

RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS

2024



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JUNAGADH AGRICULTURAL UNIVERSITY
JUNAGADH -362001 (Gujarat)



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RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS 2024



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



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Dr. V. P. Chovatia
Vice Chancellor

MESSAGE

It is a matter of great pride to present Research Accomplishments and Recommendations 2024, a reflection of Junagadh Agricultural University's continued commitment to excellence in research, innovation, and service to the farming community.

As one of Gujarat's four Agricultural Universities, JAU is entrusted with the integrated mandate of education, research, and extension. We are proud to offer a dynamic learning and research environment that empowers students, faculty, and farmers alike. JAU represents a uniquely diverse agro-ecological region of Gujarat, encompassing four Agro-climatic Zones. This biodiversity-rich region supports a wide range of activities including rainfed and dryland agriculture and horticulture. Within this dynamic setting, JAU continues to fulfill its tri-fold mandate of education, research, and extension - working tirelessly in the interest of sustainable agricultural development and the well-being of society. With 24 research stations spread across 10 districts of Saurashtra, the University is actively engaged in multidisciplinary, demand-driven, and farmer-centric research.

I extend my heartfelt congratulations to our dedicated scientists for their achievements, including the release of five new crop varieties, 22 technologies developed for farmers, and 30 innovations for the scientific community as well as 75 new technical programmes. I wish to place on record my sincere appreciation for the exceptional efforts of the Director of Research and his dedicated team for the meticulous compilation and successful publication of '**Research Accomplishments and Recommendations 2024.**' Their commitment to academic excellence and precision has resulted in a valuable resource that reflects the University's research strength. I am confident that this publication will serve as a rich source of knowledge and inspiration for scientists, students, farmers, entrepreneurs, and all other stakeholders engaged in the advancement of agriculture and allied sectors.

Junagadh
July, 29, 2025

(V. P. Chovatia)





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Dr. A. G. Pansuriya

PREFACE

It is a matter of great pleasure for me to put on record the research work carried out during 2023-24 in the Junagadh Agricultural University. The recommendations and new technical programmes were critically discussed and approved in 20th AGRESCO Subcommittee Meetings of Junagadh Agricultural University. Same were presented in 20th Combined AGRESCO meeting of SAUs, which was organized by Navsari Agricultural University, Navsari during May 10-17, 2024 through virtual mode.

The Junagadh Agricultural University represents Saurashtra region of Gujarat and about 32.74 per cent area of the state. There are 24 research stations, which include multidisciplinary main research stations, sub research stations for various crops as well as testing centers spread over 10 districts. The eight different sub-committees have been constituted and conveners were nominated to plan and monitor the research work. All the sub-committees have successfully completed their responsibilities. The University has also arranged 20th Research Council meeting on January 29, 2024 for approval of new research projects and research activities to be under taken during year. The university has also signed as many as 20 MoU for research activities. Total 22 new projects of ICAR, RKVY and other Agencies worth Rs. 560.00 lac were approved in the University during the year 2023-24.

During the year 2023-24, total 4548 quintal of breeder/ nucleus seeds of different crops were produced to fulfill the demand of private and public sectors as per the national and state indents. Under Megaseed project, 11018 quintal of truthful/ foundation/ certified seeds of different crops were produced and supplied to the farmers & various farms of the University under the brand “Gir Sawaj”. Apart from these, 1.48 lac planting material of



different fruit crop graft, sapling, seedling, ornamental & medicinal plants were produced and provided to the farmers. Total 5500 kg Bioagents viz. *Trichoderma*, *Beauveria*, *Metarhizium*; 2350 liter liquid biofertilizers viz. *Rhizobium*, *Azotobacter*; PSB, KMB, HNPV, SNPV; 36055 Fruit fly trap/ lure; 57300 Pheromone trap/ lure etc. were produced in large amount and supplied to the farmers at reasonable price.

Six different technologies for patent and one design were granted under IPR Act. A total of 120 different farm machinery, implements, equipments have been tested by Gujarat's only Farm Machinery Testing and Training Center operating at the University. Four implements/ equipments were developed for the benefits of the farmers.

In the 20th Combined AGRESCO meeting of SAUs, five new crop varieties viz. Groundnut (GG 101-Sorath Keshav, GG 24- Sorath Urja and GG 42- Sorath Shaan), Pigeonpea (GT 111-Sorath Ratan) and Endorsement of Pearl millet Hybrid (GHB 1294-Maru Moti) were recommended for release in the Gujarat state. Besides this, 22 technologies/ recommendations were made for farmers and 30 recommendations were made for Scientific Community. In addition, as many as 75 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.

Summary of 20th Combined AGRESCO meeting of SAUs

Sub Committee	No. of Recommendations		New Technical Programs
	Farmers	Scientific	
Crop Improvement	05*	01	01
Crop Production	06	08	13
Plant Protection	03	10	11
Horticulture & Forestry	03	-	08
Agricultural Engineering	10	03	18
Basic Science	-	01	05
Social Science	-	07	19
Total	05*+22	30	75

*No. of crop varieties released

Junagadh
July, 29, 2025


(A. G. Pansuriya)



RECOMMENDATIONS FOR FARMERS

I. CROP IMPROVEMENT

CROP VARIETIES RELEASED

Total five new crop varieties viz. Groundnut (GG 101, GG 24 and GG 42), Pigeonpea (GT 111) and Endorsement of Pearl millet Hybrid (GHB 1294) of JAU were recommended for release for the benefit of the farmers during the year 2023-24.

Groundnut: Gujarat Groundnut 101 (GG 101: Sorath Keshav)

The farmers of Gujarat state growing groundnut during *kharif* season are recommended to grow high yielding Spanish bunch groundnut variety Gujarat Groundnut 101 (GG 101: Sorath Keshav). This variety has recorded mean pod yield of 2860 kg/ha, which was 33.96 and 24.26 per cent higher than the check varieties, GJG 9 (2135 kg/ha) and TG 37A (2301 kg/ha), respectively. This variety has also recorded higher kernel yield than the check varieties. This variety was found comparable to the checks against late leaf spot, rust, stem rot, collar rot incidence and damage due to leaf defoliator.



