



Research Accomplishments and Recommendations 2021



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RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS

2021

Editors

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MESSAGE

I am happy to note that a booklet “Research Accomplishment and Recommendations 2021” of Anand Agricultural University is published covering multi-disciplinary technologies developed by the scientists of Anand Agricultural University. I congratulate to the scientists for their scientific efforts made for releasing new crop varieties and useful recommendations. I am sure that these recommendations will be useful for farmers, extension workers, industrialists, NGO and policy makers of the nation in general and the state in particular.

Anand Agricultural University has made a significant contribution in agricultural research and I believe that the flavor of success will encourage our scientists to dedicate themselves further for the cause of farmers of the state and nation.

I appreciate the contribution of Dr. M. K. Jhala, Director of Research and his team for their sincere efforts in bringing out this valuable scientific publication covering all the new technologies generated by the AAU Scientists. This booklet will definitely update the extension workers, students, scientists, entrepreneurs and other stake holders for recent developments in various areas of agriculture and allied sectors, helping them to contribute better for the welfare of the nation.

(K. B. Kathiria)



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

FOREWORD

It is a matter of pleasure for me to put forward the 18th annual publication of "Research Accomplishment and Recommendations 2021" of Anand Agricultural University. This publication contains technologies developed by our scientists for the benefit of farmers, scientists, veterinary/dairy professionals, extension workers, entrepreneurs and other stake holders associated with farming community. I recognize and congratulate the scientists/ team of scientist for their untiring efforts made for contributing in developing new technologies/varieties. I am sure that these technologies/varieties will help not only in developing the agricultural sector as a whole, but will also provide solutions for many problems faced by the farming community.

I express my sincere thanks to the Hon'ble Vice Chancellor, Dr. K. B. Kathiria for his constant support and guidance for improving the research outcome of AAU. I am also thankful to all the conveners of AGRESCO sub-committees and Deans of different faculties for their support in planning and execution of research projects/schemes of the university by conducting the AGRESCO meetings smoothly and fruitfully.

I also appreciate my colleagues at the Directorate of Research for their untiring support to me so as to justify the primary mandate of my office as well as for compiling and publishing the information in time.

(M. K. Jhala)

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PREFACE

The research work carried out in different fields of agricultural sciences during the year 2020-21 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 by different committees 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	9+1	04	09
Crop Production	26	03	25
Plant Protection	11	25	65
Dairy Science and FPT&BE	13	01	20
Agri. Engineering& AIT	02	05	12
Animal Production	-	07	13
Animal Health	06	02	24
Social Science	-	02	44
Total	68	49	212

RECOMMENDATIONS FOR FARMING COMMUNITY

CROP IMPROVEMENT

1. Crop : Brinjal

Variety : Gujarat Round Brinjal 8 (GRB 8: Anand Raj)



The farmers of Gujarat state are recommended to grow brinjal variety Gujarat Round Brinjal 8 (GRB 8: Anand Raj) during *kharif-rabi* season. This variety recorded 426 q/ha average fruit yield which was 25.5, 20.9, 24.3, 25.7 and 32.0 per cent higher than the checks GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1, respectively. This variety has ovoid shaped fruit with purple fruit skin colour having strong glossiness. It has less prevalence of little leaf disease reaction, lower number of jassids and white flies as well as shoot and fruit borer damage as compared to all checks. This variety contains higher total soluble sugars (3.92%) and reducing sugars (2.51%) as compared to the check varieties GAOB 2, GNRB 1, GRB 5, Swarna Mani Black and GOB 1.

(Research Scientist, MVRS, AAU, Anand)

2. Crop : Chili

**Variety : Gujarat Anand Vegetable Chilli 141
(GAVC 141: Anand Tej)**



The farmers of middle Gujarat are recommended to grow chilli variety Gujarat Anand Vegetable Chilli 141 (GAVC 141: Anand Tej) during *kharif-rabi* season. This variety gave 149 q/ha average green fruit yield in middle Gujarat, which was 12.1, 27.6, 36.9 and 64.7 per cent higher over the checks GVC 111, GAVC 112, GVC 121 and JCA 283, respectively. The fruits of this variety have medium intensity of green colour at unripe stage with smooth texture. This variety has less prevalence of chilli leaf curl disease, fruit damage by fruit borer with lower or comparable thrips infestation as compared to the checks GAVC 112 and JCA 283. This variety contains higher ascorbic acid (16.37 mg/100g), total soluble sugars (3.78%) and reducing sugars (0.50%) as compared to the checks GVC 111 and GAVC 112.

(Research Scientist, MVRs, AAU, Anand)

3. Crop : Tomato

Variety: Gujarat Anand Tomato 8 (GAT 8: Anand Roma)



The farmers of middle Gujarat are recommended to grow tomato variety Gujarat Anand Tomato 8 (GAT 8: Anand Roma) during *kharif-rabi* season. This variety gave 406 q/ha average fruit yield in middle Gujarat. It exhibited 46.4, 35.3, 38.4, 13.9, 20.4, 22.3 and 25.3 per cent higher fruit yield over the checks GT 2, AT 3, JT 3, GAT 5, JT 6, GT 7 and DVRT 2, respectively. The growth habit of this variety has determinate type and light intensity of green colour leaf. The fruits are ovoid in shape with flat to pointed blossom end. This variety has less prevalence of tomato leaf curl disease and leaf damage by leaf miner as well as comparable or less fruit damage by fruit borer as compared to the checks GAT 5, JT 6, GT 7 and DVRT 2. This variety contains 10.79 mg/100g lycopene, 11.30 mg/100g ascorbic acid, 0.10% acidity and 0.04 acidity to sugar ratio.

