Research Accomplishments and Recommendations

2024

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RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS

2024

Editors
Dr. R. A. Patel
Dr. A. L. Patel
Sh. R. B. Chauhan
Dr. S. N. Shah

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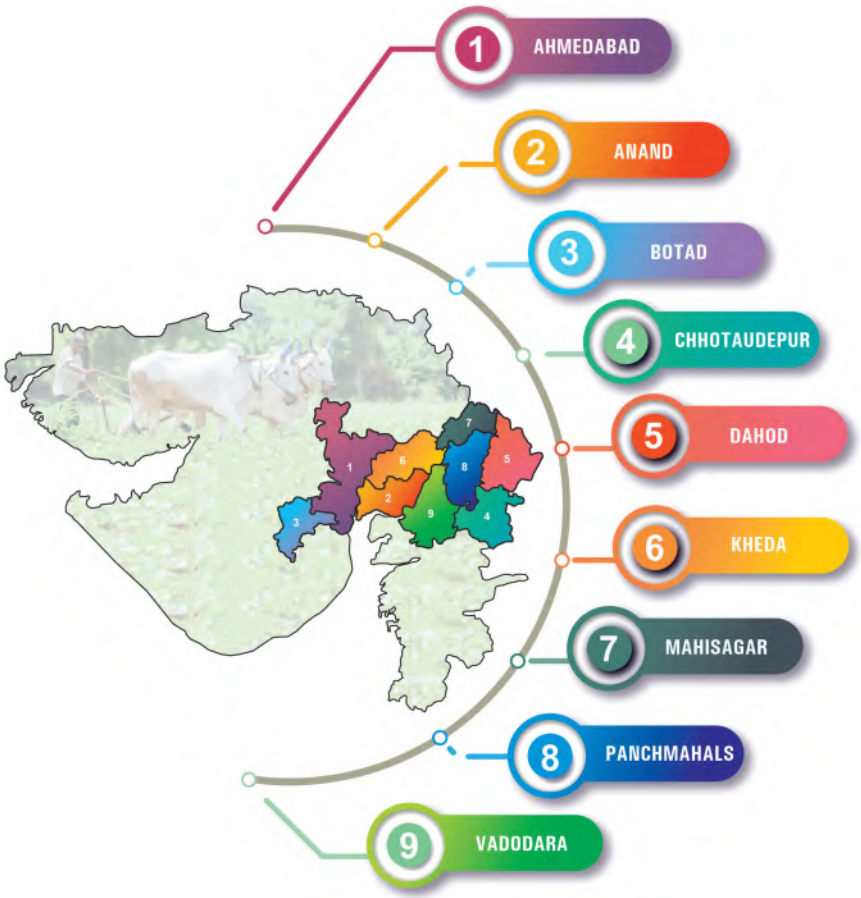
MESSAGE

Anand Agricultural University has the mandate of undertaking farmer-centric research through planning, execution, monitoring and evaluation of research and its application in agriculture and allied sciences. The scientists, teachers and supporting staff of the University dedicately work for developing suitable technologies to enhance productivity and improve quality of produce for the betterment of farmers.

I am happy that the University is publishing 'Research Accomplishments and Recommendations 2024' prepared by the Directorate of Research, Anand Agricultural University, Anand. I feel immense pleasure to put forth the informative publication containing location specific and need based technologies developed by the scientists of different faculties of the University for farming community, entrepreneur as well as scientific community of the state. I extend my congratulations to every scientist and individual involved in the research activities for the valuable work done by them which will help to improve agricultural development in the state.

The efforts made by the scientists is noteworthy, and I believe that the flavour of success will give them ample reasons to rededicate themselves for the cause of farmers of the State. I also take note of the contribution of the Director of Research Dr. M. K. Jhala and his team for monitoring and strengthening the research activities and also for their sincere effort in compilation of this publication.

(K. B. Kathiria)



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ANAND AGRICULTURAL UNIVERSITY
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Dr. M. K. Jhala
DIRECTOR OF RESEARCH
& DEAN PG STUDIES (I/c)

FOREWORD

I am happy to present the publication "Research Accomplishment and Recommendations 2024" of Anand Agricultural University. In this publication, information regarding newly generated technologies and six varieties developed for Maize, Desi Cotton, Chilli, Okra and Sponge gourd are elaborated. I take this opportunity to congratulate all the scientists who were directly or indirectly involved in developing the valuable technologies and release of varieties. The research efforts made will not only boost up the output of agriculture and allied sectors but will also improve the quality of the produce as well as help in solving many challenges faced by the state and the nation.

I express my sincere thanks to the Hon. Vice Chancellor, Dr. K. B. Kathiria for his continuous guidance for research as well as useful and constructive suggestions and decisions taken for improving the research facilities and activities in the university. I am very much thankful to all the conveners of AGRESCO sub-committees, Dr. S. N. Shah, Associate Director of Research (Agri), Deans and Unit Heads for their support in the process of monitoring, scrutinizing and executing the research projects of the University as well as conducting AGRESCO meetings smoothly.

The staff of the Directorate of Research deserves special appreciation for their constant support enabling me to justify the mandate of this office as well as for compiling and publishing the information well in time.

(M. K. Jhala)

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PREFACE

The research work carried out in different fields of agricultural sciences during the year 2023-24 has been discussed by different AGRESCO sub-committees for bringing out useful and beneficial recommendations for farmers, scientific community, entrepreneurs and other stake holders.

The numbers of recommendations and new technical programmes approved and recommended by combine AGRESCO of all the 4 SAUs are listed below.

Name of the sub-committee / faculty	No. of recommendations		No. of New Technical Programmes
	For farmers/ entrepreneurs	For scientific community	
Crop Improvement and Basic Science	06	06	12
Crop Production	25	04	44
Plant Protection	05	49	21
FPT&BE, Agri. Engineering & AIT	06	07	09
Social Science	--	05	31
Total	**42**	**71**	**117**

Schedule of 20th Sub-committee meetings of AGRESCO, Joint AGRESCO of AAU and Combined AGRESCO meeting

Sr. No	Name of Sub-committee	Date/s
1	Social Science	February 16 & 17, 2024
2	AET, AIT and FPT	February 26 & 27, 2024
3	Plant Protection	March 1 & 2, 2024
4	Crop Production	March 5 & 6, 2024
5	Crop Improvement	March 11 & 12, 2024
6	Joint AGRESCO	April 4, 2024
7	20th Combined AGRESCO of SAUs	May 10 – 17, 2024






RECOMMENDATIONS FOR FARMING COMMUNITY

CROP IMPROVEMENT

1. Crop: Maize

Variety: Gujarat Maize Hybrid 5 (GMH 5: Panam Gold)

The farmers of maize growing areas of Gujarat are recommended to grow Gujarat Maize Hybrid 5 (GMH 5: Panam Gold) during *kharif* season. This hybrid gave 7094 kg/ha average kernel yield, and it was 44.7 and 3.5% higher yield than checks GAYMH 1 and Bio-605, respectively. It is medium maturing and having orange flint kernels with higher test weight (367 g). It contains 69.45% starch, 12.55% protein, 4.85% oil, 0.59% tryptophan and 2.67 % lysine in protein. This hybrid is moderately resistant against *Maydis* Leaf Blight, *Turcicum* Leaf Blight and *Fusarium* stalk rot disease.

(Research Scientist, MMRS, AAU, Godhra)

2. Crop: Cotton

Variety: Gujarat Desi Cotton 5 (GDC 5: Anand Kanchan)

The farmers of Gujarat growing rainfed *desi* cotton are recommended to grow high yielding and long linted variety Gujarat Desi Cotton 5 (GDC 5: Anand Kanchan). This variety gave 1375 kg/ha seed cotton yield which was higher by 5.8, 20.3 and 24.8% over check varieties *viz.,* G Cot 21, GADC 2 and GADC 4, respectively over its mean. It has recorded 34.2 *per cent* ginning out turn, 27.3 mm upper half mean length, 4.2 micronaire value and 26.6 g/tex tenacity in HVI mode.

(Associate Research Scientist, RCRS, AAU, Viramgam)

3. Crop: Chilli

Variety: Gujarat Vegetable Chilli Hybrid 2 (GVCH 2: Anand Surya)

The farmers of green chilli growing area of Gujarat are recommended to grow Gujarat Vegetable Chilli Hybrid 2 (GVCH 2: Anand Surya) during *kharif-rabi* season. This hybrid gave 198.96 q/ha average green fruit yield in Gujarat which exhibited 22.64 and 52.78 *per cent* higher over the checks GAVCH 1 and GAVC 112, respectively. Fruits of this hybrid have light green colour at unripe stage and medium sinuation of pericarp, slightly rough texture with strong glossiness. This hybrid contains 0.160% total antioxidant activity, 0.195% capsaicin, 2.80% total soluble sugars and 0.059% flavonoid. Under natural field condition, this hybrid is less affected by chilli leaf curl disease incidence as well as fruit borer and thrips infestation comparable to the check GAVCH 1.

(Research Scientist, MVRS, AAU, Anand)

4. Crop: Sponge Gourd

Variety: Gujarat Sponge Gourd 3 (GSG 3: Anand Mrudula)

The farmers of Gujarat are recommended to grow sponge gourd variety Gujarat Sponge Gourd 3 (GSG 3: Anand Mrudula) during *kharif* season. This variety recorded average fruit yield 126.72 q/ha which was 33.88, 19.53 and 13.69% higher over checks GSG 1, GJSG 2 and Pusa Chikni, respectively in Gujarat. This variety has medium size fruits having dark green skin with white flesh colour. This variety contains 2.18% total soluble sugar, 9.36 mg/100gm ascorbic acid and 0.97% crude protein. This variety has comparable prevalence of CMV, powdery mildew and downy mildew diseases as well as less leaf miner and fruit fly infestation as compared to the check Pusa Chikni and GJSG 2.

(Research Scientist, MVRS, AAU, Anand)

5. Crop: Chilli

Variety: Gujarat Vegetable Non Pungent Chilli 132 (GVNPC 132: Anand Saumya)

The farmers of green chilli growing area of Gujarat are recommended to grow chilli variety, Gujarat Vegetable Non-Pungent Chilli 132 (GVNPC 132: Anand Saumya) during *kharif-rabi* season. This variety gave 195.26 q/ha average green fruit yield in Gujarat which exhibited 69.23 *per cent* higher green fruit yield over the check AVNPC 131. Fruits of this variety have medium intensity of green colour, big in size and non-pungent at unripe stage with smooth texture and strong glossiness. This variety contains higher antioxidant activity (0.112%) as well as total soluble sugars (3.00%) and lower content of capsaicin (0.088%) as compared to the check AVNPC 131. This variety has lower or comparable level of chilli leaf curl disease, fruit damage by fruit borer and thrips infestation as compared to the check AVNPC 131.

(Research Scientist, MVRS, AAU, Anand)

6. Crop : Okra

Variety: Gujarat Okra 9 (GO 9: Anand Anamika)

The farmers of Gujarat are recommended to grow Gujarat Okra 9 (GO 9: Anand Anamika) during *kharif* and summer seasons. It recorded 137.86 q/ha average fruit yield in Gujarat which manifested 22.33, 25.84, 33.04 and 17.20 per cent higher fruit yield over the checks GAO 5, GO 6, Pusa Sawani and GAO 8, respectively in *kharif* season. It produced 111.31 q/ha average fruit yield in summer season, which was 22.31, 29.66, 34.25 and 12.48% higher than checks GAO 5, GO 6, Pusa Sawani and GAO 8, respectively. This variety has short plant stature with short internodes, long leaf blade length and broad width with deep depth of lobbing. Fruits of this variety are dark green colour, tender, smooth, medium long having acute shape of apex. This variety contains 2.715% total soluble sugars, 0.112% phenol, 0.207% antioxidant activity and 14.47 g/kg mucilage which were found comparable with checks GAO 5, GO 6, Pusa Sawani and GAO 8. Under natural field conditions, this variety has less prevalence of yellow vein mosaic virus disease and enation leaf curl virus disease. It has lower jassids and whitefly population as well as shoot and fruit damage as compared to the checks GAO 5, GO 6, Pusa Sawani, GAO 8 and susceptible check (ELCv) AOL 23-01.