(Main Oilseeds Research Station, JAU, Junagadh)

Groundnut: Gujarat Groundnut 24 (GG 24: Sorath Urja)

The farmers of Gujarat state growing groundnut during *kharif* season are recommended to grow Virginia bunch groundnut variety Gujarat Groundnut 24 (GG 24: Sorath Urja). This variety has recorded mean pod yield of 2555 kg/ha, which was 20.37, 21.97 and 56.42 per cent higher over the check varieties, GJG 22 (2122 kg/ha), GG 20 (2095 kg/ha) and Kaushal (1633 kg/ha), respectively. This variety has also recorded higher kernel yield, oil yield, number of pods per plant and oil content over the check varieties. This variety was found comparable to the check varieties against late leaf spot, rust, stem rot, collar rot diseases and damage due to leaf defoliator.





(Main Oilseeds Research Station, JAU, Junagadh)

Groundnut: Gujarat Groundnut 42 (GG 42: Sorath Shaan)

The farmers of Gujarat state growing groundnut during *kharif* season are recommended to grow Virginia runner groundnut variety Gujarat Groundnut 42 (GG 42: Sorath Shaan). This variety has recorded mean pod yield of 2393 kg/ha, which was 12.51, 27.14 and 50.98 per cent higher over the check varieties, GG 41 (2127 kg/ha), GJG 17 (1883 kg/ha) and Somnath (1585 kg/ha), respectively. This variety has also recorded higher kernel yield, oil yield, number of pods per plant and shelling per cent over the check varieties. This variety was found comparable to the check varieties against late leaf spot, rust, stem rot, collar rot diseases and damage due to leaf defoliator.



(Main Oilseeds Research Station, JAU, Junagadh)

Pigeon pea: Gujarat Tur 111 (GT 111: Sorath Ratan)

Farmers of Gujarat state growing pigeon pea are recommended to grow medium maturing (177 days) variety Gujarat Tur 111 (GT 111: Sorath Ratan). It recorded 2197 kg/ha average seed yield, which was 6.6, 18.3, 14.5 and 15.9 per cent higher over check varieties GJP 1, AGT 2, BDN 2 and GT 104, respectively. Seeds of this variety are of cream colour and large in size (12.88 g/100 seeds). This variety is moderately resistant against wilt, resistant against SMD and phytophthora blight diseases, with low pod borer and seed damage due to pod fly.

(Pulses Research Station, JAU, Junagadh)



Pearl millet Hybrid: Gujarat Hybrid Bajra 1294 (GHB 1294: Maru Moti) (Endorsement)

The *kharif* pearl millet growing farmers of Gujarat state are recommended to grow early maturing hybrid GHB 1294 (Maru Moti). This hybrid recorded average 2717 kg/ha grain yield which was 20.0 % higher than check hybrid GHB-538. It has also recorded average 7306 kg/ha dry fodder yield which was 46.8 % higher than check hybrid GHB-538. The proposed hybrid is resistant against diseases like downy mildew, blast and rust and tolerant against pest like shoot fly, stem borer and heliothis larvae.



(Pearl millet Research Station, JAU, Jamnagar)

II CROPPRODUCTION

Nutrient Management

Evaluation of some cow-based bio-enhancers and botanicals for organic cultivation of *rabi* onion

The farmers of South Saurashtra Agro-climatic Zone growing *rabi* onion under organic farming are recommended to apply FYM 10 t/ha to obtain higher yield and net realization.

The farmers who are interested in cow-based farming are recommended to apply FYM 5 t/ha along with Panchagavya 3 % spray at 30, 45 and 60 DAS OR FYM 5 t/ha along with Jivamrut 500 l/ha with irrigation at sowing, 30 and 45 DAS.



(Department of Agronomy, CoA, JAU, Junagadh)



Effect of fresh cow dung on yield and yield attributes of garlic

The farmers of South Saurashtra Agro-climatic Zone growing garlic are recommended to apply slurry (cow dung: water - 1:3) of 1500 kg/ha fresh cow dung (up to 5 days) with irrigation at the time of sowing for getting higher yield, net return and improving soil fertility.



(Dept. of Soil Science & Agril. Chem. & Vegetable Research Station, JAU, Junagadh)

Effect of foliar application of water soluble macro and micro nutrients fertilizers on growth, yield and quality of *kharif* groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are recommended to apply RDF 75 % (9.37:18.75:37.50 N: P₂O₅:K₂O kg/ha) + 1.5 % (150 g/10 liter water) WSF (19-19-19-N:P:K) at 45 and 60 DAS + 1.0 % (100 g/10 liter water) Muti-micro Mixture Grade –IV (Zn-6.0 %, Fe-4.0 %, Cu-0.5 %, Mn-1.0 % and B-0.5 %) at 50 and 65 DAS as a foliar spray for obtaining higher yield and net return.



(Main Oilseeds Res. Station, JAU, Junagadh)

Nutrient management in Bt cotton under rainfed condition (Vallabhipur)

The farmers of Bhal region growing Bt cotton under rainfed condition are recommended to apply 80-40-80-20 kg N-P₂O₅-K₂O-S/ha for obtaining higher yield and net return. The nitrogen should be applied in three splits i.e. 25 % as basal at the time of sowing, 50 and 25 % as top



dressing at 35-40 and 60-65 days after sowing, respectively by drilling at 10 cm soil depth.



(Main Dry Farming Res. Stat., JAU, Targhadia and Dry Farming Res. Stat., JAU, Vallabhipur)

Cultural Practices

Multi-tier cropping system to enhance resource utilization, profitability and sustainability of Bt cotton (*Gossypium hirsutum*) production system

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton are recommended to grow the crop in paired rows (80:160:80 cm) and two rows of groundnut (40 cm distance) OR two rows of soybean (40 cm distance) OR one row of soybean + one row groundnut (40 cm distance) as intercrop between two pairs of Bt cotton for getting higher net return.



(Cotton Research Station, JAU, Junagadh)

Recycling of cotton stalks and its effect on yield and soil health

The farmers of North Saurashtra Agro-climatic Zone growing Bt cotton are recommended to apply *Ex-situ* composting of cotton stalks using shredder and addition of 10 kg N /ha through urea + compost culture @ 5 kg/ha at the time of sowing along with 80 kg N + 40 kg P₂O₅ + 250 kg gypsum/ha for obtaining higher yield and net return as well as sustaining soil health under rainfed conditions. The nitrogen should be applied in three split i.e. 25 % as basal at the time of sowing, 50 and 25 % as top dressing at 35-40 and 60-65 days after sowing, respectively by drilling at 10 cm soil depth.

OR



Incorporate cotton stalks using mobile chopper and apply one irrigation for decomposing along with 80 kg N + 40 kg P₂O₅ + 250 kg gypsum/ha for obtaining higher yield and net return as well as sustaining soil health under rainfed conditions. The nitrogen should be applied in three split i.e. 25 % as basal at the time of sowing, remaining 50 and 25 % as top dressing at 35-40 and 60-65 days after sowing, respectively by drilling at 10 cm soil depth.