(Research Scientist, MVRS, AAU, Anand)

4. Crop : Okra

Variety: Gujarat Anand Okra 8 (GAO 8: Anand Komal)



The farmers of middle Gujarat Agro-climatic zone are recommended to grow okra variety Gujarat Anand Okra 8 (GAO 8: Anand Komal) during *kharif* and summer season. This variety recorded 125 q/ha average fruit yield in middle Gujarat. While, it manifested 129 and 114 q/ha fruit yield during *kharif* and summer season, respectively. Fruits of this variety are dark green colour, tender, smooth, medium long having narrow acute shape of apex. It has strong serration of leaf blade margin and deep depth of lobbing. This variety has tall plant stature with a greater number of nodes and short internodes. It has less prevalence of yellow vein mosaic disease and enation leaf curl disease as well as lower jassids population and shoot damage as compared to the checks GAO 5, GO 6 and Pusa Sawani. This variety contains higher phenol (0.13%), total soluble sugars (2.50%) and total chlorophyll (0.55 mg/g) as compared to the checks GAO 5, GO 6 and Pusa Sawani.

(Research Scientist (Veg.), MVRs, AAU, Anand)

5. Crop : Rice

Variety: Gujarat Rice 21 (GR 21: Vatrak)



The *kharif* transplanted rice growing farmers of Gujarat state are recommended to grow Gujarat Rice 21 (GR 21: Vatrak). The average yield of variety is 5345 kg/ha. It is moderately resistant against major insect-pests viz., White Backed Plant Hopper, Yellow Stem Borer and Leaf Folder and major diseases viz., Bacterial Leaf Blight, Leaf Blast, Neck Blast, Sheath Rot and Grain Discoloration. It possesses medium slender grain type, cluster panicle, good tillering ability, medium maturity, good cooking and grain qualities as well as rice grain contain high amount of Fe and Zn.

(Research Scientist (Rice), MRRS, AAU, Nawagam)

6. Crop : Rice

Variety: Gujarat Anand Rice 22 (GAR 22: Swagat)



The *kharif* transplanted rice growing farmers of middle Gujarat are recommended to grow Gujarat Anand Rice 22 (GAR 22: Swagat). The average yield of the variety is 5613 kg/ha. It is having moderate resistance against major insect-pests viz., White Backed Plant Hopper, Yellow Stem Borer and Leaf Folder and major diseases viz., Bacterial Leaf Blight, Leaf Blast, Neck Blast, Sheath Rot and Grain Discoloration. It possesses long slender grain type, straight panicle, good tillering ability, medium maturity, good cooking and grain qualities.

(Research Scientist (Rice), MRRS, AAU, Nawagam)

7. Crop : Urdbean

Variety: Gujarat Anand Urdbean 4 (GAU 4: Shyamal)



The farmers of middle Gujarat are recommended to grow urdbean variety Gujarat Anand Urdbean 4 (GAU 4: Shyamal) during summer and *kharif* season. This variety gave 1005 kg/ha and 864 kg/ha seed yield in *kharif* and summer season, respectively in middle Gujarat. It exhibited yield advantage of 19.1 and 23.9% in *kharif* as well as 22.2 and 23.4 % in summer over the checks T 9 and GU 1, respectively. The variety has medium maturity, semi-erect in nature and resistant against YMD under natural field condition.

(Research Scientist, PRS, AAU, Vadodara)

8. Crop : Mungbean

Variety: Gujarat Anand Mungbean 8 (GAM 8: Hara Moti)



The farmers of middle Gujarat are recommended to grow mungbean variety Gujarat Anand Mungbean 8 (GAM 8: Hara Moti) during summer season. This variety recorded 1171 kg/ha seed yield, which is 86.6, 18.2, 18.9 and 14.3% higher over the check varieties GM-4, Meha, GAM 5 and GM 6, respectively. It matures within 65-75 days (medium group), having determinate growth habit with medium seed size and shiny green colour seed. It is resistant against Mungbean Yellow Mosaic Virus (MYMV) disease and the seeds have high protein content.

(Research Scientist, RRS, AAU, Anand)

9. Crop : Chrysanthemum

Variety: Ratlam Selection



The farmers of middle Gujarat are recommended to grow chrysanthemum variety Ratlam Selection released by Punjab Agricultural University, Ludhiana during *rabi* season. In middle Gujarat, this variety recorded 40.78 t/ha average flower yield, which is 130.27 and 29.83 per cent higher over the checks IIHR 6 and Sunil, respectively. The variety has determinate type of growth habit with broad leaves as well as early flowering, white in colour with semi-double flower head. This variety has less prevalence of aphid population as compared to the checks. The flowers of the variety have good shelf life.

(Principal and Dean, CoH, AAU, Anand)

10. Effect of growing methods on seed yield and quality in Bottle gourd [*Lagenaria siceraria* (Molina) Standl] GABGH 1"

Bottle gourd hybrid seed producers/farmers of middle Gujarat agro-climatic zone-III are recommended to follow trailing method for hybrid seed production during *kharif* season to get higher seed yield and net profit per hectare with better seed germination and vigour.

(Asstt. Prof. & Head, Dept. of Seed Science & Technology, BACA, AAU, Anand)

BASIC SCIENCES

-NIL-

CROP PRODUCTION

CULTURAL PRACTICES

1. Feasibilities of transplanting of cotton under varying age of seedlings

The farmers of middle Gujarat Agroclimatic Zone growing Bt. cotton are recommended to transplant either 20-30 days old seedling raised in plug nursery (cocopeat: vermiculite: perlite in proportion of 7:2:1; volume based) under open field condition on 1st July or 20 days old seedling during first fortnight of July for obtaining higher seed cotton yield and net return.

