 g/ha as early post-emergence at 7 DAS *fb* HW at 30 DAS or pendimethalin 750 g/ha as pre-emergence *fb* HW at 30 DAS.



(Department of Agronomy, CoA, JAU, Junagadh)

### Weed management in chickpea

Under Saurashtra region, effective weed management along with higher seed yield of chickpea and net return can be achieved by application of pendimethalin 750 g/ha as pre-emergence *fb* IC & HW at 30 DAS or pre-mix pendimethalin + imazethapyr 750 g/ha as pre-emergence *fb* IC & HW at 30 DAS.



(Department of Agronomy, CoA, JAU, Junagadh)

### Weed management in summer guar

Under Saurashtra region, effective weed management along with higher seed yield of guar and net return can be achieved by application of tank-mix pendimethalin 450 g/ha + oxadiargyl 30 g/ha as pre-emergence *fb* IC & HW at 30 DAS or pre-mix pendimethalin + imazethapyr 750 g/ha as pre-emergence *fb* IC & HW at 30 DAS.



(Department of Agronomy, CoA, JAU, Junagadh)

### Weed management in green gram

Under South Saurashtra Agro-climatic Zone, effective weed management along with higher seed yield of *kharif* green gram and net return can be achieved by application of pre-mix pendimethalin + imazethapyr 750 g/ha as pre-emergence *fb* IC & HW at 40 DAS or pendimethalin 900 g/ha as pre-emergence *fb* IC & HW at 40 DAS.



(Department of Agronomy, CoA, JAU, Junagadh)

### Weed management in black gram

Under South Saurashtra Agro-climatic Zone, effective weed management along with higher seed yield of *kharif* black gram and net return can be achieved by application of pre-mix pendimethalin + imazethapyr 750 g/ha as pre-emergence *fb* IC & HW at 40 DAS.



(Department of Agronomy, CoA, JAU, Junagadh)

### Soil test based fertilizer recommendation for targeted yield of wheat

The soil testing laboratories are informed that the nutrients requirement for production of one quintal wheat grain was assessed



as 3.81, 0.82 and 3.40 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, respectively and the fertilizer prescription equations are: for N: [FN = 6.82 x T - 1.01 x SN - 0.27 x FYM], P: [FP<sub>2</sub>O<sub>5</sub> = 1.80 x T - 2.25 x SP - 0.09 x FYM] and K: [FK<sub>2</sub>O = 3.14 x T - 0.46 x SK - 0.27 x FYM] with FYM 10 t/ha. While without FYM, nutrients requirement for production of one quintal wheat grain was assessed as 3.52, 0.77 and 3.02 kg N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, respectively and the fertilizer prescription equations are: for N:

[FN = 8.53 x T - 1.19 x SN], P: [FP<sub>2</sub>O<sub>5</sub> = 2.61 T - 3.07 x SP] and K: [FK<sub>2</sub>O = 5.03 x T - 0.68 x SK]. Targeted yield concept could be effectively adopted from 40 to 50 q/ha for site specific fertilizer recommendation to achieve high yield of wheat in the medium black calcareous soils of Saurashtra region of Gujarat.

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

### **Establishment of critical limit of zinc for summer green gram in medium black calcareous soils**

For recommending Zn application to green gram crop grown in calcareous soils of Saurashtra, STL of Gujarat should consider the critical limit of 0.70 ppm in soil and 47 ppm in green gram plant at 45 DAS.



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

### **Establishment of critical limit of zinc for pigeon pea crop in medium black calcareous soils**

For recommending Zn application to pigeonpea crop grown in calcareous soils of Saurashtra, STL of Gujarat should consider the critical limit of 0.63 ppm in soil and 33.9 ppm in pigeonpea plant at 60 DAS.



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

### **Effect of saline irrigation water on garlic**

It is for information to scientific community especially for plant breeders that garlic variety GJG-5 recorded superior values of different salt tolerance criteria like higher mean salinity index (77.00 %), comparable mean bulb yield (54.78 g/pot), minimum yield decline (43.61 %) at EC 5.0 dS/m and 50 % yield reduction at EC 9.32 dS/m as well as lower Na/K ratio in bulb (0.157) and straw (0.360). Garlic variety GJG-5 was found more salt tolerant as compared to GG-4, G-282 and GG-2 on the basis of salinity indices.



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

### **Effect of saline irrigation water on sesameum**

It is for information to scientific community especially for plant breeders that sesameum variety Gujarat Til-3 recorded superior value of different salt tolerance criteria like higher mean seed yield (19.69 g/pot), comparable mean salinity index (71.82 %), yield decline (38.51 %) at 5.0 dS/m and 50 % yield reduction at EC 9.47



dS/m as well as lower Na/K ratio in seed (0.253) and straw (0.551).