Methodology for preparation of compost from cotton stalks using shredder:

The farmers are advised to recycle of cotton stalk (which are either burned or wasted) by chopping into small pieces of 5-6 cm using cotton shredder and composting with addition of compost culture @ 500 g per tone, urea (N @ 0.5 %), cow dung @ 20 % as well as Azotobactor and PSM @ 500 g each per tone during first turning of cotton stalk to get enriched compost within 120 days having higher content of all plant nutrients.

(Main Dry Farming Research Station, JAU, Targhadia)

III PLANT PROTECTION

Entomology

Effect of different poison baits against fall army worm *Spodoptera frugiperda* (J. E. Smith) infesting maize

The farmers of Gujarat growing maize are recommended to apply poison baits of thiodicarb 75 WP 250 g or emamectin benzoate 5 SG 100 g mixed with 5 kg jaggery and 25 kg maize flour in 8 litre of water/ha in whorl of plants, first at the initiation of pest infestation and second application at 20 days after first application for effective management of fall armyworm.



CIB & RC format

Year	Crop	Pest	Pesticides/ Biopesticides with formulation	Dosage	Application schedule
				Quantity of formulation g or ml/kg seed, kg or l/ha	
2024	Maize	<i>Fall armyworm, S. Frugi-perda</i>	Thiodicarb 75 WP	250 g	First application at initiation of pest infestation, second application at 20 days after first application
			Emamectin benzoate 5 SG	100 g	

(Department of Entomology, JAU, Junagadh)

Standardization of number of pheromone traps for management of mango fruit fly, *Bactrocera dorsalis* (Hendel)

The farmers of South Saurashtra having mango orchards are recommended to install 30 methyl eugenol parapheromone traps per hectare at pea sized fruit stage and three meter height from ground level for effective management of fruit fly and the lure to be changed three times at an interval of 40 days.



(Department of Entomology, JAU, Junagadh)

Plant Pathology

Evaluation of ready-mix fungicides as a seed treatment against soil borne diseases of groundnut

Farmers of Gujarat growing *kharif* groundnut are recommended to apply seed treatment with carboxin 37.5 + thiram 37.5 WS @ 3 g/kg seed or carbendazim 25 + mancozeb 50 WS @ 3 g/kg seed or penflufen 13.28 + trifloxystrobin 13.28 FS @ 3 ml/kg seed as ready-mix fungicide for effective management of aflarot, collar rot and stem rot in groundnut.



CIB & RC format

Year	Crop	Pest	Pesticides/ Biopesticides with formulation	Dosage	Application schedule	Remark(s)
				Quantity of formulation g or ml/kg seed, kg or l/ha		
2024	Groundnut	Aflarot, collar rot, stem rot	Carboxin 37.5 + Thiram 37.5 WS	3 g	Seed treatment per kg at the time of sowing	These pesticides are registered with CIB & RC for use in ground nut crop for management of this disease.
			Carbendazim 25 + Mancozeb 50 WS	3 g		
			Penflufen 13.28 + Trifloxystrobin 13.28 FS	3 ml		

(Main Oilseeds Research Station, JAU, Junagadh)

IV HORTICULTURE AND FORESTRY

Response of different rootstocks under saline irrigation condition in tomato

The farmers of South Saurashtra Agro-climatic Zone growing tomatoes are recommended to use var. GT-6 grafted on Arka Vikas with use of saline irrigation water up to 2.0 dS/m EC for higher yield and net return.



(College of Horticulture, JAU, Junagadh)

Nutrient management in tomato under polyhouse

The farmers of Gujarat growing tomato under poly house are recommended to apply RDF (25.0-12.5-12.5 N-P₂O₅-K₂O kg/ 1000 m²) + Panchgavaya 3 % (3 spray at 45, 60 and 75 days after transplanting) to obtain higher yield and net return.



(College of Horticulture, JAU, Junagadh)

Propagation of a rare and medicinally important declining shrub species Agnimantha (*Premna serratifolia* L.) by hardwood cuttings

The nurserymen of Gujarat are recommended to use plant growth regulator either IBA @ 450 ppm (73.33 % sprouting) or IAA @ 450 ppm (70.67 % sprouting) [i.e. 450 mg in one litre water] for 15



minutes dipping for better propagation in hardwood cuttings of *Agnimantha* (*Premna serratifolia* L.).



(College of Horticulture, JAU, Junagadh)

V AGRICULTURAL ENGINEERING

Yield response of drip fertigation for wheat-green gram crop sequence

The farmers of South Saurashtra Agro-climatic zone growing wheat are recommended to apply 75 % of NPK of RDF (120 N:60 P₂O₅:60 K₂O kg/ha) through drip fertigation only (with no basal doze) adopting the following drip system and irrigation schedules to wheat crop in 8 equal splits at 6 days interval after 12 days of sowing to get higher grain yield and net return.

Specifications of drip irrigation system and its operating time for wheat crop				
Drip irrigation system details	Nos. and depth of irrigation and drip irrigation system operating time for wheat crop during winter season			
	DAS	No. of irrigations	Irrigation depth (mm)	Operating time/ irrigation
Lateral type =Inline Inline drip size =16 mm (OD) Dripper rate =4 lph Dripper spacing =0.5 m Lateral spacing =0.675 m Nos. of crop rows per drip line =3	0	1	40	3 h & 23 Minutes
	0-10	1	30	2 h & 32 Minutes
	10-40	5	20	1 h & 41 Minutes
	41-70	5	22	1 h & 51 Minutes
	71-90	3	24	2 h
	> 90	2	26	2 h & 12 Minutes

It is also recommended to sow green gram crop in paired row (0.3 m x 0.375 m) after harvesting of wheat crop without any cultivation operation and to apply 75 % P of RDF (20 N:40 P₂O₅:00 K₂O kg/ha) as basal doze and 75 % N of RDF through drip fertigation adopting the following drip system and irrigation schedules in 5 equal splits at 6 days interval after 12 days of sowing to get higher seed yield and net return.