*(Professor and Head, Department of Agronomy,
BACA, AAU, Anand)*

2. Feasibility of vegetable intercropping in rustica tobacco (*Nicotiana rustica* L.) under middle Gujarat conditions

The farmers of middle Gujarat Agroclimatic Zone cultivating rustica tobacco are recommended to intercrop either 3-lines of garlic at 10 cm apart OR 3-lines of radish 10 cm apart or 2-lines of onion 15 cm apart as a green vegetable into the 60 cm row spacing of rustica tobacco for obtaining higher tobacco equivalent yield and net return.

Intercrops are to be sown by 15-25 days after transplanting of tobacco and harvested by 30-45 days after sowing.



Rustica tobacco + 3
lines of garlic



Rustica tobacco +
2 lines of onion



Rustica tobacco +
3 lines of radish

(Research Scientist (Tobacco), BTRS, AAU, Anand)

3. Study of pigeon pea varieties under relay cropping system

The farmers of middle Gujarat Agro-climatic Zone are recommended to adopt either blackgram-pigeonpea or greengram-pigeonpea relay cropping system for obtaining higher pigeonpea equivalent yield and net return.

- i. In case of blackgram-pigeon pea relay cropping, blackgram is to be sown at 45 cm apart during first week of July and pigeonpea (AGT 2 or BDN 2 or Vaishali) during first week of September.
- ii. Whereas, in case of greengram-pigeonpea relay cropping, greengram is to be sown at 45 cm apart during first week of July and pigeonpea (AGT 2 or Vaishali) during first week of September.
- iii. Keep a row after each two - rows of blackgram or greengram for the sowing of pigeonpea.

(Unit Officer, Pulse Research Station, AAU, Vadodara)

4. Economic feasibility of cotton-based cropping sequences (summer) under middle Gujarat conditions (Tribal area)

The farmers of middle Gujarat Agro-climatic Zone are recommended to grow summer groundnut during first week of February after harvesting of cotton for obtaining higher net return.

(Principal, CoA, AAU, Jabugam)

5. Evaluation of vegetables during different seasons under different shade net conditions

The farmers of middle Gujarat Agro climatic Zone growing leafy vegetables are recommended to

- i. Grow coriander cv. GDLC 1 at 25 cm line sowing in open field in 2nd week of September for getting higher yield and net return.
- ii. Grow spinach cv. Pusa Anupama at 25 cm line sowing in 50% white shade net or in open field in 2nd week of September for getting higher yield and net return.
- iii. Grow amaranthus cv. Pusa Badi Chaulai at 25 cm line sowing in 50% white shade net in 2nd week of September for getting higher yield and net return.

(Prof. and Head, Department of Veg. Sci., CoH, AAU, Anand)

6. Study on intercropping in aonla based cropping system

The farmers of middle Gujarat Agro climatic Zone having adult tree of aonla orchard (8.0 x 8.0 m.) are recommended to plant vegetable purpose turmeric or ginger during 2nd week of May at 30 x 15 cm as intercrop leaving 0.5 m

distance on both the sides of aonla trunk for getting higher net return.

(Prof. and Head, Dept. of Horticulture, BACA, AAU, Anand)

NUTRIENT MANAGEMENT

7. Evaluation of nutrient composition of bacterial biodegraded crop residues

For making good quality compost from crops residues viz., banana pseudostem, pigeon pea stalk, cotton stalk and castor stalk, farmers are recommended to mix Anubhav Bacterial Biodecomposer Consortium (ABBC 1.0 L/t) and 200 kg cow dung slurry (cow dung and water in 1:2 ratio) of shredded crop residues mixed in the pit (as per required size) with maintaining optimum moisture in the pit (65-70%) to get finished compost within 40-45 days for banana pseudostem, 55-60 days for pigeon pea stalk, 70 days for cotton stalk and 80-85 days for castor stalk, which is 5-10 days earlier than the compost prepared without Bacterial Biodecomposer consortium. Further, nutrient composition in finished compost is found better in pigeon pea stalk followed by banana pseudostem, cotton stalk and castor stalk.

(Prof. and Head, Dept. Of Agronomy, BACA, AAU, Anand)

8. Nutrient management through organic sources in summer green gram (*Vigna radiata* L.)

The farmers of middle Gujarat Agroclimatic Zone growing summer green gram organically are recommended to apply 1.0 L/ha Bio NP liquid biofertilizer (*Rhizobium* and PSB) mixed with either 500 kg/ha vermicompost OR 250 kg/ha

castor cake into the soil for obtaining higher yield and net return.

(Prof. and Head, Dept. Of Agronomy, BACA, AAU, Anand)

9. Field performance of promising *Rhizobium* isolates on green gram

The farmers of middle Gujarat Agro-climatic Zone growing summer green gram (GAM 5) through organic sources are recommended to apply either FYM 2.0 t/ha + Bio NP 1 L/ha or vermicompost 0.50 t/ha + Bio NP 1 L/ha or FYM 2.0 t/ha + vermicompost 0.50 t/ha for getting higher yield and net return.

(Prof. and Head, Dept. of Agril. Microbiology, BACA, AAU, Anand)

10. Effect of nitrogen and topping levels on yield and quality of bidi tobacco hybrid varieties

The farmers of middle Gujarat Agroclimatic Zone cultivating bidi tobacco hybrid are recommended to apply 180 kg N/ha, of which 45 kg N/ha as basal through ammonium sulphate and remaining 135 kg N/ha as top dressing through urea in three equal splits at an interval of 30 days after transplanting and to do topping at 21-leaves stage for obtaining higher yield and net return.

(Research Scientist (Tobacco), BTRS, AAU, Anand)

11. Effect of integrated nutrient management on yield, chemical composition and soil status in bidi tobacco under middle Gujarat condition

The farmers of middle Gujarat Agroclimatic Zone cultivating bidi tobacco are recommended to apply 140 kg N/ha, of which 35 kg N/ha as basal through poultry manure (2 t/

ha) and remaining 105 kg N/ha as top dressing through urea in three equal splits at an interval of 30 days after transplanting for obtaining higher yield and net return.