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

### Evaluation of salt tolerance of onion varieties with and without FYM

It is for information to scientific community especially for plant breeders that among the four varieties of onion viz., Pilipatti, Agri. Found Light Red, Talaja Red, GJRO-11, the variety Agri. Found Light Red recorded significantly the highest bulb yield (7290 kg/ha), bulb girth (3.59 cm), bulb length (3.70 cm) and lowest Na/K ratio in straw (0.56) with saline irrigation water having EC 12.70 dS/m. Application of FYM 20 t/ha significantly increased bulb yield of onion. The variety Agri. Found Light Red found superior in salt tolerance up to saline irrigation water EC 12.70 dS/m.

(Dept. of Soil Sci. & Agril. Chem., CoA, JAU, Junagadh and Fruit Research Station, JAU, Mangrol,)



### Performance of different weed management practices on pearl millet productivity

Effective weed management along with higher yield and net returns from *kharif* pearl millet can be achieved by application of tembotrione 120 g/ha as post-emergence at 3-4 leaf stage of weeds.



(Main Pearl millet Research Station, JAU, Jamnagar)

### Weed management in sugarcane with special reference to *Cynodon dactylon*

The scientific community is informed that pre-plough application of glyphosate 2.5 kg/ha followed by MB ploughing at 21 days after application of glyphosate and post-emergence directed spray of either glyphosate 2.5 kg/ha or fenoxaprop 75 g/ha at 45 days after planting gave higher cane yield and net returns as well as effective control of *Cynodon dactylon*.



(Main Sugarcane Research Station, JAU, Kodinar)

### Performance of sesame genotypes differing in maturity and plant types and their response to plant spacing in summer season

In North Saurashtra Agro-climatic Zone, sesame genotypes with few branches and early maturity (AT 375 and AT 377) as well as unicum variety with late maturity (AT 363 and AT 374) gave higher seed yield and net return at 15 cm x 10 cm spacing.



(Agricultural Research Station, JAU, Amreli)



## Evaluation of pre and post emergence herbicide for chemical weed management in sesame

In North Saurashtra Agro-climatic Zone, effective weed management along with higher seed yield and net realization in rainfed sesame can be obtained by application of pendimethalin 0.50 kg/ha as pre-emergence *fb* quizalofop-ethyl 50 g/ha at 20 DAS.



(Agricultural Research Station, JAU, Amreli)

## III. PLANT PROTECTION

### (A) Entomology

#### Management of *rugose spiralling* whitefly through root feeding of insecticides in coconut

For effective management of *rugose spiralling* whitefly in coconut (>5 year old palms), root feeding (pencil size root) application of spiromesifen 22.9 SC @ 5 ml with 10 ml of water per palm, first at initiation of pest infestation and second at one month after first application.

(Department of Entomology, CoA, JAU, Junagadh)

#### Monitoring of fall army worm, *Spodoptera frugiperda* (J. E. Smith) infesting maize in saurashtra region



The infestation of fall armyworm, *Spodoptera frugiperda* (J. E. Smith) was monitored in different districts of North and South Saurashtra region of Gujarat in maize and the highest infestation was observed in Amreli (46.67-60.13 %) followed by Rajkot (19.33-35.00 %) and Junagadh (22.15-24.50 %) districts. The infestation was comparatively higher in *kharif* season (3.33-60.13 %) as compared to *Rabi* season (3.79-58.33 %).

(Department of Entomology, CoA, JAU, Junagadh)

#### Testing the bio-efficacy of insecticides against thrips in castor

Application of two sprays of spinosad 45 SC 0.009 % (2 ml/10 l of water) or dinotefuran 20 SG 0.008 % (4 g/10 L of water) or flonicamid 50 WG 0.02 % (4 g/10 L of water) or cyantraniliprole 10 OD 0.01 % (10 ml/10 L of water) at 7 days interval starting from pest infestation for effective management of castor thrips.



(Main Oilseeds Res. Station, JAU, Junagadh)

## (B) Plant Pathology

### Viability of Gir Sawaj-brand biofertilizers: *Azotobacter*, *Rhizobium* and PSM under different storage conditions in commercial packing

GIR SAWAJ brand *Azotobacter*, *Rhizobium* and PSM remain viable up to 13 months from date of packaging in different storage conditions i.e. storage at ambient temperature, storage at 28° C and storage in refrigerator at 10° C.