(Research Scientist, MVRS, AAU, Anand)

CROP PRODUCTION

CULTURAL PRACTICES

1. Study the feasibility of conservation tillage in rice - wheat cropping system under middle Gujarat conditions

The farmers of middle Gujarat Agro-climatic Zone growing wheat crop after rice harvested with combined harvester are recommended to drill wheat seed with happy seeder followed by spraying of Anubhav Bacterial Biodegradable Consortium (ABBC) @ 2 L/ha (5×10^9 CFU/ml) on rice residues to obtain higher wheat equivalent yield and net returns. Further, conservation tillage practices with ABBC improve the physico-chemical and biological properties of soil.

Conservation tillage + Anubhav Bacterial Biodegradable Consortium (ABBC)

(Research Scientist, RRS, AAU, Anand)

2. Assessment of organically managed pigeon pea based cropping sequence

The farmers of middle Gujarat Agro-climatic Zone are recommended to grow pigeonpea in *kharif* and greengram or cowpea in summer season organically and apply 25 kg N/ha through vermicompost (approx. 1250 kg/ha) only to pigeonpea crop for getting higher yield and net return.

(Research Scientist, PRS, AAU, Vadodara)

3. Effect of spacing and phosphorus management on pigeon pea grown on heavy black soil

The farmers of middle Gujarat Agro-climatic Zone growing pigeon pea (AGT2) are recommended to treat seeds with ANUBHAV PSB and *Rhizobium* culture each at 5 mL/kg seed each before sowing and fertilize the crop with 5 t FYM and 25 kg P_2O_5/ha as basal and sow the crop in paired row either at the spacing of 60-120-60 cm or 60-150-60 cm for getting higher yield and net return. Besides, application of recommended dose of nitrogen (25 kg/ha) as basal.

60-120-60 cm (Paired row) + 25 kg P_2O_5/ha + PSB

60-150-60 cm (Paired row) + 25 kg P_2O_5/ha + PSB

180 x 60 cm (Farmer's practice) +50 kg P_2O_5/ha

(Assistant Research Scientist, NIRP, AAU, Khandha)

4. Effect of spacing and nutrient management in summer black gram

The farmers of Chhotaudepur region of middle Gujarat Agro-climatic Zone growing black gram in summer season are recommended to sow at 30 cm row spacing and apply 20:20:0 kg/ha N:P_2O_5:K_2O/ha as basal for getting higher yield and net return.

30 cm row spacing + 20:20:0 kg/ha N:P_2O_5:K_2O/ha

(Principal, CoA, AAU, Jabugam)

5. Effect of spacing, nitrogen levels and biofertilizer on yield of *desi* cotton variety Wagad Gaurav under rainfed condition

The farmers of North-West Agro-climatic Zone and *Bhal* & Coastal Agro-climatic Zone growing rainfed *desi* cotton (GADC 3) are recommended to treat the seed with bio NPK consortium (10 mL/kg) keeping sowing distance either 120 x 30 cm or 180 x 45 cm and apply 40 kg N (two equal splits at 25-30 DAS and 50-60 DAS) to get higher seed cotton yield and net return.

120 x 30 cm + 40 kg N + Bio NPK

180 x 45 cm + 40 kg N + Bio NPK

(Associate Research Scientist, RCRS, AAU, Viramgam)

NUTRIENT MANAGEMENT

6. Effect of nitrogen levels on yield and quality of bidi tobacco varieties under middle Gujarat conditions

The farmers of middle Gujarat Agro-climatic Zone growing bidi tobacco (GT 7) are recommended to apply 10 t FYM/ha as basal along with 180 kg N/ha in four equal splits (45 kg N as basal through Ammonium sulphate, 135 kg N applied in three equal splits through Urea at 30 days interval after transplanting) for getting higher yield and net return.

10 t FYM/ha as basal along with 180 kg N/ha

(Research Scientist, BTRS, AAU, Anand)

7. Effect of potassium application on the yield of *Kharif* maize

The farmers of middle Gujarat Agro-climatic Zone growing hybrid maize in *kharif* season are recommended for seed treatment of 5 mL KMB/kg seed and soil application of 1 L KMB/ha (in 300 L water/ha) at 30 DAS along with recommended dose of nitrogen and phosphorus (160:20 N:P_2O_5 kg/ha) for getting higher yield and net return. Application of potash in *kharif* maize did not increase the yield.

Seed treatment of 5 mL KMB/kg seed and soil application of 1 L KMB/ha

Control

(Research Scientist, MMRS, AAU, Godhra)

8. Effect of potassium application on the yield of *Rabi* maize

The farmers of middle Gujarat Agro-climatic Zone growing hybrid maize in *rabi* season are recommended for seed treatment of KMB 5 mL/kg seed and soil application@ 1 L/ha at 30 DAS along with recommended dose of nitrogen and phosphorus (150:40 N:P_2O_5 kg/ha) for getting higher yield and net return. Application of potash in *rabi* maize did not increase the yield.

Seed treatment of 5 mL KMB/kg seed and soil application of 1 L KMB/ha

Control

(Research Scientist, MMRS, AAU, Godhra)

9. Integrated nutrient management for rice residual wheat crop sequence

The farmers of middle Gujarat Agro-climatic Zone growing Rice-Wheat cropping sequence are recommended to adopt any one of the following integrated nutrient management practices for getting higher yield and net return.

1. 50% RDF + 50% through castor cake i. e. 16 kg N, 12.50 kg P_2O_5 and about 900 kg castor cake/ha as basal, remaining 16 kg N/ha at tillering and 8 kg N/ha at panicle initiation stage through inorganic sources in rice.

OR

2. 75% RDF + 25% through castor cake i. e. 24 kg N, 18.75 kg P_2O_5 and about 450 kg castor cake/ha as basal, remaining 24 kg N/ha at tillering and 12 kg N/ha at panicle initiation stage through inorganic sources in rice.

(Research Scientist, MRRS, AAU, Nawagam)

10. Nutrient management in summer groundnut

The farmers of Chhotaudepur region of middle Gujarat Agro-climatic Zone growing groundnut in summer season are recommended for seed treatment with Bio NPK 5mL/kg seed along with application of 12.5:25:0 N:P_2O_5:K_2O kg/ha as a basal dose for getting higher yield and net return.

Seed treatment Bio NPK 5mL/kg seed + 12.5:25:0 N:P_2O_5:K_2O kg/ha

(Principal, CoA, AAU, Jabugam)

11. Nutrient management in summer sesame

The farmers of Chhotaudepur region of middle Gujarat Agro-climatic Zone growing sesame in summer season are recommended to apply 37.5:12.5:0 N:P_2O_5:K_2O kg/ha, of which 50 % N and 100 % P_2O_5 as basal, while remaining 50 % N at 30 DAS for getting higher yield and net return.

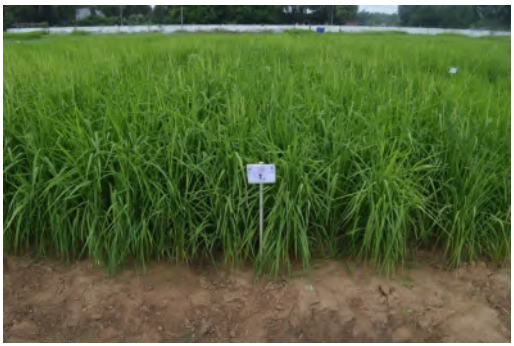
37.5:12.5:0 N:P_2O_5:K_2O kg/ha

(Principal, CoA, AAU, Jabugam)

12. Effect of soil and foliar application of multi-micronutrient mixture on growth, yield and nutrient content of drilled paddy

The farmers of Middle Gujarat Agro-climatic Zone growing drilled paddy are recommended to apply either 1.0% foliar spray (100 g/10 L water) of Government notified multi-micronutrient mixture Grade II (Fe: 6.0, Mn: 1.0, Zn: 4.0, Cu: 0.3 and B:0.5 per cent) OR 0.5% foliar spay of $FeSO_4$ (50 g/10 L water) at 20, 40 and 60 days after sowing along with 50 kg N /ha, of which 25 kg N per hectare and 25 kg P_2O_5/ha as basal and 25 kg N/ha at 30 days after sowing for getting higher yield and net return.

Note: 0.5% $FeSO_4$ solution should be neutralized with 0.25% Lime solution.



RDF + MM Grade II 1.0% foliar spray at 20, 40 and 60 DAS

(Associate Research Scientist, ARS, AAU, Derol)

WEED MANAGEMENT

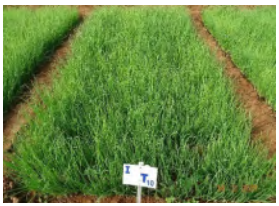
13. Weed management in onion nursery

The farmers of Gujarat raising onion seedlings in nursery keeping the distance of 10 cm between row are recommended to adopt any one of the following weed

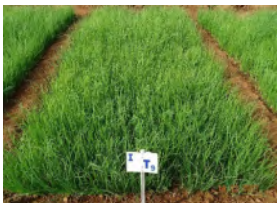
management practices for effective management of weeds, obtaining healthy transplantable onion seedlings and higher return.

- Propaquizafop 5% + oxyfluorfen 12% w/w EC (PM) 43.75+105 g a.i./ha (17.5 mL /10 L of water) at 10-15 DAS
- Oxyfluorfen 23.5% EC 80 g a.i./ha (6.8 mL /10 L of water) at 10-15 DAS
- Pendimethalin 30% EC 300 g a.i./ha (20 mL /10 L of water) at 1-2 DAS
- Hand weeding at 15 and 30 DAS

There was no any adverse effect of applied herbicide in onion nursery on succeeding crops (Wheat, Chickpea and Mustard).

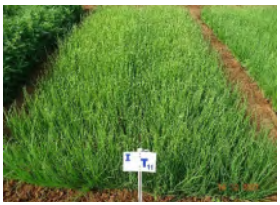


Propaquizafop 5% + oxyfluorfen 12% w/w EC at 10-15 DAS



Oxyfluorfen 23.5% EC 80 g a.i./ha EPoE

Pendimethalin 30% EC 300 g a.i./ha PE



Hand weeding at 15 and 30 DAS

Weedy check

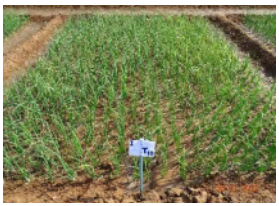
(Agronomist, AICRP-WM, BACA, AAU, Anand)

14. Weed management in onion

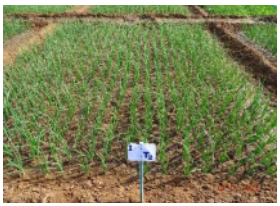
The farmers of Gujarat growing onion in *rabi* season by transplanting are recommended to adopt any one of the following weed management practices for effective management of weeds, obtaining higher onion bulb yield and return.

- Propaquizafop 5% + oxyfluorfen 12% w/w EC (PM) 43.75 +105 g/ha (17.5 mL /10 L of water) at 25-30 DATP
- Pendimethalin 38.7% CS 580.5 g/ha (30 mL/10 L of water) at 2-3 DBTP *fb* oxyfluorfen 23.5% EC 120 g/ha (10.2 mL/10 L of water) at 25-30 DATP
- Oxyfluorfen 23.5% EC 120 g/ha (10.2 mL /10 L of water) at 2-3 DATP *fb* propaquizafop 5% + oxyfluorfen 12% w/w EC (PM) 43.75 +105 (17.5 mL / 10 L of water) g/ha at 25-30 DATP
- Twice hand weeding at 20 and 40 DATP.

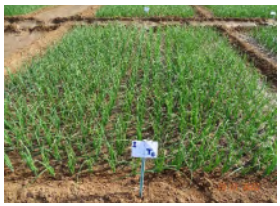
There was no adverse effect of applied herbicide in rabi onion on succeeding (pearl millet, maize and greengram) crops.