25% N from Poultry Manure + 75% RDN through Urea

(Research Scientist (Tobacco), BTRS, AAU, Anand)

12. Effect of integrated nutrient management on yield, chemical composition and soil status in rustica tobacco under middle Gujarat condition

The farmers of middle Gujarat Agro-climatic Zone cultivating rustica tobacco are recommended to apply either 150 kg N/ha through chemical fertilizer and dipping of seedling root in the solution of 5 mL/L Bio NPK liquid biofertilizer for 15 minutes or 100 kg N/ha through chemical fertilizer and 2 t/ha poultry manure together with dipping of seedling root in the solution of 5 mL/L Bio NPK liquid biofertilizer for 15 minutes before transplanting for obtaining higher yield and net return.



50% RDF + Bio NPK + CC 1 t/ha



75% RDF + Bio NPK

(Research Scientist (Tobacco), BTRS, AAU, Anand)

13. Effect of nitrogen levels on quality and yield of rustica tobacco varieties

The farmers of middle Gujarat Agro-climatic Zone cultivating rustica tobacco are recommended to apply 150 kg N/ha, of which 37.5 kg N/ha as basal through ammonium sulphate and remaining 112.5 kg N/ha as top dressing through urea in three equal splits at an interval of 30 days after transplanting for obtaining higher yield, quality and net return. Moreover, rustica tobacco variety DCT 4 registered higher yield as compared to variety GCT 3.



150 kg N / ha

(Research Scientist (Tobacco), BTRS, AAU, Anand)

14. Effect of different organic manures and Bio NPK consortium on yield and quality of Isabgul (*Plantago ovata* Forsk)

The farmers of middle Gujarat Agro-climatic Zone growing isabgul are recommended to apply 4 t FYM/ha along with either seed treatment of Bio NPK liquid biofertilizer @ 5 ml/kg seeds or soil application or 1 L/ha Bio NPK liquid biofertilizer mixed with 50 kg FYM for obtaining higher yield and net return.



FYM 4.0 t/ha + Bio NPK consortium seed treatment 5 mL/kg seeds



FYM 4.0 t/ha + Bio NPK consortium soil treatment 1 L/ha

(Associate Research Scientist (M&AP), M&AP, AAU, Anand)

15. Effect of organic manure, bio NPK consortium and chemical fertilizer on yield of hybrid maize (*Zea mays* L.) in *kharif* season

The farmers of middle Gujarat Agro-climatic Zone growing

kharif hybrid maize are recommend to apply 5 t FYM/ha along with recommended dose of 160 kg N/ha and 20 kg P_2O_5 /ha for obtaining higher yield and net return. Application of 40 kg N/ha and 20 kg P_2O_5 /ha is to be made as basal and remaining amount of nitrogen should be applied in three equal splits at 4-leaves, 8-leaves and tasseling stages.

(Associate Research Scientist, MMRS, AAU, Godhra)

16. Effect of nitrogen and phosphorus on yield of baby corn hybrid in *rabi* season

The farmers of middle Gujarat Agro-climatic Zone growing *rabi* baby corn hybrid are recommended to apply 60 kg N/ha, of which 30 kg N/ha as basal and remaining 30 kg N/ha at 30 DAS and 20 kg P_2O_5 /ha as basal for obtaining higher yield and net return.



60 kg N/ha + 20 kg
 P_2O_5 /ha



40 kg N/ha + 20 kg
 P_2O_5 /ha

(Associate Research Scientist, MMRS, AAU, Godhra)

17. Nitrogen management in early rice varieties of middle Gujarat

The farmers of AES-V (Nawagam area) and AES-II (Thasara area) of middle Gujarat Agro-climatic Zone growing early maturing rice varieties Gurjari or Mahisagar during summer season are recommended to apply 10 t FYM/ha along with 100 kg N/ha, of which 40 kg N/ha as basal, 40 kg N/ha at tillering stage and 20 kg N/ha at panicle initiation stage for obtaining higher yield and net return. Besides, apply 30 kg P_2O_5 /ha as a basal dose.



Application of 10 t FYM + 100 kg N/ha in Gurjari



Application of 10 t FYM + 100 kg N/ha in Mahisagar

(Research Scientist (Rice), MRRS, AAU, Nawagam)

18. Effect of different multi-micronutrient mixture grade application on growth, yield and quality of chickpea under conserved moisture condition in Bhal region

The farmers of *Bhal* and Coastal Agro-climatic Zone growing chickpea under conserved soil moisture condition are recommended to apply 1% foliar spray of Government notified multi-micronutrient mixture either Grade II (Fe: 6.0, Mn: 1.0, Zn: 4.0, Cu: 0.3 and B: 0.5 per cent) or Grade I (Fe: 2.0, Mn: 0.5, Zn: 4.0, Cu: 0.3 and B: 0.5 per cent) at 30, 45 and 60 days after sowing along with 20 kg N and 40 kg

P_2O_5 /ha as basal for obtaining higher yield, net return and iron content in seed.



RDF + multi-micronutrient
mixture



Control (RDF)

(Associate Research Scientist, ARS, AAU, Arnej)

19. Integrated nutrient management in summer Green gram (*Vigna radiata* L.)

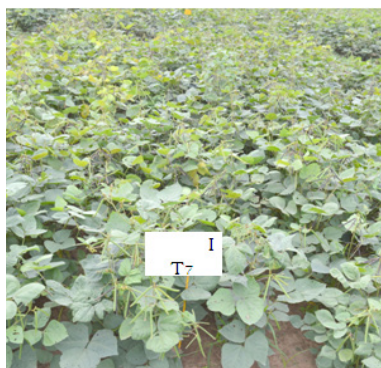
The farmers of middle Gujarat Agroclimatic Zone growing green gram during summer season are recommended to apply 40 kg P_2O_5 /ha through PROM as basal dose with Liquid Bio NP Biofertilizer (*Rhizobium* and PSB) @ 5 mL/kg seed treatment for obtaining higher yield and net return.