Drip irrigation system details	Nos. and depth of irrigation and drip irrigation system operating time for green gram crop during summer season			
	DAS	No. of irrigations	Irrigation depth (mm)	Operating time/irrigation
Lateral type =Inline	0	1	20	1 h & 41 Minutes
Inline drip size =16 mm (OD)	0-10	1	15	1 h & 16 Minutes
Dripper rate =4 lph	11-30	5	21	1 h & 46 Minutes
Dripper spacing =0.5 m	31-70	6	23	1 h & 56 Minutes
Lateral spacing =0.675 m	>70	1	22	1 h & 51 Minutes
Nos. of crop rows per drip line = 2				

[Dept. of Irrigation & Drainage Engg., CAET, JAU, Junagadh]

***In-situ* soil moisture conservation: utilization and management of rainwater for groundnut production**

The farmers of North Saurashtra Agro-climatic Zone are recommended to grow groundnut by sowing on tied ridge with plot bunding and apply agricultural waste (Groundnut shells @ 1.5 t/ha) as mulch to conserve moisture and obtaining maximum rain water use efficiency, higher productivity and net returns under dry farming

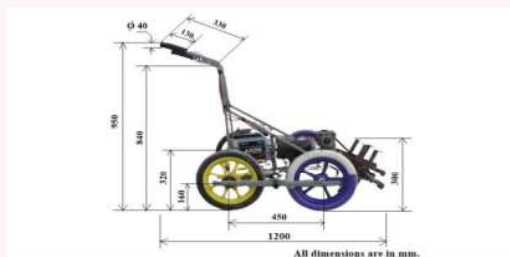


(Main Dry Farming Research Station, JAU, Targadia)

Design, development and performance evaluation of battery operated light weight interculture tool/weeder

Farmers and manufacturers are recommended to use the JAU developed battery operated (easily operated by one person) intercultural tool /weeder (having rotary type blades, operated by 0.5 hp DC motor and 12-V 74-Ah, rechargeable battery) for vegetable/ horticultural crops for interculturing / weeding operation. The working width of weeder is 30 cm with field capacity 0.02-0.03 ha/h and 84 to 90 % weeding efficiency. There is a saving of up to 85 % in time, 35 % in energy and 78 % in cost of operation.





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

Development and performance evaluation of mini tractor operated multi crop weeder

Farmers are recommended to use “Mini tractor operated multi crop sweep blades weeder” developed by Junagadh Agricultural University for better performance in weeding, time and cost saving in place of existing blade harrow.



[Dept. of Farm Engg., CoA, JAU, Junagadh]

Development and performance evaluation of mini tractor operated weed inverting roller

Farmers are recommended to use “Mini tractor operated weeder with weed inverting roller” developed by Junagadh Agricultural University for better performance in weeding, weed inverting and time saving in place of existing blade harrow.



[Dept. of Farm Engg., CoA, JAU, Junagadh]

Standardization of process parameters for sesame spread preparation

The manufacturers of sesame spread are recommended to adopt the process technology developed by Junagadh Agricultural University



for the production of good quality sesame spread. The recommended procedure involves roasting of dehulled sesame seeds at 147 °C for 27 minutes 30 second. Subsequently, the cool roasted dehulled sesame seeds are blended and grinded with jaggery (9.50 %), hydrogenated vegetable oil (6.20 %), guar gum powder (1.3 %) and salt (1.0 %). Following this process protocol leads to sesame spread with optimal quality attributes.



The manufacturers of sesame spread are recommended to store sesame spread in PET (Polyethylene Terephthalate) containers under refrigerated conditions (8°C) to ensure safety storage up to three months. This storage protocol developed by Junagadh Agricultural University maintains superior biochemical, rheological and sensory quality along with oxidative and microbial stability of the sesame spread throughout the three month storage period.

[Agricultural Research Station, JAU, Amreli]

Development of solar tunnel dryer for local spices

The farmers and processors involved with drying of spices, viz., fresh red chilies, turmeric and ginger are recommended to use the solar tunnel dryer developed by Junagadh Agricultural University to reduce the drying time, drying space, minimize post-harvest losses during drying and handling, better quality, more recovery as well as higher economic returns of their dried spices as compared to traditional sun drying method.



- Quantity of spices in the dryer: 500 ± 5 kg (Red chilies), 540 ± 5 kg (Turmeric), 525 ± 5 kg (Ginger) per batch
- Drying time: 14 days (red chilies), 22 days (turmeric), 23 days (ginger) (during January-April).

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

Development of solar tunnel dryer for local spices

The farmers and processors involved with drying of spices are recommended to use the solar tunnel dryer developed by Junagadh Agricultural University for drying spices to a safe moisture level as per following details.



Details of solar tunnel dryer:

- Capacity of dryer: 500 ± 5 kg to 540 ± 5 kg depends on spices to be dried.
- Drying trays: 64 trays arranged in two tiers.
- Maximum drying air temperature: $53^{\circ}\text{C} \pm 2^{\circ}\text{C}$.
- Maximum increment in drying temperature: 25.9°C (winter) and 28.8°C (summer).
- Solar collectors (Optional): 3 Nos. (1.22 m x 2.44 m).

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

Gasification of Castor and pigeon pea crop residues for combined gaseous and bio-char production

The farmers and entrepreneurs are recommended to use shredded castor and pigeon pea stalks as feed stalks in an open-core downdraft gasifier system developed by Junagadh Agricultural University. The maximum gasification efficiency of 71.44 % & 73.28 % and biochar production of 21.56 % & 21.78 % having the fixed carbon content of 59.61 % and 49.22 % could be achieved from castor and



pigeon pea stalk respectively at 22 m³/h gas flow rate. The carbon footprint (CF) of biochar is a net reduction of 1.67 tons of CO₂ per ton of feedstock.

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

Performance of field crops and shade resistance vegetable crops under the Agrivoltaic System

Farmers of Gujarat state are recommended to use J.A.U model of Agrivoltaic system for electricity generation along with the cultivation of field crops like; Cotton, Groundnut and Cucumber to get additional income on the same land throughout the year.

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

RECOMMENDATION FOR SCIENTIFIC COMMUNITY

I. CROP IMPROVEMENT

Heat stress mitigation through seed priming in wheat

The farmers of South Saurashtra Agro-climatic Zone growing wheat are recommended to grow variety GW 366 in late sowing condition with seed priming of salicylic acid 50 ppm (Hormonal Priming) (50 ml/l) for 14 hours followed by shade drying recorded the highest grain and biological yield per plant to mitigate heat stress.

(Dept. of Seed Science and Technology, JAU, Junagadh)

II CROP PRODUCTION

Calibration and validation of CERES model (DSSAT 4.6) for different cultivars of wheat under different sowing time

CERES-Wheat model of DSSAT family was calibrated and validated for GW 499, GW 451 and GJW 463 cultivars of wheat. The model simulations of grain yield of wheat were validated with less than 10 percent error. The genetic coefficients are recommended for use in optimization for crop management and yield prediction of wheat crop as under.