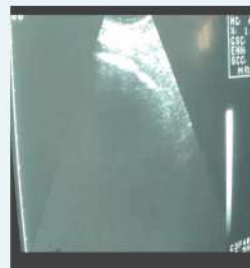


(Department of Plant Pathology, CoA, JAU, Junagadh)

## IV. ANIMAL HEALTH

### Clinical studies on physical, ultrasonographic and radiographic assessment of suspected cases of diaphragmatic hernia in buffaloes

For confirmatory diagnosis of diaphragmatic hernia in buffaloes, ultrasonography and radiography provided interdependent prognostic features and the ultrasonography additionally facilitated to locate the reticulum in relation with adjacent thoracic structures than reticular location and manner of contraction.



[Dept. of Teaching Veterinary Clinic Complex, College of Veterinary Science & A. H., JAU, Junagadh]

### Isolation and identification of active ingredients of selected medicinal plants and evaluation of *in-vitro* antioxidant and antidiabetic effects

The preparative-HPLC isolates of n-butanol fractions of *Encostema axillare* (Mamejavo) leaves and *Cassia absus* (Chimed) seeds possess good *in-vitro* antioxidant effects. The preparative-HPLC isolate of n-butanol fraction of *Encostema axillare* leaves also owing significant *in-vitro* antidiabetic activity due to presence of secoiridoid glycoside compound, swertiamarin (0.2 % w/w).



[Dept. of Veterinary Pharmacology & Toxicology, College of Veterinary Sci. & A. H., JAU, Junagadh]

### Evaluation of antioxidant potential of *Cassia absus* in cadmium-induced oxidative stress model of Zebrafish (*Danio rerio* Hamilton, 1822)

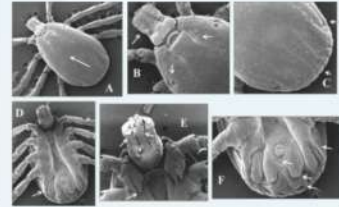
Feeding of *Cassia absus* seed powder @ 10 mg/fish/day has ameliorated the oxidative stress mediated pathological changes in liver, kidney, gills and brain of zebrafish exposed to 1 ppm cadmium chloride for 21 days. The various flavonoid compounds with antioxidant effect like isovitexin, 7, 8, 3', 4', 5'-pentamethoxyflavone, luteolin 7-rhamnosyl (1->6) galactoside, prunin and mirificin have been identified to be present in seeds of *Cassia absus*.



[Dept. of Veterinary Pharmacology & Toxicology, College of Veterinary Sci & A. H., JAU, Junagadh]

### Morphological and molecular identification of ticks infesting the domestic and wild animals

The PCR primers designed by Veterinary College, Junagadh Agricultural University can be used for the identification of *Hyalomma anatolicum*, *Rhipicephalus (Boophilus) microplus* and *Rhipicephalus sanguineus* through amplification and sequence analysis.

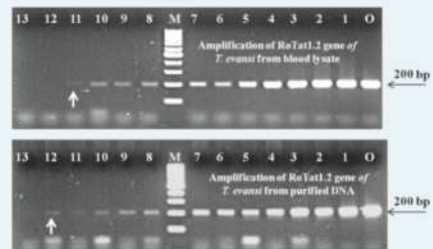


Primerseq (5' → 3')	Species of ticks	Targeted genes	Size of amplicon
atftaccgcatgaa	<i>R. (B.) microplus</i>	Cytochrome Oxidase I	1539 bp
ttattaataataatattttga			
atftaccgcatgaatat	<i>R. sanguineus</i>		
ttactaagaataatattttg			
tttgggtcctgagccg	<i>H. anatolicum</i>		818 bp
taaatatatgatgcgccat	<i>R. (B.) microplus</i>		16S rRNA
atctcatcggctctaaactag			
gtaccttttgcatagggggt			
ccctagagtattttattcatta	<i>H. anatolicum</i>	820 bp	
atacgtaccttagcattag	<i>R. sanguineus</i>	912 bp	
aaaaaagtatcctaaccaacatc			

[Dept. of Vet. Parasitology, College of Vet. Sci. & A.H. and Dept. of Biotechnology, JAU, Junagadh]

### Development of rapid blood processing method for the detection of haemoprotozoan parasites through polymerase chain reaction (PCR)

The blood lysate method developed and optimized by Veterinary College, Junagadh Agricultural University is an alternative to purified whole blood genomic DNA for molecular detection (PCR) of haemoprotozoans such as *Babesia*, *Theileria* and *Trypanosomains* cattle, buffaloes, horses and dogs is rapid, cost effective with less chances of cross-contamination, and is more convenient to operate under resource constraint laboratories.



[Dept. of Vet. Parasitology, College of Vet. Sci. & A.H. and Dept. of Biotechnology, JAU, Junagadh]

## Assessment of blood gas, acid-base and electrolyte alterations during diaphragmatic herniorrhaphy in buffaloes

The buffaloes suffering from diaphragmatic hernia exhibits metabolic alkalosis, hypokalemia and hypochloremia, warranting suitable corrective fluid therapy during surgical treatment.