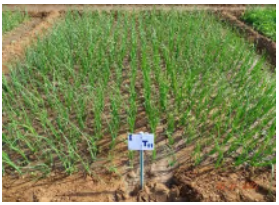
Propaquizafop 5% + oxyfluorfen 12% w/w EC at 25-30 DATP



Pendimethalin 38.7% CS at 2-3 DBTP *fb* oxyfluorfen 23.5% EC at 25-30 DATP



Oxyfluorfen 23.5% EC at 2-3 DATP *fb* propaquizafop 5% + oxyfluorfen 12% w/w EC at 25-30 DATP



Twice hand weeding at 20 and 40 DATP

Weedy check

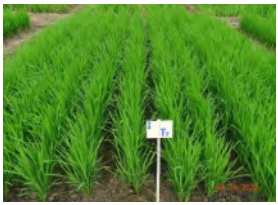
(Agronomist, AICRP-WM, BACA, AAU, Anand)

15. Weed management in direct dry seeded rice under irrigated condition

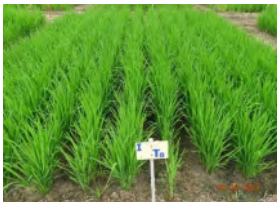
The farmers of middle Gujarat Agro-climatic Zone growing direct seeded rice (DSR) are recommended to adopt any one of the following weed management practices for effective management of weeds, obtaining higher grain yield and return.

- Triafamone 20% + ethoxysulfuron 10% WG (premix) 44.0+22.5 g a.i./ha (4.5 g/10 L of water) at 10-15 DAS *fb* HW at 30 DAS
- Penoxsulam 1.02% + cyhalofop-butyl 5.1% OD (premix) 120 g a.i./ha (40 mL /10 L of water) at 10-15 DAS *fb* HW at 30 DAS
- Pretilachlor 30% + pyrazosulfuron-ethyl 0.75% WG (premix) 600+15 g a.i./ha (40 g/10 L of water) at 1-2 days after sowing *fb* HW at 30 DAS
- Hand weeding at 20 and 40 DAS

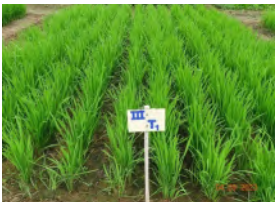
There was no adverse effect of applied herbicide in direct dry seeded rice (DSR) on succeeding (wheat, chickpea and mustard) crops.



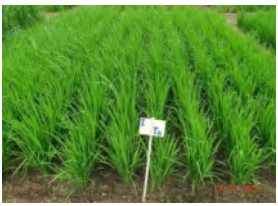
Triafamone 20% + ethoxysulfuron 10% WG (premix) at 10-15 DAS *fb* HW at 30 DAS



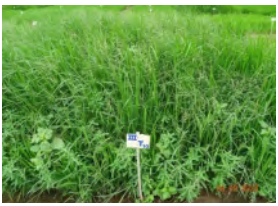
Penoxsulam 1.02% + cyhalofop-butyl 5.1% OD (premix) at 10-15 DAS *fb* HW at 30 DAS



Pretilachlor 30% + pyrazosulfuron-ethyl 0.75% WG (premix) at 1-2 days after sowing *fb* HW at 30 DAS



Hand weeding at 20 and 40 DAS



Weedy check

(Agronomist, AICRP-WM, BACA, AAU, Anand)

WATER MANAGEMENT

16. Response of sweet corn hybrid to irrigation in sandy loam soil

The farmers of middle Gujarat Agro-climatic Zone growing hybrid sweet corn in *rabi* season are recommended to irrigate the crop at sowing and at three critical stages i.e. knee-high stage (35 DAS), tasseling stage (55 DAS) and grain formation stage (65 DAS) for getting higher green cob yield and net return.

(Research Scientist, MMRS, AAU, Godhra)

HORTICULTURE

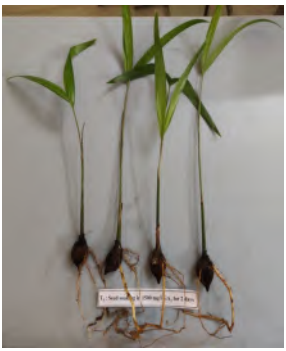
17. Effect of integrated nutrient management on growth and yield of potato (*Solanum tuberosum* L.)

The farmers of middle Gujarat Agro-climatic Zone growing potato are recommended to apply 25% RDN through vermicompost (approximately 5 t/ha) or FYM (approximately 9 t/ha) and 75 % RDF (165-82-165 NPK kg/ha) from chemical fertilizers. From this N, P and K each 82 kg/ha should be applied as basal and remaining 83 kg N and K should be applied at 30 DAP for getting higher yield and net return.

(Principal, College of Horticulture, AAU, Anand)

18. Effect of seed treatment on germination of foxtail palm (*Wodyetia bifurcata*)

Nurserymen are recommended to grow foxtail palm seeds in walk in tunnel by soaking the seed for two days (48 hrs.) in 1000 ppm solution of gibberellic acid (1000 mg / 1 L water) and sowing in plastic bag for early germination and higher survival.



Seed soaking in 1000 mg GA_3 / 1 L water for 2 days

(Principal, College of Horticulture, AAU, Anand)

19. Effect of seed treatment on germination of fishtail palm (*Caryota urens* L.)

Nurserymen are recommended to grow fishtail palm seeds in naturally ventilated poly house with seed soaking for one day (24 hrs.) in 1000 ppm solution of gibberellic acid (1000 mg / 1 L water) for early germination, higher survival and quality planting material.

Seed soaking in 1000 mg GA_3 / 1 L water for 1 day

(Principal, SDM Polytechnic, AAU, Vadodara)

20. Effect of IBA and growing conditions on growth of cutting in mogra (*Jasminum sambac*) var. Local.

Nurserymen are recommended to propagate mogra in winter season (December) by semi-hardwood cuttings after dipping the basal end cuttings in IBA 1500 mg/L water for 5 minutes and placing them after planting in Naturally Ventilated Poly house to get early growth and higher survival percentage.

Dipping the basal end cuttings in IBA 1500 mg/L water then after planting in Naturally Ventilated Poly house

(Principal, SDM Polytechnic, AAU, Vadodara)

21. Effect of growing condition, rootstock height and poly-tube cap on softwood grafting in jamun

Nursery men are recommended that, 15 months old root stock are grafted with soft wood grafting method from the height of 20 cm during the first week of November and kept in naturally ventilated polyhouse for getting higher grafted plant height and growth as well as more number of surviving grafts.

Soft wood grafting from the height of 20 cm and kept in NVPH

(Principal, SDM Polytechnic, AAU, Vadodara)

22. Effect of secondary nutrients on yield and quality of banana

The farmers of middle Gujarat Agro-climatic Zone growing banana cv. Grand Naine are recommended to apply Bentonite Sulphur (90 %) 10 g/plant at planting and $CaNO_3$ 12 g/plant in equal split at 4^{th}, 5^{th} and 6^{th} month after planting as a soil application along with RDF for getting higher yield and net return.

Note: 10 kg FYM/plant applied at planting and 40 % NK and 100 % P applied at 30 and 60 DAP in ring equal split and remaining 60 % NK applied at 90, 105, 120, 135, 150, 165 DAP equal split as fertigation.

Bentonite Sulphur (90 %) 10 g/plant + $CaNO_3$ 12 g/plant

(Principal, CoA, ARS, AAU, Jabugam)

23. Effect of micronutrients on yield and quality of banana

The farmers of middle Gujarat Agro-climatic Zone growing banana cv. Grand Naine are recommended to apply multimicronutrient government notified Grade-V @ 40 g/plant or Banana shakti @ 20 g/plant each at second and fourth month after planting as a soil application along with

RDF for getting higher yield and net return.

Note: 10 kg FYM/plant applied at planting and 40 % NK and 100 % P to be applied at 30 and 60 DAP in ring equal split and remaining 60 % NK applied at 90, 105, 120, 135, 150, 165 DAP equal split as fertigation.

Multimicronutrient Grade V @ 40 g/plant

Banana shakti @ 20 g/plant

(Principal, CoA, AAU, Jabugam)

24. Integrated nutrient management in brinjal (*Solanum melongena* L.)

The farmers of middle Gujarat Agro-climatic Zone growing brinjal are recommended to dip seedling root for 15 minutes before transplanting in liquid Bio NPK consortium (5 mL/L water) and fertilized with 80-40-40 NPK kg/ha (20 kg N, 40 kg P_2O_5 and 40 kg K_2O/ha as basal and remaining 60 kg N/ha applied in three equal split at 30 days interval after transplanting) and soil drenching with Bio NPK (1 L Bio NPK in 500 L water/ha) at 40 and 70 DATP.

80 % RDF + seedling dip with Bio NPK + soil drenching with Bio NPK at 40 and 70 DATP

(Pro. & Head, Department of Plant Pathology, BACA, AAU, Anand)

25. Integrated nutrient management in chilli (*Capsicum annuum* L.)

The farmers of middle Gujarat agro-climatic zone growing chilli are recommended to dip seedling root in liquid Bio NPK consortium (5 mL/L water) for 15 minutes before transplanting and 100-40-40 NPK kg/ha (25 kg N, 40 kg P_2O_5 and 40 kg K_2O/ha as basal and remaining 75 kg N/ha applied in three equal split at 30 days interval after transplanting) and soil drenching with Bio NPK (1 L Bio NPK in 500 L water / ha) at 40 and 70 DATP for getting higher yield and net return.

80 % RDF + seedling dip with Bio NPK + soil drenching with Bio NPK at 40 and 70 DATP

(Pro. & Head, Department of Plant Pathology, BACA, AAU, Anand)

PLANT PROTECTION

AGRICULTURAL ENTOMOLOGY

1. Effectiveness of fruit bagging on Rose-Ringed Parakeet *Psittacula krameri* (Scopoli) damage in guava

The farmers of Gujarat having guava orchard are recommended to bag fruits before maturity with butter paper bag (20 × 24 cm) to reduce the damage caused by rose ringed parakeet.

(Associate Research Scientist, AINP on VPM, Agril. Ornithology, Anand)

PLANT PATHOLOGY AND NEMATOLOGY

2. Evaluation of organic materials against root-knot nematodes in tomato

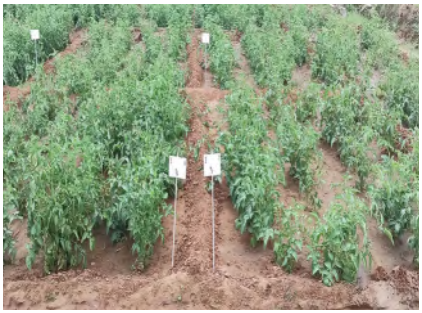
Farmers growing tomato in middle Gujarat are recommended to apply Agniastra 800 mL in 10 L of water and then dip the seedling roots for six hours. Thereafter,

drench 500 mL Agniastra solution per plant at the time of transplanting and at 15, 30 and 45 days after transplanting for effective management of root-knot nematodes. The method for preparation of Agniastra is mentioned below:

Ingredients	Required Quantity
Cow urine (*desi*)	20 L
Neem leaves paste	5 kg
Garlic paste	500 g
Green chillies paste	500 g
Tobacco dust	1 kg

- Mix all the ingredients together in vessel and boil it 4-5 times continuously at medium flame and keep it for 48 hrs. Filter this by cloth and then use it.

Root deep treatment in Agniastra @ 800 mL / 10 L water



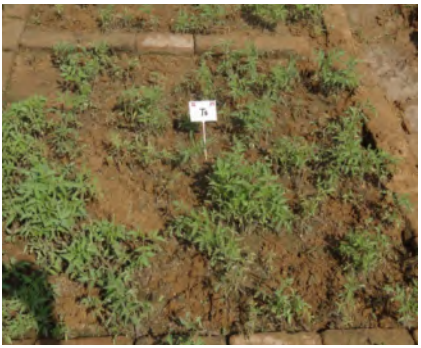
Untreated check

(Professor and Head, Dept. of Nematology, BACA, AAU, Anand)

3. Eco-friendly management of *Meloidogyne* spp. infecting tomato in nursery tomato

Farmers raising tomato nursery in Gujarat are recommended for soil application of neem cake powder @ 200 g/m^2 area at 15 days prior to seeding in nursery for the effective management of root-knot nematodes and thereby increase in number of transplantable seedlings.