Symbol	Description	GW 499	GW 451	GJW 463
PHINT	Phyllochron interval (days)	73.4	71.2	72.8
P1V	Vernalization coefficient	0.5	0.4	0.5
P1D	Photoperiodism coefficient	1.80	1.90	2.00
P5	Grain filling duration coefficient	3.25	3.15	3.10
G1	Kernel number coefficient	5.55	5.60	5.50
G2	Kernel weight coefficient	4.20	4.35	4.25
G3	Spike number coefficient	5.25	5.35	5.30

DSSAT model can be used for predicting wheat grain yield and



phenological events under various agro-climatic conditions. The model may also be used to improve and evaluate the current practices of wheat growth management to increase the crop production.

(Department of Agronomy, CoA, JAU, Junagadh)

Calibration and validation of CERES model (DSSAT 4.6) for different cultivars of wheat under different sowing time

It is informed to the scientific community that wheat crop under South Saurashtra Agro-climatic condition can be sown around 15th November (Minimum temperature 15 to 17 °C and Maximum temperature 32 to 34 °C) and prefer varieties GW 499, GW 451 and GJW 463 for getting higher yield and net return.



(Department of Agronomy, CoA, JAU, Junagadh)

Dynamics of weed flora in major *rabi* crops

It is informed to scientific community that information on weed dynamics in wheat, chickpea and coriander during *rabi* season is as below:

- Total sixteen existing weed species of eleven different families were identified and observed during *rabi* season. From total sixteen species of weeds, the families constituted as Amaranthaceae (02), Asteraceae (03), Chenopodiaceae (01), Cyperaceae (01), Euphorbiaceae (01), Leguminosae (01), Liliaceae (01), Poaceae (03), Portulacaceae (01), Solanaceae (01) and Tiliaceae (01).
- Total weeds in floristic composition were *Cyperus rotundus*, *Asphodelus tenuifolius*, *Echinochloa colona*, *Eleusine indica*, *Dactyloctenium aegyptium*, *Digera arvensis*, *Eclipta alba*, *Euphorbia hirta*, *Parthenium hysterophorus*, *Indigofera glandulosa*, *Portulaca oleracea*, *Corchorus olitorius*, *Tridax procumbens*, *Physalis minima*, *Amaranthus spinosus* and *Chenopodium album*.
- Highest weeds were observed of families; Asteraceae ≥ Poaceae > Amaranthaceae.



- *Cyperus rotundus*, *Asphodelus tenuifolius*, *Chenopodium album*, *Echinochloa colona*, *Physalis minima*, *Digera arvensis*, *Eluopus vilosus*, *Indigofera glandulosa*, *Eclipta alba* and *Euphorbia hirta* were found to be the most common weed species in *rabi* season.
- The most dominant succession of *Cyperus rotundus*, *Asphodelus tenuifolius* and *Echinochloa colona* and *Digera arvensis* were noted throughout season.
- *Echinochloa colona* with wheat, *Asphodelus tenuifolius*, *Indigofera glandulosa* and *Physalis minima* with chickpea and coriander; *Cyperus rotundus* with all crops throughout *rabi* season were associated than other weed species.
- Dry weight of weeds increased over time. The lowest weed dry weight was registered in wheat, followed by coriander and the highest weed dry weight at all the stages was recorded in chickpea.
- Among the crops, monocots > dicots > sedges in wheat, monocots > sedges > dicots were observed in chickpea and coriander. Among weed management practices, monocots > dicots > sedges in unweeded, monocots in weed free, monocots > sedges in HW and monocots > sedges > dicots order in herbicidal treatment was observed.
- The weed late to emerge was observed i.e., *Eluopus villosus* up to 15 DAS.
- Uprooting of weeds at 15 days interval decreased periodical weed dry weight, followed by two hand weeding and application of pre- & post-emergence herbicides. Whereas, the undisturbed weedy condition progressively increased weed dry weight.
- Number of weeds decreased with time. The weed count at all the stages was more or less same in wheat, chickpea and coriander.
- Removal of existing weeds put forth the emergence of new weeds. HW at 15 & 30 DAS and application of pre- & post-emergence herbicides were almost equally effective in suppressing weed count. Whereas, undisturbed condition reduced weed count over time, but had the highest weed count at all the stages as compared to weed control methods.
- The most densely weeds viz., *Asphodelus tenuifolius*, *Echinochloa colona* and *Cyperus rotundus* and least densely were *Tridax procumbens*, *Chenopodium album* and *Corchorus olitorious*.
- Removal of weeds at 15 days interval increased yields of wheat, chickpea and coriander. Manual weeding and herbicidal weed control



were found equally effective in increasing crop yield.

- Weed species vary according to crop and weed management practices.



(Department of Agronomy, CoA, JAU, Junagadh)

Dynamics of weed flora in major *kharif* crops

The scientific community is informed that information on weed dynamics in groundnut, soybean and pearl millet during *kharif* season is as below:

- From total nineteen weeds species, families constituted as *Aizoaceae*, *Amaranthaceae*, *Asteraceae*, *Commelinaceae*, *Cyperaceae*, *Euphorbiaceae*, *Fabaceae*, *Lamiaceae*, *Lythraceae*, *Poaceae*, *Portulacaceae*, *Solanaceae* and *Tiliaceae*. Highest weeds observed of families; *Poaceae* > *Asteraceae* > *Euphorbiaceae*.
- Total weeds in floristic composition were *Cyperus rotundus*, *Echinochloa colona*, *Eluopus villosus*, *Dactyloctenium aegyptium*, *Digitaria sanguinalis*, *Digera arvensis*, *Eclipta alba*, *Euphorbia hirta*, *Indigofera glandulosa*, *Tridax procumbens*, *Leucas aspera*, *Phyllanthus niruri*, *Corchorus olitorious*, *Commelina benghalensis*, *Portulaca oleracea*, *Ammannia baccifera*, *Parthenium hysterophorus*, *Physalis minima* and *Trianthema portulacastrum*.
- The most dominant succession of *Cyperus rotundus*, *Echinochloa colona*, *Commelina benghalensis*, *Leucas aspera* and *Digera arvensis* were noted throughout season.
- *Echinochloa colona* and *Eluopus villosus* with pearl millet, *Indigofera glandulosa* with groundnut and soybean; *Cyperus rotundus* throughout the *kharif* season were associated.
- Among the crops, monocots > dicots > sedges in pearl millet, dicots > sedges > monocots were observed in soybean and groundnut. Among weed management practices, dicots > monocots > sedges in unweeded, monocots in weed free and HW and monocots > sedges > dicots order in herbicidal treatment was observed.