[Dept. of Veterinary Medicine, College of Vet. Sci. & A. H., JAU, Junagadh]

## V. ANIMAL PRODUCTION AND FISHERIES SCIENCE

### Surveillance of shrimp diseases in shrimp farms of Gujarat

It is informed to the scientific community that during 2015-2020, several diseases like white spot disease (WSD), *Enterocytozoon hepatopenaei* (EHP) infection, white faces, white gut and black gill disease were observed throughout the culture period. *Enterocytozoon hepatopenaei* (EHP) infection and Infectious Myonecrosis (IMN) are newly emerging diseases observed in shrimp farms of Gujarat.



(Dept. of Aquaculture, College of Fisheries Sci., JAU, Veraval)

### Study of heavy metal analysis in the selected spp. of cephalopod, shrimp and fish of Saurashtra region

The concentration of heavy metals in the muscles of fishes, cephalopods and shrimp samples collected from Saurashtra sea coast (Arabian sea) are in the range of As (1.62±1.10 to 3.46±0.28), Be (0.12±0.02 to 0.43±0.02), Fe (24.02±1.53 to 88.41±1.4), Zn (22.12±1.63 to 44.40±2.08), Cd (0.02±0.01 to 1.51±0.01), Sb (12.33±0.57 to 84.91±2.63), Sn (0.87±0.03 to 12.91±0.18), Cu (03.24±1.14 to 18.18±2.12), Co (0.96±0.01 to 5.43±0.04), Ni (1.96±0.20 to 4.61±0.48), Pb (0.15±0.10 to 0.43±0.02), Cr (0.23±0.05 to 1.22±0.03), Ba (0.23±0.03 to 8.63±0.36) and Hg (0.22±0.03 to 0.47±0.04) ppm. Level of heavy metals in liver was found more than in the muscles of fishes, while it was higher in the tentacles than muscles of cephalopods. All heavy metals observed were within the universally accepted limits.



(Fisheries Research Station, JAU, Okha)

### Diversity and distribution of Opisthobranch fauna at Sikka coast

It is informed to scientific community that the Sikka coast, located in Gulf of Kachchh, Gujarat harbours forty-seven species from 35 genera belonging to 18 families of Opisthobranch fauna viz. *Hydatina physis*, *Berthellina citrina*, *B. delicata*, *Doriopsis granulosa*, *Atagama rugosa*, *A. spongiosa*, *A. tristis*, *Jorunna funebris*, *Thordisa villosa*, *Rostanga* sp., *Peltdoris murrea*, *Carminodoris* sp.1, *Carminodoris* sp.2, *Sclerodoris tuberculata*, *Taringa sublutea*, *Tayuva lilacina*, *Plocamopherus ceylonicus*, *Thecacera* sp., *Hypselodoris infucata*, *Goniobranchus bombayanus*, *G. fidelis*, *Goniobranchus* sp., *Mexichromis mariei*, *Phyllidiella*

*zeylanica*, *Dendrodoris fumata*, *D. atromaculata*, *Doriopsilla miniata*, *Bornella stellifera*, *Janolus toyamensis*, *J. flavoanulatus*, *Melibe viridis*, *Phestilla lugubris*, *Phestilla sp.*, *Trinchesia yamasui*, *Baeolidia salaamica*, *Anteaeolidiella poshitra*, *Phidiana militaris*, *Cratena poshitraensis*, *Pteraeolidia semperi*, *Sakuraeolis gujaratica*, *Bakawan rotundata*, *Philinopsis speciosa*, *Aplysia oculifera*, *Elysia ornata*, *E. expansa*, *E. thompsoni* and *E. tomentosa*.

(Fisheries Research Station, JAU, Sikka)

### **Breeding and larval rearing of Opisthobranch fauna (*Elysia tomentosa*, *Hypselodoris infucata*, *Erronea onyx* (Cowry))**