Neem cake @ 2 t/ha



Control

(Professor and Head, Dept. of Nematology, BACA, AAU, Anand)

4. Bio-efficacy of fungicidal schedule for management of damping-off in bidi tobacco nursery

1. Drench ready-mix fungicide metalaxyl 8% + mancozeb 64%, 30 g/200 L water/100 m^2 two days before seeding in nursery with rose cane
2. Drench Bordeaux mixture (0.6% copper sulphate 1.2 kg and lime 1.2 kg dissolved separately in water and make final volume 200 L), drench it in 100 m^2 with rose cane at the appearance of disease
3. Drench ready-mix fungicide metalaxyl 8% + mancozeb 64%, 30 g/200 L water/100 m^2 in nursery with rose cane again if the disease reappears
4. Spray drench of azoxystrobin 23 SC, 50 mL/50 L water/ 100 m^2 with knapsack sprayer again, if the disease reappears

OR

1. Spray drench of azoxystrobin 23 SC, 50 mL/50 L water/ 100 m^2 two days before seeding in nursery with knapsack sprayer

2. Drench Bordeaux mixture (0.6 %, copper sulphate 1.2 kg and lime 1.2 kg dissolved separately in water and make final volume 200 L), drench it in 100 m^2 with rose cane at the appearance of disease

3. Again, if disease reappear, spray drench of azoxystrobin 23 SC, 50 mL/50 L water/100 m^2 with knapsack sprayer

4. Drench ready-mix fungicide metalaxyl 8 % + mancozeb 64 %, 30 g/200 L water/100 m^2 in nursery with rose cane again, if the disease reappears

Recommendation for PHI as per CIB guidelines

Year	Crop	Pest	Pesticide with formulation	Dosage				Application schedule	Waiting period/ PHI (days)
				g. a.i./ ha	Quantity of formulation/ ha	Conc. (%)	Dilution in water (10 L)		
2024	Bidi Tobacco (Nursery)	Damping-off	Metalaxyl 8 % + mancozeb 64	3.6 kg	5.0 kg	0.015	1.5 g	As per treatment detail	--
			Azoxystrobin 23 SC	230	1 L	0.023	10 mL		

(PI and Research Scientist, BTRS, AAU, Anand)

5. Rotational study with resistant bidi tobacco to manage root-knot disease in bidi tobacco

Bidi tobacco farmers whose fields are infested with root-knot nematode are recommended to grow Anand Bidi Tobacco 10 (root-knot resistant) by replacing susceptible variety for four years continuously for effective management of root knot nematode.

(PI and Research Scientist, BTRS, AAU, Anand)

FPT&BE, AGRICULTURAL ENGINEERING AND AIT

FOOD PROCESSING TECHNOLOGY

1. Process development for nutritive extruded snack utilizing amaranth grain

Entrepreneurs and food processors interested in manufacturing nutritious extruded snacks are recommended to adopt technology developed by AAU, Anand. The technology involves blending of coarse flours of amaranth (40%), rice (30%) and maize (30%) followed by moisture conditioning (15.3%). This flour blend is passed through the extruder (Screw speed: 287.50 rpm, Barrel temperature: 118°C) and extruded snack is further dried for 1 h at 60 °C in a hot air oven. This product contains 12.2% protein, 4.8% fat, 4.9 mg/100 g iron, 65.0 mg/100 g calcium, 3.9 mg/100 g zinc and 469.3 mg/100 g phosphorus. The product remains acceptable up to 90 days at ambient temperature. The cost of 100 g pack is approximately Rs. 6.42.

Optimized amaranth based extruded snack

(PI & HOD, Dept. of FPT, College of FPTBE, AAU, Anand)

2. Standardization of thermal processing of drumstick pod pulp and its utilization in food products

Part-I

Entrepreneurs and food processors interested in processing of drumstick pod are recommended to adopt the technology developed by Anand Agricultural University, Anand. In this technology, matured drumstick pods are washed, cut and blanched followed by pulp extraction using brush type pulper, filling in retortable pouches, exhausting, sealing of pouches and thermal processing at F0 5 min in retort. This processed and packaged product of drumstick is acceptable up to 12 months at ambient condition.

Part-II

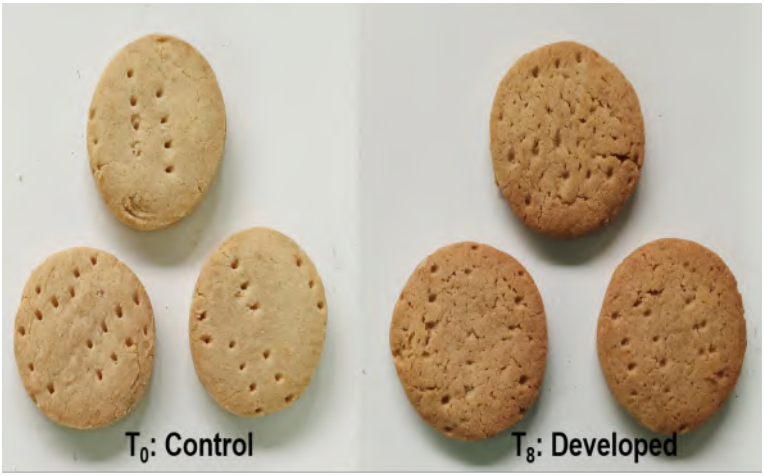
Entrepreneurs and food processors interested in production of drumstick chutney from thermally processed drumstick pod pulp are recommended to adopt the technology developed by Anand Agricultural University, Anand. The micronutrients rich drumstick chutney can be prepared with 62 % drumstick pod pulp and with other ingredients. The chutney is thermally processed, filled hot and packed in metalized laminated polyester pouches. The shelf life of drumstick chutney is 137 days at 7°C and 83 days at 30°C.

(PI & HOD, Dept. of FPT, College of FPTBE, AAU, Anand)

3. Development of sorghum based multigrain biscuits

Bakery owners and entrepreneurs interested in production of multigrain gluten free biscuits are recommended to use the technology developed by Anand Agricultural University, Anand. The technology involves formulation of 65 % sorghum flour, 20 % soybean flour and 15 % oat flour. This product contains 11.69 % protein and 2.57 %

fiber. The biscuits packed in polypropylene and aluminum laminates have remained acceptable upto 60 days at 30±1ºC temperature.



Sorghum multigrain Biscuits
(65% sorghum flour + 15% oat flour + 20% soybean flour)

(PI & HOD, Dept. of FPT, College of FPTBE, AAU, Anand)

4. Development of pizza base incorporating millets

The technology developed by Anand Agricultural University is recommended to the bakery owners and entrepreneurs interested in manufacturing millet pizza base. Millet pizza base prepared by 40% Maida, 35% Sorghum flour, 15% Moraiyo flour and 10% Kodo flour shows 2.06g (68.90%) and 2.19g (106.80%) more ash and fiber per 100g, respectively as compared to normal pizza base. Antioxidant activity of millet pizza base was found slightly higher as compared to control. Millet pizza base can be stored up to 4 days in polyethylene pouches at ambient temperature.

Millet pizza base

(PI & HOD, Dept. of FPT, College of FPTBE, AAU, Anand)

AGRICULTURAL ENGINEERING

5. Development of perforated storage bin for garlic

Manufacturers, restaurant owners and retailers are recommended to use storage bin (805 mm height x 470 mm diameter) having perforations of 6 mm developed at Anand Agricultural University to store 50 kg garlic bulbs with 21.99% losses for at least 6 months.

(PI & HOD, Dept. of PFE, CAET, AAU, Godhara)

6. Experimental investigations of energy yield from Bifacial Silicon Solar photovoltaic (PV) module and its comparison with mono-facial solar photovoltaic module

Solar panel installers and consumers interested to adopt solar photovoltaic systems are suggested to implement the recommendations based on the field experiments carried out by the Anand Agricultural University, Anand. Bifacial solar photovoltaic modules, if installed at a height of two feet facing towards the south direction tilted at an angle equal to the latitude with reflective (white) surface having

a minimum albedo between 0.25-0.30 of the site, produces 18-20 percent more energy compared to the mono facial solar photo voltaic modules and also produces 15-16 percent and 19-20 percent more energy higher compared to the one feet and five feet Bifacial solar photovoltaic installations respectively.

(PI & HOD, Deptt. of BEAS, CAET, Godhara)

RECOMMENDATIONS FOR SCIENTIFIC COMMUNITY

CROP IMPROVEMENT

1. Effect of number of fruit retention and days to fruit maturity on seed yield and quality parameters of okra

For seed production of Gujarat Anand Okra 8 (Anand Komal), the fruit should be harvested at 60-65 days after fruit formation with 20 number of fruits retention per plant for higher germination (as per Indian minimum seed certification standards) and higher seed yield under the middle Gujarat condition.

(Assistant Professor and Head, Dept. of Seed Science & Technology, BACA, AAU, Anand)

BASIC SCIENCE

2. QTL mapping for wilt resistance in castor

In castor, SSR markers namely, P-1014 and P-1015 located on LG1 found linked with Fusarium wilt resistance and can be used for the development of resistant varieties through backcross breeding and to screen the germplasm at seedlings stage.

Details of linked SSR markers identified for wilt resistance in castor

Sr. No	Marker name	Primer sequence (5'-3')	Product size (bp)	
			RP (48-1)	SP (JI-35)
1	P-1014	F:GGCCCATTTTGGCATTAAC R:TCCTTCAGATGGAAGGTTCA	250	215
2	P-1015	F:TTACCGATACCAAAAAGCAGG R:CAAGCTTTCATTCCCACACA	230	190

RP: Resistant product; SP: Susceptible product

(Associate Res. Scientist & Unit Officer, Department of Biotechnology, AAU, Anand)

3. Technology Development for Micropropagation of Indian sandalwood (*Santalum album* L.)

The standardized protocol for micropropagation of Indian sandalwood (*Santalum album* L.) involves utilization of nodal segment explants collected during the month of June from 20 years mature tree for establishment on WPM basal media. Multiple shoot induction was successfully achieved on WPM medium supplemented with 10 mgl^{-1} IBA with highest number of multiple shoots (6.67 ± 0.67). For defoliation control, WPM with 10 mgl^{-1} IBA and 185 mgl^{-1} Magnesium sulphate was found best for defoliation control with highest number of leaves per explants (25.33 ± 1.99). The rooting of the *in vitro* shoots can be achieved on MS medium supplemented with 0.5 mgl^{-1} NAA and 0.5 mgl-1 IBA with highest rooting percentage (40 %). *In vitro* hardening with dipping in liquid MS basal medium for twelve months reported to produce maximum shoots (3.00 ± 0.00) with highest average length of 10.00 ± 0.57 cm and highest number of roots (2.00 ± 0.00), while in case of ex vitro hardening, these plantlets showed highest percentages of

survival (93%) with least mortality (7 %). After successful hardening, the plantlets were transferred to soil bags in polyhouse with host Brazilian joyweed (*Alternanthera brasiliana*) for futher growth and development.

(PI & Unit Officer, Department of Biotechnology, AAU, Anand)

4. Technology development for mass multiplication using tissue culture and sex determination using molecular markers in papaya

Micropropagation protocol for mass multiplication of Arka Prabhat variety of Papaya (*Carica papaya* L.) has been standardized utilizing nodal segment explants collected from field grown 6 months old plant during July month for establishment on MS medium supplemented with 0.2 mgl^{-1} NAA and 0.1 mgl^{-1} Kinetin. Multiple shoot induction for large scale multiplication of cultures was successfully achieved on MS + 0.5 mgL^{-1} BAP + 0.01 mgL^{-1} IAA + 200 mgL^{-1}casein hydrolysate with highest number of shoot per explants of 2.05 and highest multiplication rate (1.62). The best rooting of the in vitro shoots has been achieved on MS + 4 mgL^{-1} IAA + 4 mgL^{-1} IBA + 200 mgL^{-1} casein hydrolysate with number of roots, length of roots, number of secondary roots, days to root induction and rooting (%) recorded were 5.67, 8.50 cm, 13.67, 30 days and 80%, respectively. DNA based marker, CPSM-90 (Forward primer: 5' TAGCCTAGTGTACCATCTCT 3', Reverse primer: 5'GAATTCATAGAATATGCATCC 3') produced 390 bp male specific bands in seed raised population of 'Madhubindu' and 'Arka Prabhat' varieties whereas; CPSM-31 (Forward primer: 5' TCCTCTCAATCCTAATAGCCTA 3', Reverse primer: 5'GAGTTAGTTGCTCTCAAGGAGT 3') produced 550 bp male specific bands in seed raised population of

'Madhubindu' variety. These markers can be used for the identification of male/hermaphrodite plants in seed raised population of 'Madhubindu' and 'Arka Prabhat' varieties.