- The herbicidal treatments have lowest monocot weeds up to 30 DAS.
- Dry weight of weeds increased over time. Uprooting of weeds at 15 days interval decreased periodical weed dry weight, followed by hand weeding and herbicidal treatments. Whereas, the undisturbed weedy condition progressively increased weed dry weight.
- Number of weeds decreased with time. Weed species vary according periodical stages, crops and weed management practices.
- The most densely weeds viz., *Echinochloa colona* and *Cyperus rotundus* and least densely were *Tridax procumbens*, *Parthenium hysterophorus* and *Trianthema portulacastrum*.
- The weeds late to emerge were *Digitaria sanguinalis* up to 15 DAS, *Eluopus villosus* up to 30 DAS and *Ammannia baccifera* up to 45 DAS.
- Removal of existing weeds put forth the emergence of new weeds specially weed i.e., *Ammannia baccifera* and *Cyperus rotundus*.
- *Ammannia baccifera* found dominating around 45 DAS in weed free condition when the rainfall amount was more.
- The *Phyllanthus niruri* dominant only in earlier season, hence it has completed life cycle within 30-45 DAS.



(Department of Agronomy, CoA, JAU, Junagadh)

Effect of plant growth retardants on growth, yield attributes and yield of *kharif* groundnut

It is informed to the scientific community that in *kharif* groundnut foliar application of Chlormequate Chloride 1000 ppm at 45 and 60 DAS gave higher groundnut pod and haulm yield.



(Main Oilseeds Research Station, JAU, Junagadh)



Evaluation of soil texture of Junagadh district

It is informed to scientific community that, soil texture of Junagadh district is clayey, consisting of soil separate viz. sand 29.05 %, silt 24.67 % and clay 46.23 % i.e. 64 % area of soils of Junagadh district. Among the different talukas, Malia, Mangrol and Visavadar talukas soils falls under clay loam texture, while, in Vanthali, Bhesan, Keshod, Manavadar, Mendarda and Junagadh talukas soils falls under clayey texture.

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

Effect of FYM with and without phosphorus on groundnut (GG 20) yield

It is informed to scientific community that in *kharif* groundnut application of FYM 10 t ha⁻¹ along with 20 kg P₂O₅ ha⁻¹ every year gave higher yield and net return and also increases phosphorus content and uptake by pod and haulm. Application of FYM 10 t ha⁻¹ along with 20 kg P₂O₅ ha⁻¹ every year also increasing the phosphorus level in soil as compared to control.

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

Screening of sesame varieties/germplasm lines for yield performance under organic condition in *kharif* season

The scientific community is informed that under Saurashtra region of Gujarat sesame varieties/germplasm lines G.Til 4, G. Til 10, AT 375, GJT 5, AT 371, AT 314, G.Til 3 and AT 377 gave high seed yield in *kharif* season under organic condition.



(Agriculture Research Station, JAU, Amreli)

III PLANT PROTECTION

Entomology

Effect of different poison baits against fall army worm *Spodoptera frugiperda* (J. E. Smith) infesting maize

Two applications of poison baits in whorl of plants containing indoxacarb 15.8 EC 125 ml, 5 kg jaggery and 25 kg maize flour in 8 L of



water/ha, first at the initiation of pest infestation and second application at 20 days after first application found effective against fall armyworm infesting maize.

(Department of Entomology, CoA, JAU, Junagadh)

Standardization of number of pheromone traps for pink bollworm, *Pectinophora gossypiella* (Saunders) in cotton

Installation of 50 sex pheromone traps per hectare at crop canopy level after 40 days of sowing for effective management of cotton pink bollworm and the lure to be changed three times at an interval of 40 days.



(Department of Entomology, CoA, JAU, Junagadh)

Effect of biorationals against aphid, *Lipaphis erysimi* (Kalt.) infesting mustard

Apply two sprays of *Beauveria bassiana* 1.15 WP (1×10^8 CFU/g) at 0.007 % (60 g/10 L of water) or neem oil (10000 ppm) at 0.004 % (40 ml/10 L of water) first spray when pest cross ETL level (1.5 aphid index/plant) and second spray at 10 days after first spray for effective management of mustard aphid.



(Main Oilseeds Research Station, JAU, Junagadh)

Effect of date of sowing and acaricides against yellow mite, *Polyphagotarsonemus latus* (Banks) infesting cluster bean

Sowing of cluster bean crop during fourth week of February and two sprays of diafenthiuron 50 WP 0.05 % (10 g/10 lit of water) or fenpyroximate 5 EC 0.005 % (10 ml /10 lit of water), first spray at initiation of the pest and second at 20 days after first spray found effective against mobile stage of yellow mite, *Polyphagotarsonemus latus* (Banks) infesting cluster bean.



(Department of Entomology, CoA, JAU, Junagadh)



Evaluation of different insecticides against thrips in groundnut

Two sprays of spinetoram 11.7 SC 0.012 % (10 ml/10 L of water) or spinosad 45 SC 0.014 % (3 ml/10 L of water) or cyantraniliprole 10.26 OD 0.010 % (10 ml/10 L of water), first spray at the initiation of pest infestation and second at 10 days after first spray for the management of thrips in groundnut.



(Main Oilseeds Research Station, JAU, Junagadh)

Bio-efficacy of ready-mix insecticides against capsule borer, *Dichocrosis punctiferalis* infesting castor

Two sprays of chlorantraniliprole 10 + lambda cyhalothrin 5 ZC (4 ml/10 L of water) or novaluron 5.25 + emamectin benzoate 0.9 SC (15 ml/10 L of water) or novaluron 5.25 + indoxacarb 4.5 SC (16 ml/10 L of water) first spray at the initiation of pest infestation and second at 15 days after first spray for the management of castor capsule borer.



(Main Oilseeds Research Station, JAU, Junagadh)

Plant Pathology

Integrated management practices to minimize *Aspergillus flavus* infection in groundnut

Seed treatment with mancozeb 75 WP 3 g/kg of seed + chlorpyrifos 20 EC 25 ml/kg of seed at the time of sowing + furrow application of *Trichoderma harzianum* 1.00 % WP (2 x 10⁶ cfu/g min.) 2.5 kg in 500 kg of FYM/ha at the time of sowing + soil drenching of chlorpyrifos 20 EC 5 ml/lit of water at 30 and 60 days after sowing to reduce the aflarot infection in groundnut.