(Unit Head, TRTC, AAU, Devgadhi Baria)

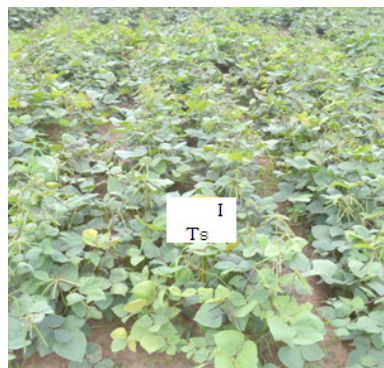
20. Effect of foliar application of organic and inorganic nutrients sources on growth, yield and quality of green gram (*Vigna radiata* (L.) Wilczek)

The farmers of middle Gujarat Agro-climatic Zone growing

green gram during *kharif* season are recommended to apply 10 kg N and 20 kg P_2O_5 /ha as basal along with foliar spray of either 3% urine of indigenous cow at pre-flowering stage OR 10 % vermiwash at pre-flowering and pod formation stages for obtaining higher yield and net return.



50% RDF fb 3 % Cow Urine at pre- flowering stage

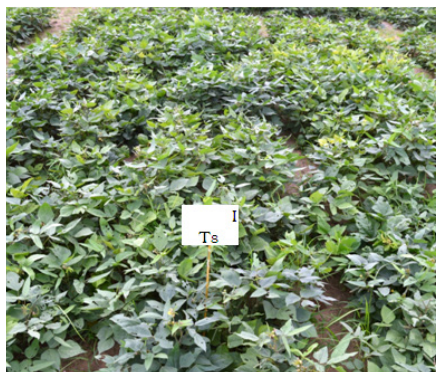


50% RDF fb 10 % Vermiwash at pre-flowering and pod formation stage

(Associate Research Scientist, ARS, AAU, Derol)

21. Effect of foliar application of organic and inorganic nutrients sources on growth, yield and quality of black gram (*Vigna mungo* (L.) Hepper)

The farmers of middle Gujarat Agro-climatic Zone growing black gram during *kharif* season are recommended to apply 10 kg N and 20 kg P_2O_5 /ha as basal along with foliar spray of 10 % vermiwash at pre-flowering and pod formation stage for obtaining higher yield and net return.



50% RDF *fb* 10 % Vermiwash at pre-flowering and pod formation stage

(Associate Research Scientist, ARS, AAU, Derol)

22. Effect of integrated nitrogen management on yield and quality of mustard (*Brassica juncea* L.)

The farmers of middle Gujarat Agro-climatic Zone growing mustard are recommended to adopt any of below given integrated nitrogen management for obtaining higher yield and net return. Besides, apply 50 kg P_2O_5 /ha as basal.

- i. Out of recommended dose of 50 kg N/ha, apply 12.5 kg N/ha either through castor cake or vermicompost or FYM as basal and 37.5 kg N/ha from chemical fertilizer in three equal splits as basal, at 30 and 60 DAS.
- ii. Out of recommended dose of 50 kg N/ha, apply 25 kg N/ha through FYM as basal and 25 kg N/ha from chemical fertilizer in two equal splits as basal and at 30 DAS.

(Principal, CoA, AAU, Vaso)

23. Optimization of NPK requirement for growth and curd yield of broccoli (*Brassica oleracea* var. *italica* L.) under middle Gujarat condition

The farmers of middle Gujarat Agro climatic Zone growing broccoli (1st week of November) are recommended to apply 10 t FYM with 75 kg N, 75 kg P₂O₅ and 50 kg K₂O/ha at the time of transplanting and 75 kg N/ha at 30 days after transplanting for higher yield and net return.

(Principal, CoA, AAU, Vaso)

WATER MANAGEMENT

24. Effect of dates of sowing and irrigation scheduling at critical growth stages on sesame

The farmers of middle Gujarat Agro-climatic Zone growing summer sesame are recommended to sow sesame during 3rd week of February and apply five irrigations at sowing, branching (30-45 DAS), flowering (45-50 DAS), capsule development (55-60 DAS) and seed development (65-70 DAS) stages for obtaining higher yield and net return.



Sowing on 3rd week of February with five irrigations

(Principal, CoA, AAU, Jabugam)

25. Effect of limited irrigation on production and fibre quality of desi cotton

The farmers of North-West Gujarat Agro-climatic Zone growing desi cotton under limited irrigation are recommended to apply only one irrigation at 20 days after withdrawal of monsoon for obtaining higher seed cotton yield and net return.

(Associate Research Scientist, RCRS, AAU, Viramgam)

26. Nitrogen management in tomato (*Lycopersicon esculentum* L.) under drip irrigation system in goradu soil of middle Gujarat conditions

The farmers of middle Gujarat Agro climatic Zone growing tomato in *rabi* season on *goradu* soil are recommended to transplant tomato seedling in paired row (45-135-45 x 45 cm) under drip irrigation system at 0.8 PEF and fertilize the crop with 120-75-75 kg NPK/ha of which 30 kg N as basal and remaining 90 kg N/ha in 5 equal splits at weekly interval starting from 25 days after transplanting through drip (In the form of Urea) for getting higher yield and net return.