(PI & Unit Officer, Department of Biotechnology, AAU, Anand)

5. Physiological and molecular responses of zinc (bulk and nano) particles on seedling growth of wheat (*Triticum aestivum* L.)

Zinc oxide nanoparticles were synthesized from the analytical grade zinc sulphate by pH mediated size reduction method as recommended earlier for synthesis of nanoparticles having desirable hydrodynamic size (72.76 nm), pdi (0.33) and zeta potential (-24mV). Seed priming by zinc using conventional and nano form on wheat found beneficial to seedling at physiological and biochemical level with promotory effect on seed germination, seedling growth, vigour and chlorophyll and protein content and lower IAA oxidase activity at a very lower concentration of 50 ppm. For gene expression study, eleven reference genes were evaluated for their stability in nano and normal treated seedling at two leaf stage. Among these reference genes, 18s rRNA endogenous gene was found to be highest stable transcript in all the treated seedlings. Further, IAA biosynthesis related gene study reveals that at 50 ppm, highest expression of YUCCA9 (flavin mono oxygenase like protein) and ARF (auxin response factor) and AUX1 (auxin cellular influx carrier) confirms the biochemical and physiological observation and results into normal growth of seedlings under exposed nano particles concentration.

(PI & Unit Officer, Department of Biotechnology, AAU, Anand)

6. Green synthesis of iron oxide nanoparticles and evaluation of its nano-priming activity in rice

Green synthesis of iron oxide nanoparticles using neem leaves extract and ferric chloride has been developed by Anand Agricultural University. Analytical grade ferric chloride was found to be more efficient as source of iron compared to sulphate for the iron oxide nanoparticle synthesis. Among the two approaches, room temperature mediated synthesis was found to be more effective in conversion of normal to nanoparticle. However, larger particle synthesis needs to be reduced using high energy 60 amplitude frequency source i.e. sonication for 10 mins at 60% amplitude frequency was found optimum for overcoming particle aggregation. The size of iron nanoparticles synthesized at room temperature for 12 hrs followed by sonication, recorded least 12.79 nm size with 0.24 PDI. Seed priming with iron oxide nanoparticle proves to be beneficial for the enhancement of rice physiological parameters like germination (%), vigour index I and II etc along with better biochemical response compared to bulk treatment.

(PI & Unit Officer, Department of Biotechnology, AAU, Anand)

CROP PRODUCTION

1. Effect of Nano NP fertilizer on growth, yield and quality of summer fodder maize

Application of either 100% RDF (80 kg N: 40 kg P_2O_5: 40 kg K_2O/ha) **OR** 25% RDF + 250 ppm Nano NP foliar spray at 30 DAS **OR** 10 t FYM/ha + 1% Urea phosphate foliar spray at 30 and 45 DAS **OR** 25% RDF + 100 ppm Nano NP foliar spray at 30 and 45 DAS **OR** 10 t FYM/ha + 100 ppm Nano

NP foliar spray at 30 and 45 DAS produced higher green fodder yield and quality of fodder maize cv. African Tall in summer season.

(Professor& Head, Department of Soil Science, BACA, AAU, Anand)

2. Evaluation and inter-comparison of CROPGRO, InfoCrop- and WOFOST models for cotton growth and yield simulation

CROPGRO-Cotton, Info Crop-cotton and WOFOST-cotton models calibrated and validated for two cultivars of cotton (GTHH 49 and G.Cot H8) and for three planting time (D_1: 1 June, D_2: 11 June and D_3: 21 June) in middle Gujarat agro-climatic zone. The validations of the models reveal that performance of CROPGRO-Cotton model is relatively accurate for phenology and productivity of cotton. The genetic coefficients of CROPGRO-Cotton model are as follow for crop management and yield simulations of cotton crop.

Parameter	Description of parameter coefficients controlling development aspects	GTHH49	G. Cot H 8
CSDL	Critical Short Day Length below which reproductive development processes with no day length effect (for short day plants) (hours)	25	25
PPSEN	Slope of the relative response of development to photoperiod with time (positive for short day plants) (1/hours)	0.01	0.01

EM-FL	Time between plant emergence and flower appearance (R1)	49	51
FL-SH	Time between first flower and first pod (R3) (photothermal days)	13	10
Fl-SD	Time between first flower and first seed (R5) (photothermal days)	19	22
SD-PM	Time between first seed (R5) and physiological maturity(R7) (photothermal days)	74	70
FL-LF	Time between first flower (R1) and end of leaf expansion (photothermal days)	75	74
LFMAX	Maximum Leaf photosynthesis rate at 30 ^{0}C, 350 vpm CO_2 and high light ($mgCO_2/m^2$ S)	2.20	2.60
SLAVR	Specific leaf area of cultivar under standard growth condition (cm^2/g)	259	258
SIZLF	Maximum size of full leaf (three leaflets) (cm^2)	380.2	388.5
XFRT	Maximum fraction of daily growth that is partitioned to seed + shell	1.25	1.80
WTPSD	Maximum weight per seed (g)	0.290	0.300

SFDUR	Seed filling duration for pod cohort at standard growth conditions (photothermal days)	43	41
SDPDV	Average seed per pod under standard growing conditions (#/pod)	31	28.65
PODUR	Time required for cultivar to reach final pod load under optimal conditions (photothermal days)	10	9

(Professor & Head, Dept. of Meteorology, BACA, AAU, Anand)

3. Moisture stress detection in *rabi* sunflower (*Helianthus annuus* L.) based on canopy-air temperature differential measurements

In infrared thermometry based crop water stress detection, Crop Water Satisfactory Index (CWSI) value 0.28±0.047 should be used as threshold. The higher CWSI than the threshold indicates the crop is in water stress. The upper baseline (Tc-Ta)*ul* for CWSI calculation is 5.1oC. The lower baseline (Tc-Ta)*ll* calculated from canopy– air temperature difference and vapor pressure deficit using lower base line equation.

$(Tc - Ta)_{ll} = -1.558VPD - 0.8101$

Where,

$(Tc-Ta)_{ll}$ = Lower baseline

VPD = Vapour Pressure Deficit (kPa)

(Professor & Head, Dept. of Meteorology, BACA, AAU, Anand)

4. Screening of different rice varieties for methane emission

Early and mid-early maturing rice varieties showed lower methane emission as compared to late and mid late rice varieties. Irrespective of varietal traits, higher methane emission was observed during reproductive phase. Methane emission pattern was found to have positive correlation with morpho-physiological traits of the crop and root zone soil properties. Methane emission was found significantly correlated with root length, shoot length, root and shoot biomass and number of aerenchyma.

(Professor and Head, Department of Agricultural Microbiology, BACA, AAU, Anand)

PLANT PROTECTION

AGRICULTURAL ENTOMOLOGY

1. Evaluation of various insecticides as lure toxicants for fruit fly in mango orchard

To prepare fruit fly traps using plywood block (5 x 5 x 1.2 cm) impregnating with ethyl alcohol: methyl eugenol: malathion 50 EC (6:4:1) (v/v) or ethyl alcohol: methyl eugenol: spinosad 45 SC (6:4:1) (v/v) and install at 30 meter apart to each other one feet below the crop canopy at flowering stage to trap maximum male fruit flies in mango orchard.

(Professor & Head, Department of Entomology, BACA, AAU, Anand)

2. Evaluation of various insecticides as lure toxicants for fruit fly in bitter gourd

To prepare fruit fly traps using plywood block (5 x 5 x 1.2 cm) impregnated with in Ethyl alcohol: Cue-lure: Malathion 50

EC (6:4:1) (v/v) and install at 30 meter apart to each other one feet below pendal at flowering stage to trap maximum male fruit flies in bittergourd orchard (Cucurbetaceae vegetables). Incase of unavailability of malathion 50 EC, use spinetoram 11.7 SC for trap preparation.

(Professor & Head, Department of Entomology, BACA, AAU, Anand)

3. Evaluation of eco-friendly inputs against sucking pests of potato

Three sprays of either tobacco decoction 2 per cent (200 g/ 10 L water) or neem oil 0.5 per cent (50 mL/ 10 L water) first at initiation of pests and subsequent two sprays after 15 days interval found effective for management of sucking pests viz., jassid, whitefly and thrips in potato.

Note: Add sticker (10 mL/ 10 L water) in neem oil 0.5%.

Methods of Preparation of Tobacco decoction 2% (Cold method):

Take 200g of tobacco dust and soak in one litre of water, filter it with muslin cloth next day and add 9 L of water to make it 2%.

(Assistant Professor and Head, Dept. of Plant Protection, CoH, AAU, Anand)

4. Impact of date of sowing on incidence of fall armyworm, *Spodoptera frugiperda* infesting sweet corn

Fall armyworm infestation remained low in sweet corn crop sown during 2nd to 4th week of June and recorded higher green cob as well as fodder yield.

(PI & Research Scientist, MMRS, AAU, Godhra)

5. Evaluation of insecticides as a seed treatment against thrips in summer green gram

Treat the seeds with imidacloprid 48% FS (8 mL/kg seeds) and sow after drying for 12 hr for effective management of sucking pests viz., thrips, whitefly and jassid up to one month after sowing in summer green gram.

Note: For the treatment of 1 kg seeds, prepare 25 ml solution by adding required quantity of water.

(PI & Associate Research Scientist, ARS, AAU, Derol)

6. Management of fall armyworm, *Spodoptera frugiperda* (J. E. Smith) in fodder maize

Treatment of the seeds with acephate 50% + imidacloprid 1.80 SP, 6 g/kg seed using equal quantity of water before 12 hours of sowing and apply two foliar sprays of *Bacillus thuringiensis* var. kurstaki 1 % WG (1×10^8 cfu/g), 20 g/10 litre water, first spray at 25 and second spray at 35 days after sowing was found effective for the management of fall armyworm.

Note: The treated seeds should be dried under shade condition before sowing.

(PI & Associate Research Scientist, ARS, AAU, Sansoli)

7. Evaluation of bio-pesticides against invasive thrips, *Thrips parvispinus* (Karny) infesting chilli

Application of neem cake @ 250 kg/ha during soil preparation followed by sequential one spray of following bio-pesticides at 7 days interval starting from initiation of pests was found effective against black thrips *Thrips parvispinus* in chilli.

1. *Pseudomonas fluorescens* 1% WP (2 x 108 cfu/g) 40 g /10 litre of water
2. *Metarhizium anisopliae* 1.15% WP (1 x 109 cfu/g) 40 g /10 litre of water
3. Aqueous bidi tobacco dust extract 2 %, 200 g/ 10 litre of water
4. *Pseudomonas fluorescens* 1% WP (2 x 108 cfu/g) 40 g /10 litre of water
5. *Metarhizium anisopliae* 1.15% WP (1 x 109 cfu/g) 40 g /10 litre of water
6. Aqueous bidi tobacco dust extract 2 %, 200 g/ 10 litre of water

OR

Application of neem cake @ 250 kg/ha during soil preparation followed by sequential one spray of following bio-pesticides at 7 days interval starting from initiation of pests was found effective against black thrips *Thrips parvispinus* in chilli.

1. Neem Seed Kernel Extract 5%, 500 g/ 10 litre of water
2. Azadirachtin 10000 ppm, 0.003%, 30 ml/ 10 litre of water
3. Aqueous bidi tobacco dust extract 2 %, 200 g/ 10 litre of water
4. Neem Seed Kernel Extract 5%, 500 g/ 10 litre of water
5. Azadirachtin 10000 ppm, 0.003%, 30 ml/ 10 litre of water

6. Aqueous bidi tobacco dust extract 2 %, 200 g/ 10 litre of water

(Professor and Head, Dept. of Agril. Entomology, BACA, AAU, Anand)

8. Evaluation of different modules against invasive thrips, *Thrips parvispinus* (Karny) in chilli

For effective management of *Thrips parvispinus* in chilli adopt following module,

1. Root dipping of chilli seedlings with imidacloprid 17.8 SL 10 ml per 10 litre of water for two hours before transplanting
2. Application of Neem cake @ 250 kg/ha at the time of transplanting and 30 days after transplanting
3. Installation of blue sticky trap @ 75/ ha at 30 DAT
4. Spraying of spinetoram 11.7 SC, 0.0117%, 58.50 g a.i./ ha, 10 ml/ 10 litre of water at initiation of pest
5. Spraying of *Metarhizium anisopliae* 1.15% WP (1 x 108 cfu/g), 50 g/ 10 litre of water after 10 days of first spray
6. Spraying of broflanilide 300 G/L SC, 0.005%, 25.2, g a.i./ha, 1.68 ml/10 litre of water after 7 days of second spray
7. Spraying of azadirachtin 10000 ppm, 20 ml/ 10 litre of water after 10 days of third spray
8. Spraying of tolfenpyrad 15 EC, 0.030% 150 g a.i./ha, 20 ml/ 10 litre of water at 7 days of fourth spray

(Principal Research Scientist, AICRP on Biological Control of Crop Pests, AAU, Anand)

9. Development of low-cost production medium of bio-pesticide *Metarhizium anisopliae*, using spent larval medium of *Corcyra cephalonica*

The use of sorghum grains 100 g (33.3 %) with spent larval medium 200 g (66.7 %) of *Corcyra cephalonica* is found effective medium for the production of *Metarhizium anisopliae* AAUBC Ma1 with highest spore yield.