(Main Oilseeds Research Station, JAU, Junagadh)



Management of pearl millet blast (*Pyricularia grisea*) disease

Two sprays of azoxystrobin 11 + tebuconazole 18.30 SC 0.05 % (17.00 ml/10 L of water) or tebuconazole 50 + trifloxystrobin 25 WG 0.05 % (6.50 g/10 L of water) first at initiation of disease and second spray after 15 days of first spray for the management of blast disease in pearl millet.

(Pearl millet Research Station, JAU, Jamnagar)

Management of pearl millet blast by using chemical and bio agents

Spray of *Pseudomonas fluorescens* 1.00 WP 1×10^8 cfu/g min. (100 g/10 l of water) at 20 days after sowing (DAS) and second spray of tebuconazole 50 + trifloxystrobin 25 WG 0.04 % (5.33 g/10 L of water) at 35 DAS or two sprays of tebuconazole 50 + trifloxystrobin 25 WG 0.04 % (5.33 g/10 L of water) at 20 and 35 DAS for the management of blast disease in pearl millet.

(Pearl millet Research Station, JAU, Jamnagar)

Effect of different fungicides for the management of blight and powdery mildew in fennel

Three sprays of azoxystrobin 11 + tebuconazole 18.30 SC 0.044 % (15 ml/ 10 L water) or metiram 55 + pyraclostrobin 5 WP 0.18 % (30 g/10 L water) or tebuconazole 50 + trifloxystrobin 25 WG 0.045 % (6 g/10 L water) first spray at initiation of disease and subsequent two sprays at an interval of 20 days for the management of Alternaria blight of fennel.



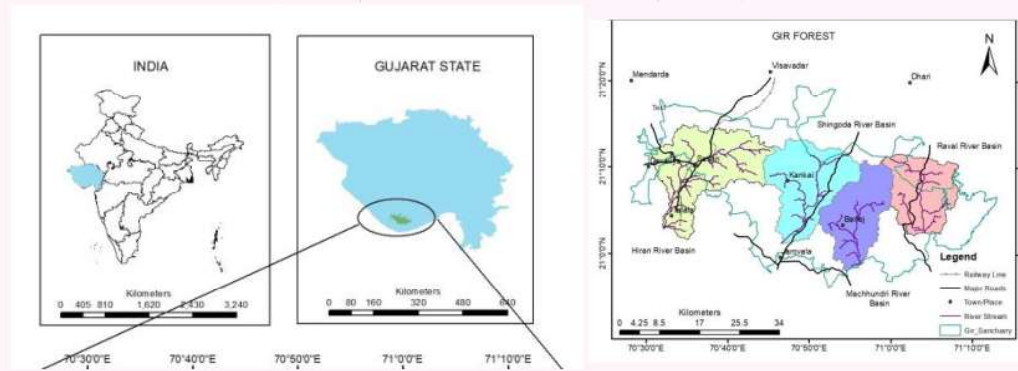
(Dept. of Plant Pathology, CoA, JAU, Junagadh)

IV AGRICULTURAL ENGINEERING

River flow simulations integrating satellite data in a forested catchment

In assessing the spatial soil wetness condition of a catchment, microwave remote sensing proves to be an invaluable tool. However, it is





advised the scientific community to exercise caution when applying scatterometer data for estimating river water levels in forested catchments. The presence of a dense forest canopy can lead to reduced radar backscatter, potentially affecting the accuracy of the estimates.

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

River flow simulations integrating satellite data in a forested catchment

It is recommended to use the following power function relationship as a tool for estimating downstream discharge (outlet discharge) based on water level measurements.

$$Y = a * X^b$$

Where, $a = 0.7501$, $b = 2.4511$, X = river water level, meter and Y = discharge in cumec)

This equation offers invaluable assistance to forest planners in effectively managing available water resources. By employing this relationship, planners can make informed decisions, ensuring sustainable and efficient water allocation within forested regions, thereby contributing to sound environmental stewardship and resource conservation.



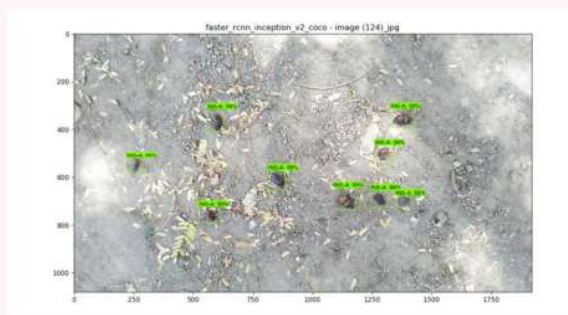
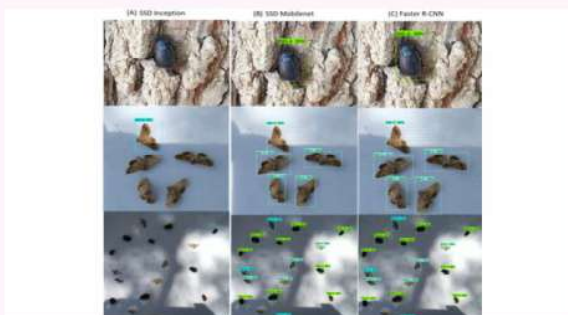
[Dept. of Soil & Water Conservation Engg., CAET, JAU, Junagadh]

Detection and Classification of the major Nocturnal flying Insects using Deep Learning

It is recommended to use Convolutional Neural Network (CNN)'s meta-architecture Faster Region-Convolutional Neural Network (Faster R-CNN) for the detection and classification through digital view of major nocturnal flying insects for better performance. In



the case of addressing class imbalance issues, an augmentation technique with Faster R-CNN is recommended.