It is informed to scientific community that *Elysia tomentosa*, *Hypselodoris infucata* and *Erronea onyx* (cowry) can successfully rear and bred in captive condition. They can be reared in glass aquaria with seawater with ambient temperature and salinity. The fecundity of *Elysia tomentosa* ranged from 70,000 to 88,000 during the study and the egg ring size ranged from 100-550  $\mu$  and width measured 1 mm. The egg ring colour remains yellow. The size of embryo in the egg ring measured 78.96 \*118.44  $\mu$ . The size of embryo after three days' reaches to 87\*104.4  $\mu$  while size of larvae after 10 days reaches to 102\*158 $\mu$ . The incubation period extends up to 7-10 days. The fecundity of *Hypselodoris infucata* ranged from 40,000 to 1,25,000 and egg ring size ranged from 17-22 cm. The width of egg ring measured 0.5 cm. The colour of the egg remains off white which turns into light creamish at the time of hatching. The size of embryo in the ring measured 157\*157  $\mu$  while the size of larvae measured 171\* 250  $\mu$  and 265\* 265  $\mu$  at the interval of 15 and 22 days respectively. The incubation period extends up to 5 -10 days. The *Erronea onyx* (Cowry) shows remarkable parental care by perching its eggs throughout incubation period. The number of egg capsule (gelatinous) ranged from 300-400 depending upon the size of brooders. The number of embryos per capsule ranged from 60-131 number. Incubation period extends up to 30-35 days. Egg capsule size was ranged from 1316\*987 $\mu$  to 1827\*2896  $\mu$ . The size of embryo ranges from 158\*118  $\mu$ . The size of larvae after 8 days of hatching reaches to the 240\*290  $\mu$  while after 15 days the size reaches to the 235\*566  $\mu$ .



(Fisheries Research Station, JAU, Sikka)

## VI. BASIC SCIENCE

### Canopy management in HDPS cotton under high fertility condition

The farmers of Saurashtra region growing irrigated non Bt cotton hybrids under HDPS (60 cm x 15 cm) are advised to spray growth inhibitor Mepiquat Chloride (MC) @ 40 ppm (0.4 g a.i. /10 lit. water) at 60 & 75 DAS for balanced growth, higher seed cotton yield and net return. This is due to increase in the number of sympodia & sympodial length, number of bolls & boll weight and maximum transportation of photosynthates into bolls.



(Cotton Research Station, JAU, Junagadh)

### Elemental, nutritional and microbiological analysis of panchagavya (ancient liquid organic)

The Scientific community involved in Panchagavya research or microbial research are recommended to use 19<sup>th</sup> day old Panchagavya to study maximum microbial diversity. The higher proportion of  $\alpha$ -proteobacteria was



observed in 19<sup>th</sup> day of Panchagavya preparation while 21<sup>st</sup> day Panchagavya formulation was found to be dominated by Firmibacteria,  $\beta$ -proteobacteria or Actinobacteria. The presence of unknown /novel microbes were higher in 21<sup>st</sup> day old Panchagavya on the basis of results of Metagenomic analysis.

a) Panchagavya contained dominant bacteria of nitrogen fixing, phosphate solubilizers and potash mobilizers. Moreover, it showed antagonism towards plant pathogenic fungi like *Helminthosporium* (47%), *A. flavus* (45 %), *A. niger* (35 %) and *Sclerotium rolfsii* (40 %) *in vitro*. Elemental composition of Panchagavya showed higher concentration of Fe (158.94 ppm), Ca (2789.99 ppm), Mg (1553.76 ppm) and Mo (25.50 ppm). It also contained N-Methyl-2-pyrrolidinone used as insecticide, herbicide and fungicide. Phenylacetaldehyde is a second major compound found which has very important antibiotic compound.

b) Bijamrut elemental analysis revealed that it contains Cu (4.19 ppm), Fe (111.16 ppm), Mn (1.56 ppm), Zn (2.40), Ca (1211.63 ppm) and Mg (1084.65 ppm) which can provide immunity against various diseases and improve seed germination. It also contained important compound 5(6)-EpETrE-EA which has antagonist activity against pathogenic microbes. 17 beta-Nitro-5 alpha-androstane is the aza-steroid which enhances the germination of plant seed.

c) Liquid organic preparation of Jivamrut has bacteria, fungi, actinomycetes, N-fixers and P-solubilizers and K-mobilizers. Jivamrut inhibited *Helminthosporium* (40 %), *A. flavus* (30 %), *A. niger* (25 %) and *Sclerotium rolfsii* (35 %), *Fusarium oxysporum* (35 %). Jivamrut contains high concentration of Fe (115.09 ppm), Ca (1575.78 ppm), Mg (621.57ppm) and Co (88.90 ppm). LC-QToF analysis showed Pyropheophorbide is an antioxidant found in Jivamrut.

d) Amrutpani is a good source of micronutrient which includes high concentration of Fe (208.44 ppm), Ca (2276.73 ppm), Mg (1119.15 ppm) and Ti (73.05 ppm). LC-QToF analysis revealed that Adouetine Z is an insecticidal cyclic peptide and (5alpha, 8beta, 9beta)-5,9-Epoxy-3,6-megastigmadien-8-ol is an antioxidant compound found in Amrutpani.

e) Sanjivak has antagonist activity and micronutrient content with important compound like Methyl jasmonate.