System details:

1.	Lateral spacing	180 cm
2.	Dripper spacing	45 cm
3.	Dripper discharge	4 lph
4.	Operating pressure	1.2 kg/cm ²
5.	Operating frequency	Three day
6.	Operating time	October to December for 40 minutes and January to March 60 minutes

(Associate Research Scientist, ARS for Irrigated Crops, AAU, Thasra)

PLANT PROTECTION

AGRICULTURAL ENTOMOLOGY

1. Bio-rational management of mango hoppers

Mango orchardists of Gujarat are recommended to apply neem seed kernel extract 5% (500 g/10 L water) or neem oil 0.5% (50 mL + 10 g detergent powder/10 L water) or neem leaf extract 10% (1000 g/10 litre water) first when hopper population crosses ETL (i.e. 5 hoppers/panicle) and second at 10 days after first spray for effective management of hoppers in mango.

As per CIBRC format:

Year	Crop	Pest	Bio-pesticides	Dosage				Application schedule	Waiting period/ PHI (days)
				Conc . (%)	Dose/ 10 lit	Quantity of formulation / ha	Dilution in water (litre/ ha)		
2021	Mango	Hoppers	Neem seed kernel extract	5	500 g	25 kg	500	First spray when the pest crosses ETL (i.e, 5 hoppers/ panicle) and second at 10 days after the first spray	--
			Neem oil	0.5	50 ml	2.5 litre			--
			Neem leaf extract	10	1 kg	50 kg			--

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

2. Bio-efficacy of botanicals against aphids on coriander

Farmers growing coriander in Gujarat and interested in non-chemical control are recommended to spray aqueous bidi tobacco dust extract 2% (200 g/10 L water) or aqueous ginger rhizome extract 5% (500 g/10 L water) first when aphid population start building up and forming colony on branches and second at 10 days after first spray for effective management of aphids in coriander. For preparation of 5%

ginger rhizome aqueous extract, 500 g ginger rhizome to be crushed in required quantity of water followed by filtration and dilution in 10 litres of water.

As per CIBRC format:

Year	Crop	Pest	Biopesticides	Dosage				Application schedule	Waiting period/ PHI (days)
				Conc. (%)	Dose/ 10 litre	Quantity of formulation/ ha	Dilution in water (litre/ ha)		
2021	Coriander	Aphid	Aqueous bidi tobacco dust extract	2	200 g	8 kg	400	First when started to build up and formed colony on branches second at 10 days interval	-
			Aqueous ginger rhizome extract	5	500 g	20 kg			-



Tobacco decoction 2%



Ginger rhizome water extract 5%



Control

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

3. Evaluation of insecticides against *Callosobruchus maculatus* (Fabricius) infesting green gram seed during storage

The farmers and seed producers of Gujarat are recommended to smear green gram seeds with spinosad 45 SC, 0.0004% (0.13 mL in 15 L water for 1000 kg seed) or fipronil 5 SC, 0.0004% (1.20 mL in 15 L water for 1000 kg seed) or deltamethrin 2.8 EC, 0.0004% (2.15 ml in 15 litre

water for 1000 kg seeds) to protect seeds from pulse beetle infestation up to six months.

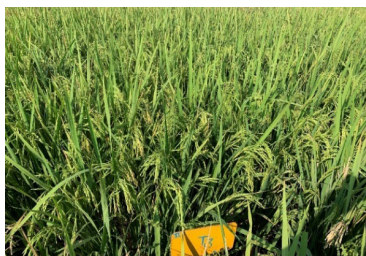
(Prof. and Head, Dept. of Entomology, BACA, AAU, Anand)

4. Evaluation of insecticides against yellow stem borer and leaf folder in rice

The rice growers of Gujarat are recommended to apply two sprays of chlorantraniliprole 18.5 SC, 0.006% (3 mL/10 L water) 47 days PHI or cartap hydrochloride 75 SG, 0.075% (10 g/10 L water) 35 days PHI or ready-mix insecticide flubendiamide 4% + buprofezin 20% SC, 0.042% (17.5 mL/10 L water) 30 days PHI, first at the initiation of insect-pests and second after 15 days for effective management of yellow stem borer and leaf folder.

As per CIBRC format:

Year	Crop	Pests	Insecticides	Dosage				Application Schedule	Waiting period/ PHI (days)
				g a.i./ ha	Conc. (%)	Quantity of formulation/ ha	Dilution in water (litre/ha)		
2021	Rice	Yellow stem borer and leaf folder	Chlorantraniliprole 18.5 SC	30	0.006	150 ml	500	First spray at initiation of incidence of yellow stem borer and leaf folder and second after 15 days	47
			Cartap hydrochloride 75 SG	375	0.075	500 g	500		35
			Flubendiamide 4% + buprofezin 20% SC	210	0.042	875 ml	500		30



**Chlorantraniliprole 18.5% SC
(30.0 g a.i./ha)**



**Cartap hydrochloride 75 % SG
(375.0 g a.i./ha)**



**Flubendiamide 4 % + buprofezin 20 %
w/w SC (210.0 g a.i./ha)**



Untreated

(Research Scientist (Rice), MRRS, AAU, Nawagam)

5. Evaluation of local practices for management of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) in maize

Farmers of Gujarat growing maize and interested in non-chemical management are recommended to apply soil or sand 5 g/plant in whorl at 30 and 45 days after sowing for reducing the damage of fall armyworm.

As per CIBRC format:

Year	Crop	Pest	Local practices	Dosage			Application Schedule	Waiting period/PHI (days)
				Dose (g/plant)	Quantity of formulation	Dilution in water (litre/ha)		
2021	Maize	Fall armyworm	Soil	5	--	NA	Whorl application at 30 and 45 days after sowing	NA



Soil application



Sand application



Untreated (control)

(Research Scientist (Maize), MMRS, AAU, Godhra)

6. Efficacy of different botanicals against pod borer complex of pigeonpea

Farmers of Gujarat are recommended to spray azadirachtin 0.15 EC, 0.0006% (40 mL/10 L water) or neem seed kernel extract 5% (500 g/10 L water) at initiation of pest and subsequent two sprays at 10 days interval for effective management of pod borer complex (*Helicoverpa armigera*, plume moth and pod fly) in pigeonpea.