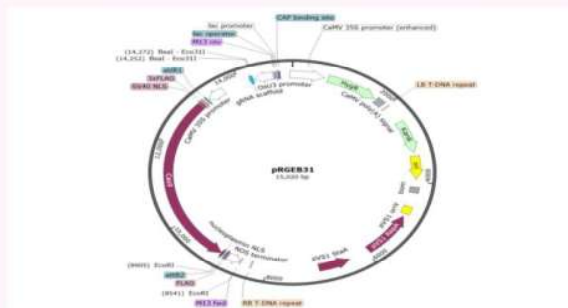


[Information Technology Cell, JAU, Junagadh]

V BASIC SCIENCE

Improvement of Groundnut oil quality for high oleic acid through CRISPR/Cas gene editing technology

The scientific community involved in groundnut improvement through genome editing technology is recommended to use the optimized tissue culture protocol using de-embryonated cotyledone as explants (multiple shoot formation: MS + 25.0 mg/l 6-benzylaminopurine, shoot elongation: MS + 3.0 mg/l 6-benzylaminopurine, + 1.0 mg/l gibberellic acid, root induction: MS + 1.0 mg/l naphthalene acetic acid), CRISPR/Cas9 technology and binary vector for successfully editing the gene of interest (AhFAD2B) in groundnut for achieving high O/L ratio (8.52). A single guide RNA sequence (5'TGTGGTCTATGATCTGTTAATGG3'), designed by using CHOPCHOP, was utilized to guide the Cas nuclease for precise editing.



(Department of Biotechnology, JAU, Junagadh)



VI SOCIAL SCIENCE

Changing Cost Structure and Total Factor Productivity Growth of Onion in Gujarat

It is suggested to the policymakers that since the onion yield growth rate during the last three decades in Gujarat could not outpace the growth in labour, seed and plant protection costs, the negative growth in total factor productivity (TFP) and higher growth of real cost of production (RCP) over farm harvest prices (FHP) need to be countered with the promotion of large-scale mechanisation in farm operations, proper management of agronomical practices and optimal seed rate.

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

Performance and determinants of Plant Varietal Protection (PVP) behaviour in Indian agriculture with special reference to Gujarat

It is recommended that targeted sensitization drives through training and workshops be scaled up to increase the grassroots awareness of PPVFRA and enhance the registration of farmers' varieties. In addition, it is also recommended for promoting location-specific hand-holding sessions for filing the applications of farmers to address the imbalances in crop-wise and region-wise registrations. Both public and private agencies should also be encouraged to share their infrastructure and technical knowledge, leading to the enhanced prospects of registration and commercialization of improved varieties/hybrid cultivars.

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

Hectarage Prediction Models for major Oilseed crops of Gujarat: An Empirical Investigation

It is recommended to the scientific community that area under selected crops can be precisely predicted using the single equation models rather than simultaneous equation models as single equation model gives maximum R^2 and $\bar{R}^2$ with low values of MAPE, RMSE and MAE.

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

Development of Statistical Analysis Programme using Python Machine Learning and Data Visualization

The scientists/researchers of SAUs are recommended to use new computer programs developed by the Junagadh Agricultural University



which are requirement specific, unique, user friendly with the important features of descriptive auto conclusion and auto data visualization for Individual, pooled, control vs rest CRD, RBD, FCRD and FRBD analysis respectively, simple linear, multiple linear and polynomial regression as well as one, two and pair sample T tests. It is also recommended to JAU to develop & design open source user interface, so SAUs of the Gujarat can be used these computer programs without any charges.

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

Farmers' adoption of cotton production technologies recommended by JAU, Junagadh

The extension functionaries are advised to conduct training programmes, field demonstrations and exhibitions of pest and disease samples for cotton growing farmers in line with the recommended cotton production technologies of Junagadh Agricultural University to ensure their maximum adoption by farmers.

(Dept. of Agril. Extension Education, CoA, JAU, Junagadh)

Value chain analysis of Kesar mango in Saurashtra region

Stakeholders and policymakers involved in the Kesar mango value chain in the Saurashtra region are advised to strengthen crop management system, develop post-harvest infrastructure and improve post-harvest operations to maintain better quality of Kesar mango for the remunerative farming and consumer satisfaction.

(Post Graduate Institute of Agribusiness Management, JAU, Junagadh)

Effect of micro irrigation system on livelihood in Saurashtra region

Extension functionaries are recommended to advise farmers of the Saurashtra region to adopt and use micro irrigation system in their farm to reduce their poverty level and increase the financial and overall livelihood.

(Post Graduate Institute of Agribusiness Management, JAU, Junagadh)



Table-1: Production and distribution of “Gir Sawaj” brand quality seeds; planting materials of fruit crops/ ornamental plants; bio-agent and liquid bio-fertilizers during the year 2023-24

Sr. No.	Particular	Production
1	Nucleus and Breeder Seeds (q)	4548
2	Truthful, foundation and certified seeds (q)	11019
3	Fruit crop graft (Nos.)	18386
4	Fruit crops saplings (Nos.)	44082
5	Seedlings (Nos.)	34527
6	Ornamentals & Medicinal plants (Nos.)	50858
7	Bioagents (<i>Trichoderma</i> , <i>Beauveria</i> , <i>Metarhizium</i>) (kg)	5500
8	Liquid biofertilizer (litre) (<i>Rhizobium</i> , <i>Azotobacter</i> , PSB, KMB, HNPV, SNPV)	2346
9	Fruit fly traps (Nos.)	11566
10	Fruit fly lure for fruit and vegetable crops (Nos.)	19963
11	Pheromone Trap (Nos.)	8919
12	Pheromone Lure for Pink bollworm (Nos.)	13476
13	Pheromone Lure (Nos.) (<i>Heliothis</i> , Brinjal shoot & fruit borer, <i>Spodoptera</i> and Fall armyworm)	3389

Table-2: Patent and Design Granted

Sr. No.	Title of Patent/ Design	Patent/ Design No.	Date of Grant
Patents			
1	Nano-biosensor and methods for Detecting Potassium Ion Concentration	438688	13/07/2023
2	A Grain Treater for Pre-Milling Enzymatic Treatment to Pigeon pea	470670	20/11/2023
3	Device for Insects Trapping for Managing Insects	478250	07/12/2023
4	A Process of Enzymatic Pre-treatment on varieties of Pigeonpea	486988	21/12/2023
5	Pomegranate Juice Extractor	506284	01/02/2024
6	Preparation of the Fishing Net Mending Table and its Application for Fabrication and Mending of the Fishing Net	528441	15/03/2024
Design			
7	Open Core Throat Less Downdraft Biomass Gasifier	394622-001	22/03/2024

Table-3: No. of Farm Machineries/ Implements/ equipments (category wise) tested at testing centre of FMPE, CAET during the year 2023-24

Category	Name of Equipment / Machine	No. of Equipment / Machine Tested
A	Land development, tillage & seedbed preparation equipment	60
B	Sowing and planting equipment	12
C	Intercultivation equipment	0
D	Plant protection equipment	10
E	Harvesting and threshing equipment	26
F	Equipment for residue management	11
G	Post-harvest and agro processing equipment	01
Total		120





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