(Dept. of Biotechnology, CoA, JAU, Junagadh)

### Studies on phytochemicals and metabolomics profiling of seaweeds



The seaweed resources viz., Green, Red and Brown seaweeds analyzed through Ms/Ms based platform showed presence of 375 unique compounds. These seaweeds were found to contain important oil content, vitamin D3 and many bioactive compounds that can be used as nutraceutical products. In case of  $\omega$ -3 polyunsaturated fatty acids, eicosapentaenoic acid (EPA) was found in seaweed species, viz., *Sarconema filiforme* (5.02 %) and *Spatoglossum asperum* (4.04 %). Vitamin D-3 was found in *Caulerpa Lenthilifolia* (16.7 %), *Caulerpa sertulorioides* (8.5 %), *Ulva fasciata* (10.7 %), *Halimeda tuna* (12.7 %), *Hydroclatharus clathratus* (18.9 %), *Halymenia venusata* (6.5 %), *H. porphyraeformis* (20.6 %), *Dictyopteris marginatum*, *Gelidiopsis repens* (18.2 %) and *Heterosiphonia muelleri* (26.1 %). Some species of seaweeds viz., *Dictyopteris delicatula* (2.68 %), *Heterosiphonia muelleri* (0.24 %), *Dictyopteris marginatum (stoecospermum)* (4.07 %), *Spatoglossum asperum* (8.1 %), *Padina gymnospora* (4.86 %), *Caulerpa lenthilifolia* (0.96 %) contained docosahexaenoic acid (DHA). These compounds are not found in plants.

(Dept. of Biotechnology, CoA, JAU, Junagadh)

### Transcriptome and proteomic characterization for identification of candidate genes responsible for pistillate inflorescence and its reversion in castor

The scientific communities involved in castor improvement are recommended to use the set of 14 primers as mentioned below to distinguish the pistillate and monoecious plants in castor. They are also advised to use the castor database developed (<http://webtom.cabgrid.res.in/castdb/>) for the identification of gene of interest and selection of SSRs and their primers to be used under Marker Assisted Selection and molecular breeding.



Sr. No	Name of the Gene	Forward primer	Reverse Primer	Gene Function
1	Dynamin-2A	GCTAAGCAAGGGT TC GTCAG	CTGGCAGGTCGATCAA TTTT	Response to hormone stimulus
2	Auxin response factor	CACACATGGTGGG TT CTCAG	TGAGTTGGTGGTTGCA TTGT	Organ development; and post-embryonic development
3	ATP-binding protein	CATTGGACAGGT CCT CCACT	AAGCAAGGTGAAGCA AGGAA	Regulation of ARF protein signal transduction
4	Spermidine synthase	GGTGTGCATTTTC TC TCCTC	TGCCCTGGAATAAATC TTGC	Polyamine biosynthetic process
5	Xaa-pro amino peptidase	GGATGGAAGCTTTGG CATAA	GCCCTTCTACCAAAA TTGA	Auxin transport
6	Conserved hypothetical protein	TCGAATGAAGAGGCC ATTCT	GTGAGAAGGGCAAAA GCAAG	Abscisic acid metabolic process
7	MADS box protein	AAAGGTTGGCCTGA GGAGTT	GTCACCTGCCTGTTGC TTGA	Transcription, DNA - dependent
8	RNA polymerase sigma factor rpoD1	GATCTTCAGGCAAG CACTCC	ATATCCTCCCCTTGGTC CAC	DNA-dependent transcription, initiation
9	Protein with unknown function	TTGTCAAGGGCCAG TTCTTT	TTGACCTGCTGTGTCCC ATA	Guanylrbonucleotide binding
10	Arginine/serine-rich splicing factor	CGGAAGCTTGATGA CACTGA	GGCTTCTACTTCGGCTC CTT	Sex differentiation
11	Acid phosphatase	TCCTGTAACCGTTCC TTTCG	TGTTCAAGGCTCGAAAC CTCT	Phosphatase activity
12	DNA replication helicase dna2	AGGCTGTGAATAACC CAACG	CCCAATATCTTCGCCTT GAA	DNA metabolic process
13	Eukaryotic translation initiation factor2c	CACGACTTTTCCCG TTGAT	GAAGTCCCTCTGGTGG CATA	Translation
14	s-adenosyl-methyltransferase	TCTCCGTTCTTCGT CGATT	GGGTCAACATCCATTC CAAC	rRNA methylation

(Dept. of Biotechnology, CoA, JAU, Junagadh)

## Genome Sequencing of cumin (*Cuminum cyminum* L.) to reveal insight of its Genomic Architecture

The scientific community involved in cumin improvement are recommended to use genomic information generated ([https://drive.google.com/file/d/1uklnR77lYWJcRlp8m40lLpmOP\\_ujqJz/view?usp=sharing](https://drive.google.com/file/d/1uklnR77lYWJcRlp8m40lLpmOP_ujqJz/view?usp=sharing)) for cumin in Marker Assisted Selection for the improvement of cumin. They are also advised to use the genes identified as mentioned below and SSRs identified in Marker Assisted Selection.