As per CIBRC format:

Year	Crop	Pest	Biopesticides	Dosage				Application schedule	Waiting period /PHI (Days)
				Conc. (%)	Dose/ 10 litre	Quantity of formulation/ ha	Dilution in water (litre/ ha)		
2021	Pigeonpea	Pod borer complex (<i>H.armigera</i> , <i>E. atomosa</i> , and <i>M. obtusa</i>)	Azadirachtin 0.15 EC	0.0006	40 ml	2.4 litre	600	First spray at initiation of pest and subsequent two sprays at 10 days interval.	-
			Neem seed kernel extract	5	500 g	30 kg	600		-

(Associate Research Scientist, ARS, AAU, Derol)

PLANT PATHOLOGY AND NEMATOLOGY

7. Management of root rot caused by *Macrophomina phaseolina* in mungbean through seed treatment of *Trichoderma viride* and *Glomus intraradices*

Farmers of Gujarat growing mungbean are recommended to give soil application of *Trichoderma viride* 1% WP (2×10^8 cfu/g) enriched FYM (10 kg *T. viride*/ ton FYM), 1 ton/ha in soil prior to 10 days of sowing as well as seed treatment with *T. viride*, 10 g/kg seeds and with mycorrhiza *Glomus intraradices* 3000 IP/g, 17 g/kg seeds at the time of sowing for effective management of root rot disease.

As per CIBRC format:

Year	Crop	Disease	Biocontrol agents	Dosage				Application schedule	Waiting period/ PHI (days)
				cfu	Conc. (%)	Quantity of formulation/ ha	Dilution in water (litre/ ha)		
2021	Mung bean	Root rot	<i>T. viride</i> + <i>G. intraradices</i>	2×10^8 cfu /g + 3000 IP/g	1% WP	-	-	Soil application of <i>Trichoderma viride</i> 1% WP (2×10^8 cfu/g) enriched FYM (10 kg <i>T. viride</i> / ton FYM), 1 ton/ha in soil prior to 10 days of sowing as well as seed treatment with <i>T. viride</i> , 10 g/kg seeds and with <i>Glomus intraradices</i> 3000 IP/g, 17 g/kg seeds at the time of sowing	Not applicable

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

8. Management of foliar diseases of turmeric through fungicides

Farmers of Gujarat growing turmeric are recommended to spray ready-mix fungicide, azoxystrobin 18.2% + difenoconazole 11.4% SC, 0.03% (10 mL/ 10 L of water) along with commercially available sticker, 0.1% (10 mL/ 10 L of water) first at the initiation of the disease and subsequent two sprays at 15 days interval for effective management of foliar (leaf blotch and leaf spot) diseases. PHI minimum of 60 days should be kept.

As per CIBRC format:

Year	Crop	Diseases	Ready-mix fungicides	Dosage				Application schedule	Waiting period/ PHI (days)
				g a.i./ ha	Conc. (%)	Quantity of formulation/ ha	Dilution in water (litre/ha)		
2021	Turmeric	Leaf blotch and leaf spot	Azoxystrobin 18.2% + difenoconazole 11.4% SC and commercially available sticker	150	0.030	500 ml	500	First spray at the initiation of the disease and subsequent two sprays at 15 days interval	60
					0.1	500 ml			

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

9. Effect of date of planting on root-knot nematodes in tomato

The farmers of Gujarat cultivating tomato are recommended

to transplant tomato seedlings during the first-week of November for the management of root-knot nematodes.

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

10. Efficacy of different oils for the management of damping-off disease caused by *Pythium aphanidermatum* in bidi tobacco nursery

Farmers of Gujarat are recommended to apply neem oil or castor oil, 1% (100 mL oil and 10 mL commercially available sticker/10 L of water) at pre-seeding followed by three applications after germination at 10 days interval as spray drench for management of damping-off disease and increase healthy transplantable seedlings in bidi tobacco nursery.

(Research Scientist, BTRS, AAU, Anand)

11. Management of false smut of rice

Rice growers of Gujarat are recommended to apply two sprays of ready-mix fungicides, tebuconazole 50% + trifloxystrobin 25% WG, 0.060% (8 g/ 10 L of water) (PHI 35 days) OR picoxystrobin 7.05% + propiconazole 11.7% SC, 0.037% (20 mL/ 10 L of water) (PHI minimum of 24 days), first at 50% flowering stage and second at the time of 100% flowering stage for effective management of false smut.

As per CIBRC format:

Year	Crop	Disease	Ready-mix fungicides	Dosage				Application schedule	Waiting period/ PHI (days)
				g a.i./ ha	Conc. (%)	Quantity of formulation / ha	Dilution in water (litre/ ha)		
2021	Rice	False smut	Tebuconazole 50% + trifloxystrobin 25% WG	300	0.060	400 g	500	First spray at 50% flowering stage and second at the time of 100% flowering stage	35
			Picoxystrobin 7.05% + propiconazole 11.7% SC	187.5	0.037	1000 ml	500		24

***(Research Scientist, Main Rice Research Station,
AAU, Nawagam)***

DAIRY SCIENCE / FPT&BE

DAIRY SCIENCE

1. Technology for development of fermented milk powder

A technology developed by Anand Agricultural University, Anand for the manufacture of 'Fermented Milk Powder' has potential to yield 'Ready-to-reconstitute' product (Buttermilk); such powder has a shelf life of 120 days at ambient ($37 \pm 2^\circ\text{C}$) storage temperature packaged in metalized Pet-Polyester/Polyfilm pouches (85 μ thick).