The formulation *M. anisopliae* AAUBC Ma1 - 1% WP ($1x10^9$ cfu/g) prepared from the above growth medium, applied once on tree trunk during the month of November @ 40 or 50 g/10 L of water and three sprays on foliage at ten days interval with the initiation of pest is found effective against hoppers infesting mango.

(Principal Research Scientist, AICRP on Biological Control of Crop Pests, AAU, Anand)

10. Efficacy of different biocontrol agents against onion thrips, *Thrips tabaci* L.

Foliar spray of either *Metarhizium anisopliae* AAU Ma1-1% WP (50 g/10 L of water) or Azadirachtin 10000 ppm (20 mL/10 L of water) for three times at ten days interval with the initiation of pest is found effective for the management of thrips, *Thrips tabaci* infesting onion crop.

(Principal Research Scientist, AICRP on Biological Control of Crop Pests, AAU, Anand)

11. Residues and persistence of fluopyram 400 g/L SC in tomato (Drip irrigation)

Following either a single application of fluopyram 400 g/L SC at 500 g a.i./ha (at 3 days after transplanting) or two applications each at 250 g a.i./ha (at 3 and 21 days after

transplanting) through drip irrigation to tomato crop, the residues of fluopyram in tomato fruits respectively at 50 and 29 days after the last application were found below the CODEX MRL of 0.5 mg/kg. Therefore, the preharvest interval (PHI) of 50 days (for a single application at 500 g a.i./ha) and 29 days (for two applications each at 250 g a.i./ha) are suggested for use at the recommended dose in tomato.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

12. Residues and persistence of fluopyram 400 g/L SC in pomegranate (Soil drench)

Following either a single application of fluopyram 400 g/L SC at 500 g a.i./ha (at 2 days after defoliation) or two split applications each at 250 g a.i./ha (at 2 and 45 days after defoliation) through soil drenching near root zone of pomegranate tree, the residues of fluopyram in mature pomegranate fruits respectively at 176 and 131 days after the last application were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 176 days (for a single application at 500 g a.i./ha) and 131 days (for two split applications each at 250 g a.i./ha) are suggested for use at recommended dose in pomegranate.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

13. Residues and persistence of fluoxapiprolin 30 g/L + fluopicolide 200 g/L SC in cucumber

Following three foliar applications of a combi-product fluoxapiprolin 30 g/L + fluopicolide 200 g/L SC at 18.75 + 125 g a.i./ha (at 7 days interval starting from fruit development

stage) to cucumber, the residues of fluoxapiprolin and fluopicolide in cucumber fruits were found below the LOQ value of 0.01 mg/kg at 5 and 21 days after the last foliar application, respectively. Therefore, the preharvest interval (PHI) of 21 days is suggested for use at the recommended dose in cucumber.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

14. Residues and persistence of fluopyram 400 g/L SC in potato (Soil drench)

Following either a single application of fluopyram 400 g/L SC at 500 g a.i./ha (at 10 days after sowing) or two applications each at 250 g a.i./ha (at 14 and 35 days after sowing) through soil drenching near root zone of potato plant, the residues of fluopyram in potato tubers respectively at 78 and 43 days after the last application were found below the CODEX MRL of 0.15 mg/kg. Therefore, the preharvest interval (PHI) of 78 days (for a single application at 500 g a.i./ha) and 43 days (for two applications each at 250 g a.i./ha) are suggested for use at the recommended dose in potato.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

15. Residues and persistence of fluopyram 400 g/L SC in okra (Drip irrigation)

Following either a single application of fluopyram 400 g/L SC at 500 g a.i./ha (at 10 days after sowing) or two applications each at 250 g a.i./ha (at 10 and 24 days after sowing) through drip irrigation to okra, the residues of

fluopyram in okra fruits respectively at 30 and 16 days after the last application were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 30 days (for a single application at 500 g a.i./ha) and 16 days (for two applications each at 250 g a.i./ha) are suggested for use at the recommended dose in okra.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

16. Residues and persistence of fluopyram 400 g/L SC in okra (Soil drenching)

Following either a single application of fluopyram 400 g/L SC at 500 g a.i./ha (at 10 days after sowing) or two applications at each 250 g a.i./ha (at 10 and 24 days after sowing) through soil drenching near root zone of okra plant, the residues of fluopyram in okra fruits respectively at 30 and 16 days after the last application were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 30 days (for a single application at 500 g a.i./ha) and 16 days (for two applications each at 250 g a.i./ha) are suggested for use at the recommended dose in okra.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

17. Residue and persistence of isocycloseram 9.2% w/w DC in tomato

Following two foliar applications of isocycloseram 9.2% w/v DC at 60 g a.i./ha (at 10 days interval starting from the fruit development stage) to tomato, the residues of isocycloseram in tomato fruits at 15 days after the last foliar application were found below the LOQ value of 0.01

mg/kg. Therefore, the preharvest interval (PHI) of 15 days is suggested for use at the recommended dose in tomato.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

18. Residues and persistence of fluopyram 250 g/L + trifloxystrobin 250 g/L SC in mango

Following three foliar applications of a combi-product fluopyram 250 g/L + trifloxystrobin 250 g/L SC at 20 + 20 g a.i./100 L water (at 10 days interval starting from 35 days before harvest of mature mango fruits) to mango trees, the residues of fluopyram and trifloxystrobin in immature mango fruits (with peel) respectively at 0-day (2 h) and 1-day were found below the CODEX MRL of 1.00 mg/kg and FSSAI MRL of 0.40 mg/kg. Likely, the respective residues in mature mango fruits (with peel) and mango pulp 15 days after the last application were also found below the CODEX MRL of 1.00 mg/kg and FSSAI MRL of 0.40 mg/kg. Therefore, the preharvest interval (PHI) of 1 day for unripe mango fruits and 15 days for mature mango fruits are suggested for use at the recommended dose in mango.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

19. Residues and persistence of flonicamid 20% + fipronil 8% SC in okra

Following two foliar applications of a combi-product flonicamid 20% + fipronil 8% SC at 98.4 + 39.4 g a.i./ha (at 15 days interval starting from the fruit development stage) to okra, the residues of flonicamid and fipronil in okra fruits respectively at 7 and 20 days after the last foliar application were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 20 days is suggested for use at the recommended dose in okra.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

20. Residues and persistence of tolfenpyrad 18.75% + emamectin benzoate 0.94% w/w SC in cauliflower

Following two foliar applications of a combi-product tolfenpyrad 18.75% + emamectin benzoate 0.94% SC at 140 + 7 g a.i./ha (at 14 days interval starting from curd development stage) to cauliflower, the residues of tolfenpyrad and emamectin benzoate in cauliflower curd respectively at 15 and 7 days after the last foliar application were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 15 days is suggested for use at the recommended dose in cauliflower.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

21. Residue and persistence of tetraniliprole 480 g/L FS in maize

Following a seed treatment of tetraniliprole 480 g/L FS at 7.20 g a.i./kg of maize seed, the residues of tetraniliprole in maize leaves, immature cobs, mature grain, and stover at 30 days after sowing were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 30 days is suggested for use at the recommended dose as a seed treatment in fodder maize.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

22. Residues and persistence of isoxaflutole 225 g/L + thiencarbazone-methyl 90 g/L SC in maize

Following a single application of a combi-product isoxaflutole 225 g/L + thiencarbazone-methyl 90 g/L SC at 90 + 36 g a.i./ha either as pre-emergence or as early pre-emergence in fodder maize field, the residues of isoxaflutole

and thiencarbazone-methyl in maize leaves, immature cobs, mature grains, and stover at 30 days after sowing were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 30 days is suggested for use at the recommended dose in fodder maize.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

23. Residues and persistence of fluopyram 250 g/L + trifloxystrobin 250 g/L SC in banana

Following three foliar applications of a combi-product fluopyram 250 g/L + trifloxystrobin 250 g/L SC at 125 + 125 g a.i./ha (at 10 days interval starting from 35 days before harvest of mature banana fruits) to banana, the residues of fluopyram and trifloxystrobin in banana fruit (mature banana fruit with peel and banana pulp) at 15 days after the last foliar application were found below the respective MRLs of CODEX 0.80 mg/kg and FSSAI 1.0 mg/kg. Therefore, the preharvest interval (PHI) of 15 days is suggested for use at the recommended dose in banana.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

24. Residues and persistence of tetraniliprole 120 g/L + spirotetramat 240 g/L SC in okra

Following three foliar applications of a combi-product tetraniliprole 120 g/L + spirotetramat 240 g/L SC at 45 + 90 g a.i./ha (at 7 days interval starting from fruit development stage) to okra, the residues of tetraniliprole and spirotetramat (and its metabolite, spirotetramat-enol) in okra fruits respectively at 5 and 0 days (2 h) after the last application was found below the LOQ value of 0.01 mg/kg

and CODEX MRL of 1.0 mg/kg, respectively. Therefore, the preharvest interval (PHI) of 5 days is suggested for use at the recommended dose in okra.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

25. Residue and persistence of flupyradifurone 200 g/L SL in tomato

Following three foliar applications of flupyradifurone 200 g/L SL at 200 g a.i./ha (at 10 days interval starting from the fruit development stage) to tomato, the residues of flupyradifurone in tomato fruits at 0 days (2 h) after the last foliar application were found below the CODEX MRL of 1.0 mg/kg. Therefore, the preharvest interval (PHI) of 1 day is suggested for use at the recommended dose in tomato.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

26. Residues and persistence of tolfenpyrad 18.75% + emamectin benzoate 0.94% w/w SC in brinjal

Following two foliar applications of a combi-product tolfenpyrad 18.75% + emamectin benzoate 0.94% SC at 140 + 7 g a.i./ha (at 14 days interval starting from fruit development stage) to brinjal, the residues of tolfenpyrad and emamectin benzoate in brinjal fruits respectively at 15 and 0 (2 h) days after the last application were found below the LOQ value of 0.01 mg/kg and CODEX MRL of 0.02 mg/kg, respectively. Therefore, the preharvest interval (PHI) of 15 days is suggested for use at the recommended dose in brinjal.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

27. Residues and persistence of pyrithiobac sodium 12.5% + bispyribac sodium 5% SC in paddy (direct seed rice)

Following a single application of combi-product pyrithiobac sodium 12.5% + bispyribac sodium 5% SC at 62.5 + 25.0 g a.i./ha (at 15 days after sowing) in direct seed rice field, the residues of pyrithiobac sodium and bispyribac sodium in plant foliage at 7 days after application were found below the LOQ of 0.01 and FSSAI MRL of 0.05 mg/kg, respectively. The residues in the paddy grains, husk, and straw at 105 days after application were also found below the respective MRLs. Therefore, the preharvest interval (PHI) of 105 days is suggested for use at the recommended dose in direct-seeded paddy.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

28. Residues and persistence of fluopyram 200 g/L + tebuconazole 200 g/L SC in tomato

Following three foliar applications of a combi-product fluopyram 200 g/L + tebuconazole 200 g/L SC at 100 + 100 g a.i./ha (at 10 days interval starting from fruit development stage) to tomato, the residues of fluopyram and tebuconazole in tomato fruits at 0 (2 h) days after the last application were found below the CODEX MRL 0.5 mg/kg and FSSAI MRL of 2.0 mg/kg, respectively. Therefore, the preharvest interval (PHI) of 1 day is suggested for use at the recommended dose in tomato.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