Sr. No.	Character	Number of genes	Gene identified
1.	Flavonoid	21	U78D2, C75A2, C75A4, C75B3, C93C2, F3PH, FAOMT, FL3H3, MOMT, SOMT2, SOT5, UFOG, UFOG1, UFOG2, UFOG3, UFOG4, UFOG5, UFOG6, UFOG7, UFGFT and Y1103
2.	Chalcone synthase	9	6DCS, CHS1, CHS2, CHSA, CHSB, CHSD, CHSL1, CHSY, PKS5
3.	Chalconeisomerase	4	CFI, CF11, CFI2B, CFI3
4.	Flavanone synthase	3	C93C1, FNSI, C93B1
5.	Terpenoid synthase	15	BAMS, GBIS1, GBIS2, HUMS, TPS01, TPS05, TPS07, TPS08, TPS09, TPS16, TPS18, TPS22, TPS26, TPS29, TPS30
6.	Disease resistance	89	ADR2, CDR1, CHS1, CSA1, DF230, DR206, DRL12, DRL13, DRL14, DRL15, DRL16, DRL17, DRL18, DRL19, DRL2, DRL20, DRL21, DRL23, DRL24, DRL25, DRL26, DRL27, DRL28, DRL29, DRL3, DRL30, DRL31, DRL32, DRL33, DRL34, DRL36, DRL37, DRL38, DRL39, DRL4, DRL40, DRL41, DRL42, DRL43, DRL45, DRL5, DRL7, DRL8, DRL9, DSC1, DSC2, EDR1, EDR2, EDR2L, EDR4, LAZ5, LOV1A, NDR1, R13L1, R13L2, R13L3, R13L4, RFL1, RGA1, RGA2, RGA3, RGA4, RLM1B, RLM3, RP8HA, RP8L2, RP8L3, RP8L4, RPM1, RPP1, RPP13, RPP4, RPP5, RPP8, RPS2, RPS4C, RPS4L, RPS4W, RPS5, RPS6C, RPS6R, RPS6R, SUMM2, TAO1, WR52C, WR52N, WR52R, WR52W, Y4117
7.	Antifungal	4	DEF1, DEF15, DEF2, DEF4
8.	Early flowering	13	ASHH2, EFM, ELF3, ELF6, HD16N, PAF1, PIE1, REF6, RUP1, RUP2, SKIP, SWC6, VIP6
9.	Aromatic	11	5MAT, ANTA, AVT3A, AVT3B, AVT3C, DDC, ISS1, PGL1, PGL2, PGL3, SOT16
10.	Drought	8	AL7A1, DIS1, ERG14, HDG11, LSM5, SAD2, SDIR1, SSP1A
11.	Nematodes	2	ELF3, HSPR2

(Dept. of Biotechnology, CoA, JAU, Junagadh)

### Transcriptome analysis in coriander for identification of candidate genes against stem gall disease

The scientific community involved in coriander improvement is recommended to use the following set of seven primers in the process of marker assisted selection for the identification of disease defense genes in coriander genotypes.



Sr. No	Gene Name	Forward Primer	Reverse Primer	Function
1.	RL31	GCCAAACCAAAAGG TGAGAA	CGGATACCCTTAGCC CAGAT	Jasmonic acid mediated signaling pathway
2.	A0A2Z5 D854	CCACCGTTTCCAATG CTAGT	GGAATCTCTCGGGCC TAAAC	Metal ion binding
3.	A0A166 CJ74	ATTGGCTGAGCTTTG GATTG	GGCTTGATGCTCCAT TGTTT	Regulation of transcription DNA- template
4.	A0A166 CJ74	CACGCATTTCTCCTC CTGAT	TCAGAGGGGGTTTTT TGATG	DNA-template
5.	Y1934	ACTCGGTGTCACGGT TTTTT	CAAAAGCCGAGATT GTGGAT	Molecular function DNA-binding
6.	TGA10	CCCTGTTGGGAAACT TCGTA	GCTGCAAAGGTCCA GCTATC	Nitrogen-activated protein kinase binding
7.	A0A164 XUZ0	GAGTTGGAGTTCAG GGAGGA	GATGAGCGGGATAT CTGGAA	Affects Fungal Development and Pathogenicity of Fusarium graminearum

(Dept. of Biotechnology, CoA, JAU, Junagadh)

### Biochemical and molecular evaluation of A1 and A2 casein protein of milk in *Holstein friesian* cow and indigenous gir cow

The scientific community involved in cow improvement is recommended to use DNA markers to detect or distinguish A1A2 and A2A2 genotypic frequency among the Gir Bulls and Cows using below mentioned marker.