29. Residue and persistence of tebuconazole 430 g/L SC in mango

Following three foliar applications of tebuconazole 430 g/L SC at 47.30 g a.i./100 L water (at 10 days interval starting from 35 days before harvest of mature fruits) to mango, the residues of tebuconazole in mature mango fruits (with peel and without peel i.e. mango pulp) at 15 days after the last foliar application were found below the FSSAI MRL of 0.2 mg/kg. Therefore, the preharvest interval (PHI) of 15 days is suggested for to use at the recommended dose in mango.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

30. Residues and persistence of fluopyram 250 g/L + trifloxystrobin 250 g/L SC in okra

Following three foliar applications of a combi-product fluopyram 250 g/l + trifloxystrobin 250 g/ SC at 150 + 150 g a.i./ha (at 10 days interval starting from fruit development stage) to okra, the residues of fluopyram and trifloxystrobin in okra fruits at 5 days after the last application were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 5 days is suggested for use at the recommended dose in okra.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

31. Residues and persistence of tebuconazole 50% + trifloxystrobin 25% WG in turmeric

Following three foliar applications of a combi-product tebuconazole 50% + trifloxystrobin 25% WG at 200 + 100 g a.i./ha (at 10 days interval starting from 50 days before harvest of fresh mature rhizomes) to turmeric, the residues

of tebuconazole and trifloxystrobin in mature fresh turmeric rhizomes and dry turmeric powder at 30 days after the last application were found below the LOQ value of 0.01 mg/kg. Therefore, the pre-harvest interval (PHI) of 30 days is suggested for use at the recommended dose in turmeric.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

32. Residues and persistence of fluopyram 250 g/L + trifloxystrobin 250 g/L in tomato

Following three foliar applications of a combi-product fluopyram 250 g/L + trifloxystrobin 250 g/L SC at 150 + 150 g a.i./ha (at 10 days interval starting from fruit development stage) to tomato, the residues of fluopyram and trifloxystrobin in tomato fruits at 0 days (2 h) after the last foliar application were found below the CODEX MRL of 0.5 mg/kg and FSSAI MRL of 1.0 mg/kg, respectively. Therefore, the preharvest interval (PHI) of 1 day is suggested for use at the recommended dose in tomato.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

33. Residues and persistence of fluopyram 200 g/L + tebuconazole 200 g/L SC in okra

Following three foliar applications of a combi-product fluopyram 200 g/L + tebuconazole 200 g/L SC at 100 + 100 g a.i./ha (at 10 days interval starting from the fruit development stage) to okra, the residues of fluopyram and tebuconazole in okra fruits at 7 days after the last application were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 7 days is suggested for use at the recommended dose in okra.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

34. Residues and persistence of beta-cyfluthrin 90 g/L + imidacloprid 210 g/L OD in rice

Following three foliar applications of a combi-product beta-cyfluthrin 90 g/L + imidacloprid 210 g/L OD at 22.5 + 52.5 g a.i./ha (at 10 days interval starting from the panicle initiation stage) to paddy, the residues of beta-cyfluthrin and imidacloprid in dry mature whole rice grains (with husk), polished rice grains, husk and straw at 40 days after the last application were found below the LOQ value of 0.01 mg/kg and FSSAI MRL of 0.05 mg/kg, respectively. Therefore, the preharvest interval (PHI) of 40 days is suggested for use at the recommended dose in paddy.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

35. Residues and persistence of fluopyram 250 g/L + trifloxystrobin 250 g/L in cucumber

Following three foliar applications of a combi-product fluopyram 250 g/L + trifloxystrobin 250 g/L SC at 150 + 150 g a.i./ha (at 10 days interval starting from the fruit development stage) to cucumber, the residues of fluopyram and trifloxystrobin in cucumber fruits at 5 days after the last application were found below the CODEX MRL of 0.50 mg/kg and LOQ value of 0.01 mg/kg, respectively. Therefore, the preharvest interval (PHI) of 5 days is suggested for use at the recommended dose in cucumber.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

36. Residues and persistence study of azoxystrobin 4.8% + chlorothalonil 40% SC in pea

Following two foliar applications of a combi-product azoxystrobin 4.8% + chlorothalonil 40% SC at 100.85 +

739.15 g a.i./ha (at 10 days interval starting from the pod formation stage) on pea, the residues of azoxystrobin and chlorothalonil in green pea at 0 day (2 hr) after the last application were found below the CODEX MRL of 20 mg/kg and LOQ value of 0.01 mg/kg, respectively. The respective residues in dry peas 30 days after the last application were also found below the CODEX MRL of 20 mg/kg and LOQ value of 0.01 mg/kg. Therefore, the preharvest intervals (PHI) of 1 days for green peas and 30 days for dry peas are suggested for use at the recommended dose in peas. The dissipation of azoxystrobin (for a recommended dose) in green pea pods and green peas appeared to be monophasic with half-lives of 3.29 and 9.29 days, respectively. Likely the dissipation of chlorothalonil (for a recommended dose) in green pea pods was also monophasic with a half-life of 3.88 days.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

37. Residues and persistence study of flubendiamide 90 g/L + deltamethrin 60 g/L SC in mango

Following three foliar applications of a combi-product flubendiamide 90 g/L + deltamethrin 60 g/L SC at 4.50 + 3.00 g a.i./100 L water (at 10 days interval starting from 35 days before harvest of mature mango fruits) to mango, the residues of flubendiamide and deltamethrin in mature mango fruit (without peel i.e. mango pulp) at 15 days after the last application were found below the LOQ value of 0.01 mg/kg and FSSAI MRL of 0.01 mg/kg, respectively. Therefore, the preharvest interval (PHI) of 15 days for mature mango (without peel i.e. mango pulp) is suggested for use at the recommended dose in mango. The dissipation of flubendiamide (for a recommended dose) in immature

mango fruits appeared to be monophasic with a half-life of 9.4 days.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

38. Residues and persistence study of tetraniliprole 200 g/L SC in groundnut

Following three foliar applications of tetraniliprole 200 g/L SC at 50 g a.i./ha (at 10 days interval starting from the pod formation stage) to groundnut, the residues of tetraniliprole and its metabolite (BCS-CQ63359) in mature groundnut pods, dry kernels, oil, and cake at 30 days after the last application were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 30 days for mature groundnut pods, dry kernel, oil, and cake is suggested for use at the recommended dose in groundnut. The dissipation of tetraniliprole (for a recommended dose) in groundnut leaves appeared to be monophasic with a half-life of 19.3 days.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

39. Residues and persistence study of chlorantraniliprole 4.3% + abamectin 1.7% SC in watermelon

Following two foliar applications of a combi-product chlorantraniliprole 4.3% + abamectin 1.7% SC at 37.5 + 37.5 g a.i./ha (at 15 days interval starting from the fruit development stage) to watermelon, the residues of chlorantraniliprole and abamectin in watermelon fruit at 15 days after the last application were found below the LOQ value of 0.01 mg/kg. Therefore, the preharvest interval (PHI) of 15 days is suggested for use at the recommended

dose in watermelon. The dissipation of chlorantraniliprole (for a recommended dose) in watermelon fruits appeared to be monophasic with a half-life of 3.79 days.

(Residue Analyst, AINP on Pesticide Residues, AAU, Anand)

40. Impact of storage bag container, application methods and insecticide against *Callosobruchus maculatus* (Fabricius) infesting green gram during storage

Green gram seeds can be stored for 135 days by managing pulse beetle effectively by adopting following measures

- Jute bag treated by spraying or impregnation with deltamethrin 2.8 EC (0.7 mL/L water) for 10 minutes,

OR

- Seed treated with deltamethrin 2.8 EC (0.7 mL/L water) or spinosad 45 SC (0.04 mL/L water) or fipronil 5 SC (0.40 mL/L water) and stored in jute bag.

(Research Scientist & Nodal Office (Seed), RRS, AAU, Anand)

41. Study to find out the critical weather parameters on insect-pests of rice at Nawagam

In *kharif* (end of July to August) transplanted rice, stem borer, leaf folder and white backed plant hopper population has congenial condition due to low minimum temperature (ºC) and high sunshine hours. The overall peak infestation of stem borer, leaf folder occurs during 45th SMW, while maximum population of WBPH occur during 41st SMW.

(Research Scientist, MRRS, AAU, Nawagam)

42. Efficacy of different insecticides against pod borer complex of pigeon pea

Two sprays of chlorantraniliprole 8.80% + thiamethoxam 17.5% SC, 0.025%, 150 g a.i/ha (9.50 mL/ 10 L of water) first at flowering and second at pod setting stage was found effective for management of pod borer, *Heliocoverpa armigera*, blue butterfly, *Lampides boeticus* and plume moth, *Exelastis atomosam* infesting pigeonpea.

Two sprays either chlorantraniliprole 8.80% + thiamethoxam 17.5% SC, 0.025%, 150 g a.i./ha (9.50 mL/ 10 L of water) or emamectin benzoate 5% + lufenuron 40% WG, 0.005%, 27 g a.i./ha (1 g/ 10 litre of water) first at flowering and second at pod setting stage was found effective against pod fly, *Melanagromyza obtusa* infesting pigeonpea.

(PI & Associate Research Scientist, ARS, AAU, Derol)

PLANT PATHOLOGY AND NEMATOLOGY

43. Screening of potato varieties against foliar diseases

Among the 23 varieties screened, Kufri Lima was found resistant against early blight disease of potato whereas, Kufri Ganga and Kufri Arun were found resistant against late blight disease in potato.

(Professor and Head, Dept. of Pl. Path., BACA, AAU, Anand)

44. Evaluation of nematicides against *Meloidogyne* spp. in cucumber

The application of fluopyram 400 g/L SC, 34.48% SC, 0.625 L/ha as soil drenching with 200 ml solution/ pit at 4 days before sowing reduced root-knot nematode population and

root knot index with higher fruit yield of cucumber without any phytotoxicity.

(Prof. & Head, Department of Nematology, BACA, AAU, Anand)

45. Eco-friendly management of *Meloidogyne incognita* infecting cucumber under protected cultivation

Soil application of FYM enriched *Bacillus amyloliquefaciens* strain No. IIHR Ba 2 ($2x10^8$ cfu/g), 1 kg/1000 m^2 before sowing and 45 DAS in soil is effective for management of root-knot nematodes and with higher fruit yield of cucumber under polyhouse.

(Prof. & Head, Department of Nematology, BACA, AAU, Anand)

46. Bio-efficacy of ready-mix fungicides for management of powdery mildew in fenugreek

Two sprays of tebuconazole 10% + sulphur 65% WG at 0.187% (25 g /10 L of water), first at initiation of powdery mildew and second at 15 days after first spray are effective against powdery mildew of fenugreek.

(Head, Department of Plant Protection, COH, AAU, Anand)

47. Bio-efficacy of different bioagents against early blight of potato

The application of bioagents viz., *Trichoderma harzianum* (AAUBC-Th1, $2x10^6$ cfu/g) 1% WP and *Pseudomonas fluorescens* (NBAIR PfDWD, $2x10^8$ cfu/g) 1% WP through any of the following methods is effective for the management of early blight disease of potato.

1. Soil application of vermicompost enriched with bioagents (1.25 kg of each bioagent/250 kg vermicompost/ha) before transplanting, seedling root dip (5 g of each bioagent/L of water) for 30 min just before transplanting and two foliar sprays (2.5 g of each bioagent/L of water), first spray starting with the appearance of the disease and second at 10 days after first spray.

2. Soil application of vermicompost enriched with bioagent (2.5 kg of *P. fluorescens*/250 kg vermicompost/ha) before transplanting, seedling root dip (10 g of *P. fluorescens*/L of water) for 30 min just before transplanting and two foliar sprays (5 g of *P. fluorescens*/L of water), first spray starting with the appearance of the disease and second at 10 days after first spray.

Note:

- For the preparation of vermicompost enriched with bioagents, mix the bioagents with vermicompost and keep for 10 days under shade.
- For seed treatment, mix the bioagents with equal quantity of plain talc powder for uniform treatment of tubers.