1	A1 Forward	5' CTTCCCTGGGCCCATCCA 3'
	A1 Reverse	5' AGACTGGAGCAGAGGCAGAG 3'
2	A2 Forward	5' CTTCCCTGGGCCCATCCC 3'
	A2 Reverse	5' AGACTGGAGCAGAGGCAGAG 3'

(Dept. of Biotechnology, CoA, JAU, Junagadh)

## VII. SOCIAL SCIENCE

### Spatial and temporal integration analysis and price discovery mechanism of potato wholesale markets in Gujarat

For harnessing the benefits of market integration of potato wholesale markets in Gujarat state, the existing market information and dissemination infrastructure needs to be strengthened. In this regard, real-time market intelligence inputs, including price forecasting, should be made available throughout the potato supply chain either through training programmes or by hosting literature in public domain, thereby, enabling the producers to take proper production, storage and marketing decisions.

*(Dept. of Agril. Economics, CoA, JAU, Junagadh)*

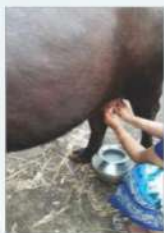
### Business performance analysis of Farmer Producer Organizations of Saurashtra region

The Farmer Producer Organizations (FPOs) in Saurashtra region are advised to increase the number of business activities *vis a vis* improve the members' involvement for better business performance.

*(Post Graduate Institute of Agri Business Management, JAU, Junagadh)*

### Adoption of scientific dairy husbandry practices by farmers in Amreli district

For increasing benefit of livestock owners of Amreli district, extension functionaries are suggested to give emphasis on extension activities for practices *viz.*, feeding of salt and mineral mixture, cleaning of udder and teats before milking with antiseptic, milking with full-hand method, navel disinfection of newborn calf and initiation of breeding of heifers on the basis of body weight/size



*(Bull Mother Farm, JAU, Amreli)*

**Production and distribution "Gir Sawaj" brand quality seeds and bioagents/ liquid biofertilizer as well as planting materials of fruit crops/ ornamental plants**

Sr. No.	Particular	Production
1	Nucleus and Breeder Seeds (q)	4137
2	Truthful, foundation and certified seeds (q)	7287
3	Fruit crop graft (Nos.)	8693
4	Fruit crops saplings (Nos.)	83180
5	Seedlings (Nos.)	60269
6	Ornamentals & Medicinal plants (Nos.)	52082
7	Liquid biofertilizers (litre) e.g. <i>Rhizobium</i> , <i>Azotobacter</i> , PSB, KMB, HNPV, SNPV	2997
8	<i>Metarhizium</i> (kg)	247
9	Trichocard (Nos.)	1100
10	Fruit fly Traps (Nos.)	14677
11	Fruit Fly lure (Nos.) (For fruit and vegetable crops)	17674
12	Pheromone Trap (Nos.)	7888
13	Pheromone lure (Pink Bollworm) (Nos.)	9500
14	Pheromone lure ( <i>Heliothis</i> , <i>Prodenia</i> , Brinjal shoot & fruit borer and <i>Fall armyworm</i> ) (Nos.)	8448
15	MDP Technology for Pink Bollworm (100 g tube)	793

**No. of Farm Machineries/ Implements/ equipments (category wise) tested at testing centre of FMPE, CAET, JAU, Junagadh**

Category	Name of Equipment / Machine	Nos.
A	Land development, tillage & seedbed preparation equipment	79
B	Sowing and planting equipment	39
C	Intercultivation equipment	7
D	Plant protection equipment	13
E	Harvesting and threshing equipment	2
F	Equipment for residue management	9
G	Post-harvest and agro processing equipment	1
H	Hand tools	1
	<b>Total</b>	<b>151</b>

**Distribution of Semen doses at Cattle Breeding Farm of JAU**

Sr. No.	Particular	Gir Bulls	Jaffrabadi Bulls
1.	Frozen semen doses available in stock from last year (Nos.)	188847	112958
2.	Frozen Semen doses Produced (Nos.)	27310	21340
3.	Frozen Semen doses used for AI in Field (Nos.)	2475	2750
4.	Frozen Semen doses used for AI on Farm (Nos.)	620	185
5.	Frozen Semen doses sold to AI Workers (Nos.)	582	2004
6.	Frozen semen doses in stock (Nos.)	212480	129359
7.	Animals transferred to Grampanchayat, Gaushala, other Institute etc. (Nos.)	39	25