(Principal Research Scientist, AICRP on Biological Control of Crop Pests, AAU, Anand & Professor & Head, Dept. of Pl. Path. BACA, AAU, Anand)

48. Bio-efficacy of ready-mix fungicides against purple blotch of onion

Two foliar sprays of kresoxim-methyl 15% + chlorothalonil 56% WG, 0.177% (25 g per 10 L of water) mixed with sticker

0.1% (10 mL per 10 L of water), first at the appearance of disease and second spray at 10 days after first spray are found effective in managing purple blotch in onion.

(Assistant Professor, Dept. of Pl. Path. COA, AAU, Jabugam)

49. Screening of maize genotypes for their resistance against *Turcicum* (*Exserohilum turcicum*) leaf blight of maize

Among 46 different maize inbreds screened, GWH-1230, I-07-66-2-2, GWC-1210, IGPHC-1203, and HKI-287-1 are resistant against *Turcicum* leaf blight (*Exserohilum turcicum*) of maize.

(Research Scientist, MMRS, AAU, Godhra)

FPTBE, AGRICULTURAL ENGINEERING AND AIT

FOOD PROCESSING TECHNOLOGY

1. Modification and performance evaluation of heat pump assisted dryer (HPAD) for effective heat transfer

Modified Heat Pump Assisted Dryer (HPAD) increased the temperature by 24.72% and reduced relative humidity by 15.59% in no load condition within dryer cavity. After modifications, temperature and velocity profile became uniform throughout the dryer cavity (870 x 530 x 870 mm) with maximum temperature of 50.05 °C and average velocity of 1.03 m/s. The modified drying chamber achieved a time saving of 2 hours and 27 minutes compared to the unmodified dryer for complete drying of fenugreek leaves.

(PI & HOD, Dept. of FPE, FPTBE, AAU, Anand)

2. Evaluation of decontamination efficacy of ozone on selected microorganisms

For non-thermal decontamination of strawberries and cherry tomatoes, treatment with aqueous ozone at a concentration of 3 ppm for 15 minutes decontaminates *Staphylococcus aureus* ATCC 25923 as well as *Escherichia coli* O157:H7 population by up to 6 logs.

(PI & HOD, Dept. of FSQA, FPTBE, AAU, Anand)

3. Boric acid detection in wheat flour using "Tears of the wine" phenomenon

Boric acid adulteration in wheat flour can be detected using "Tears of Wine" phenomenon based method. This method can detect minimum level of 0.4% boric acid adulteration in wheat flour.

(PI & HOD, Dept. of FSQA, FPTBE, AAU, Anand)

AGRICULTURAL ENGINEERING

4. Development of location specific synthetic hyetographs for Middle Gujarat

To mitigate the necessity of employing distinct sets of rainfall intensities for each drainage area or watershed, a set of synthetic rainfall distributions (hyetographs) has been developed based on study of empirical data of middle Gujarat under Anand Agricultural University jurisdiction. These distributions can be an effective method for analyzing the hydrologic response of watersheds to rainfall events. It is recommended to scientists, hydrologists and decision-makers to utilize the developed hyetographs (synthetic rainfall distributions) AAU-6 h, AAU-12 h, and AAU-24

h for the districts of middle Gujarat to estimate runoff characteristics and design effective water management strategies for watersheds.

(PI & HOD, Deptt. of AE, BACA, AAU, Anand)

AGRICULTURAL INFORMATION TECHNOLOGY

5. Classification of soil fertility for Anand district of Gujarat using Machine Learning techniques

The researchers and scientists are recommended to use a tree-based "Random Forest" Machine Learning algorithm for the classification of soil fertility using soil parameters viz., pH, EC, OC, OM, N, P, K, Zn, Fe, Cu, and Mn for the Anand District of Gujarat.

(PI & HOD, Dept. of Agril. Science, CAIT, AAU, Anand)

6. Estimating evaporation using artificial intelligence technique

The researchers and scientists are recommended to use Bagging Random Forest machine learning regression model developed by Anand Agricultural University, Anand for better prediction of weekly pan evaporation (mm) based on temperature °C (maxT & minT), bright sunshine hours (hr), wind velocity (km/hr) and relative humidity (%) data for Anand district.

(PI & HOD, Dept. of Agril. Science, CAIT, AAU, Anand)

7. *Brassicaceae* family ontology development

The scientific community is advised to develop information systems based on Fertilizer application ontology for Cabbage, Cauliflower and Mustard crops of Brassicaceae family developed by Anand Agricultural University, Anand and even extend it further.

(PI & HOD, Dept. of Ag. Stat., BACA, AAU, Anand)

SOCIAL SCIENCE

1. Evaluation and development of yardstick of CV % for Vegetable crops experiments

The yard stick of CV% for accepting the results of the vegetable crops experiment is recommended as 16.72, i.e. 17 per cent for yield character.

(Professor and Head, Dept. of Agril. Statistics, BACA, AAU, Anand)

2. Evaluation and development of yardstick of CV% for forage crops experiments

The yard stick of CV% for accepting the results of the forage crops experiment is recommended as 13.50, i.e. 14 per cent for yield character.

(Professor and Head, Dept. of Agril. Statistics, BACA, AAU, Anand)

3. Detection of late blight and early blight diseases of potato using deep learning

It is recommended that the custom Convolutional Neural Network (CNN) architecture developed for detection of late blight and early blight diseases of potato can be utilized for disease identification based on its proven high accuracy rate of 97%, along with its computational efficiency, with reduced number of parameters relative to established models like VGG 16 and AlexNet.

(Assistant Professor and Head, Dept. of Basic Science, College of Horticulture, AAU, Anand)

4. Development and standardization of a scale to measure attitude of youth towards Agri- startup programmes

The scale is recommended for those researchers who want to measure the attitude of youth towards Agri startup programmes.

A. Final statements for scale to measure attitude of youth towards Agri startup programmes

Sr. No.	Statement	SA	A	UD	DA	SDA
1	Agri-startup initiative helps in addressing India's unemployment problems. (+) ભારતમાં બેરોજગારીના પ્રશ્નનું નિરાકરણ કરવામાં એગ્રીસ્ટાર્ટઅપ કાર્યક્રમ મદદરૂપ થશે. (+)	5	4	3	2	1
2	It is complicated to obtain financial aid through Agri-startup programmes. (-) એગ્રીસ્ટાર્ટઅપ કાર્યક્રમ માટે નાણાકીય સહાય મેળવવી જટિલ છે.(-)	1	2	3	4	5
3	Agri-startup programmes are helpful to give a contribution to the community by developing a successful business. (+) એગ્રીસ્ટાર્ટઅપ કાર્યક્રમો સફળ વ્યાપાર/ધંધાના વિકાસ દ્વારા સમાજને મદદરૂપ થાય છે. (+)	5	4	3	2	1
4	Agri-startup programmes help to achieve a high standard of living. (+) લોકોના જીવન ધોરણ ઊંચા લાવવામાં એગ્રીસ્ટાર્ટઅપ કાર્યક્રમો મદદરૂપ થાય છે. (+)	5	4	3	2	1

5	Agri-startup programmes help in building self-reliance among youth. (+) એગ્રીસ્ટાર્ટઅપ કાર્યક્રમો યુવાનોને સ્વનિર્ભર બનાવવામાં મદદરૂપ થાય છે. (+)	5	4	3	2	1
6	Agri-startup programmes promote versatility in the business. (+) એગ્રીસ્ટાર્ટઅપ કાર્યક્રમો વ્યાપાર/ધંધાના વૈશ્વિકરણને પ્રોત્સાહન આપે છે. (+)	5	4	3	2	1
7	Agri-startup programmes face a lot of problems due to a lack of market access. (-) એગ્રીસ્ટાર્ટઅપ કાર્યક્રમો ચલાવવામાં બજાર વ્યવસ્થાના અભાવને લીધે ઘણા પ્રશ્નો જોવા મળે છે. (-)	1	2	3	4	5
8	Starting an Agri-start up is not a practical approach for all the youth. (-) બધા જ યુવાનો માટે એગ્રી સ્ટાર્ટઅપ કાર્યક્રમ શરૂ કરવો એ વ્યાવહારિકરીતે (પ્રેક્ટીકલી) અનુકૂળ અભિગમ નથી. (-)	1	2	3	4	5

SA-Strongly Agree, A - Agree, UD - Undecided, DA - Disagree, SDA -Strongly Disagree

(Professor and Head, Dept. of Agril. Extn. & Com., AAU, Anand)

5. Development of a scale to measure attitude of the trainees towards online training programmes

The scale is recommended for those researchers who want to measure the attitude of the trainees towards online training programmes.

A. Final statements for scale to measure attitude of the trainees towards online training programmes.

Sr. No.	Statement	SA	A	UD	DA	SDA
1	Online training is best alternative in situation like Covid (+) Covid-19 જેવી પરિસ્થિતિમાં ઓનલાઈન તાલીમ એ ઉત્તમ વિકલ્પ છે. (+)	5	4	3	2	1
2	Online training saves resources (+) ઓનલાઈન તાલીમ, તાલીમ માટેના સ્ત્રોતની બચત કરે છે.	5	4	3	2	1
3	It is most convenient to me as I can turn anywhere with Internet access and electricity (+) ઓનલાઈન તાલીમ મારા માટે સૌથી અનુકૂળ છે, જેમાં હું ઈન્ટરનેટ અને વિજળીની ઉપલબ્ધતાથી ગમે ત્યાંથી તાલીમમાં ભાગ લઈ શકું છું.	5	4	3	2	1
4	Online training increases workload (-) ઓનલાઈન તાલીમ કામનું ભારણ વધારે છે. (-)	1	2	3	4	5
5	I prefer online training as it is hassle free (+) હું ઓનલાઈન તાલીમને પ્રાધાન્ય આપું છું કારણ કે પ્રમાણમા સરળ છે. (+)	5	4	3	2	1
6	It is difficult to connect with other participants in online training (-) ઓનલાઈન તાલીમમાં અન્ય સહભાગીઓ સાથે જોડાવું મુશ્કેલ છે. (-)	1	2	3	4	5
7	Trainees are less responsive in online training class (-) ઓનલાઈન તાલીમ વર્ગમાં તાલીમાર્થીઓ ઓછા પ્રતિભાવ આપે છે. (-)	1	2	3	4	5

8	Skill training is impossible through online training (-) કૌશલ્યયુક્ત તાલીમ ઓનલાઈન માધ્યમ દ્વારા અશક્ય છે. (-)	1	2	3	4	5
9	Online training lacks practical learning (-) ઓનલાઈન તાલીમમાં પ્રાયોગિક શિક્ષણનો અભાવ છે.	1	2	3	4	5

SA-Strongly Agree, A - Agree, UD - Undecided, DA - Disagree, SDA -Strongly Disagree

(Director, EEI, AAU, Anand)

xxxxx

Liquid Biofertilizer Technology Commercialized to

- Kemrock Agritech
- Gujarat State Fertilizer and Chemicals Limited
- Gujarat Agro Industries Corporation Limited
- AMC, Ahmedabad
- Margosa Biogrow India Pvt. Ltd.
- GUJCOMASOL
- Narmada Biochem Ltd.
- IMC, Indore
- AMUL, Anand
- Banas Dairy, Palanpur
- KRIBHCO, Hazira, Surat

Liquid Biofertilizer Products

- Azotobacter
- Azospirilum
- Rhizobium
- PSB
- KMB
- Bio NP consortium
- Bio NPK consortium

Department of Agril. Microbiology, BACA, AAU, Anand

Department of Nanotechnology, AAU, Anand

Centre for Advanced Research in Plant Tissue Culture, AAU, Anand

LC MS MS

GC-QTOF

NABL Accredited Pesticide Residues Laboratory

Regional Research Station

Main Vegetable Research Station

Bidi Tobacco Research Station

Medicinal & Aromatic Plants Research Station

Micronutrient Research Centre

Main Forage Research Station

AINP on Pesticide Residue

Centre of Excellence in Biotechnology

Bio-control Research Laboratory

AINP on Vertebrate Pest Management

On Campus Research Stations/Centers

Off Campus Research Stations/Centers


MRRS, Nawagam


MMRS, Godhra


ARS, Derol


ARS, Thasra

PRS, Vadodara

ARS, Dabhoi


TRTC, D'Baria


ARS, Dharmaj


ARS, Dahod


ARS, Sansoli


ARS, Khambholaj


Kankanpur


NIRS, Khandha


ARS, Kansari


SSRS, Sanand

RCRS, Viramgam


ARS, Arnej


ARS, Dhandhuka