Fermented Milk Powder

(Prof. & Head, Dept. of Dairy Plant Operations, DSC, AAU, Anand)

2. Technology for manufacture of milk based multigrain Ladoo

Anand Agricultural University, Anand recommends a technology for manufacture of gluten-free Multi Grain Ladoo with acceptable qualitative properties from multigrain flour composed of pearl millet, chickpea, ragi; along with Khoa, Ghee and sugar. The developed product has a shelf life of 28 days at room temperature ($37\pm 2^{\circ}\text{C}$) and 120 days at refrigeration temperature ($7\pm 2^{\circ}\text{C}$) when wrapped in aluminium foil ($12\ \mu$) and packed in polypropylene (PP) plastic container with lid.



Multi Grain Ladoo

(Prof. & Head, Dept. of Dairy Technology, DSC, AAU, Anand)

3. Development of indicator-based method for detection of selected vegetable oils adulteration in ghee

Anand Agricultural University, Anand, has developed a method to detect the presence of cotton seed oil, hydrogenated vegetable oil (HVO) and palm oil adulteration in ghee by quantitative analysis of reduction of DPPH indicator by spectrophotometric method. Samples giving more than 25 per cent reduction of DPPH after 15 min reaction period measured at wavelength of 517 nm indicates the presence of the adulterants.

(Prof. & Head, Dept. of Dairy Chemistry, DSC, AAU, Anand)

4. Evaluation of Lactic Acid Bacteria for β -galactosidase activity and its use in preparation of lactose hydrolysed milk

A protocol is developed by Anand Agricultural University, Anand for the production of β -galactosidase enzyme from *Lactobacillus* cultures [*Lactobacillus helveticus* MTCC 5463, *Lactobacillus rhamnosus* NK2 & *Lactobacillus casei* NK9] as well as for preparation of sensorially acceptable lactose hydrolyzed milk using the partially purified β -galactosidase enzyme by adding @ 2% in sterilized reconstituted skim milk and incubation at 37°C/12h.

(Prof. & Head, Dept. of Dairy Microbiology, DSC, AAU, Anand)

5. Development of ready to reconstitute coffee powder

Anand Agricultural University, Anand recommends method for preparation of Ready-to-Reconstitute (RTR) coffee mix powder by drying the admixture of coffee decoction (70:30, Arabica: Robusta, 30 % TSS) and milk concentrate (30% TS) in the ratio of 1:5 (w/w) by vacuum tray drying method

which has storage stability of 9 months at room temperature ($37 \pm 2^\circ\text{C}$) when packed in glass jar. Sensorial acceptable coffee beverage can be obtained on reconstitution of 25 g of such RTR coffee mix powder to 150 mL water.



Ready-to-Reconstitute (RTR) coffee mix powder

(Prof. & Head, Dept. of Dairy Engineering, DSC, AAU, Anand)

6. Design and development of a solar based incubation room

Dairy Industry and Entrepreneurs are recommended to adopt the solar based incubation room developed by Anand Agricultural University, Anand for incubation of fermented dairy products. The solar based incubation room having capacity of 100 crates (1200 litres) can work 24x7 with solar fraction of 0.81 to 1.00. The payback period of the air heating system is 3 years and 8 months.

(Prof. & Head, Dept. of Dairy Engineering, DSC, AAU, Anand)

7. Energy saving potential through partial homogenization of milk over conventional homogenization

Anand Agricultural University, Anand recommends process involving partial homogenization of market milk as it

utilizes lower pressure and less energy with additional benefits of about 68% reduction in energy usage over use of conventional homogenization of milk.

(Prof. & Head, Dept. of Dairy Engineering, DSC, AAU, Anand)

FOOD PROCESSING TECHNOLOGY

8. Technology for production of Indian gooseberry (Aonla) murabba

The entrepreneurs interested in the production of Indian gooseberry (aonla) shredded murabba are advised to adopt the processing technology developed for the purpose by Anand Agricultural University, Anand. The technology involves the blanching of aonla fruits in water at 100°C for 6 min followed by shredding through 5 mm stainless shredder. Final product is prepared by using aonla shred (54.25%), sugar (40.75%) and spices mix (5%) having 116.66 (mg/100g) ascorbic acid (Vitamin C) followed by thermal processing. The developed aonla shredded murabba can be stored safely for 180 days at the ambient condition.



Indian gooseberry (aonla) shredded murabba

(Prof. & Head, Dept. of FPT, FPT&BE, AAU, Anand)

9. Development of production technology for vegetable based juice from carrot and tomato

The entrepreneurs interested in the production of vegetable based blended juice from carrot and tomatoes are advised to

adopt processing technology developed for the purpose by the Anand Agricultural University, Anand. The technology involves the blanching of 15 mm carrot slices in water at 100°C for 8.5 min. Blended juice is prepared by optimizing carrot juice (50.03 mL), tomato juice (50.00 mL), lime juice (6.92 mL) and mint extract (8.48 mL) having 12.28 (mg/100 mL) ascorbic acid (Vitamin C) followed by thermal processing at 85°C for 20 min. The developed blend juice can be stored safely for 90 days at the ambient condition.



Vegetable based blended juice from carrot and tomatoes

(Prof. & Head, Dept. of FPT, FPT&BE, AAU, Anand)

10. Process development of cereals-based product enriched with garden cress for lactating women

The entrepreneurs and food processors interested in manufacture of nutri-cereal based products are advised to adopt the production technology of garden cress enriched Laddoos developed by Anand Agricultural University, Anand. The technology involves malting of wheat, finger millet and garden cress grains followed by drying and roasting. All the roasted grains are milled to obtain flour. Final product is prepared using wheat flour, finger millet flour and garden cress flour. To prepare Laddoos, ghee

is heated, in which mixed flour and powdered sugar are added, mixed well and Laddoos are made from this heated mixture. This product provides 500 kcal/100g energy, while it contains 144.65, 4.28 and 241.00 mg/100 g of calcium, iron and phosphorus respectively. This product is costing around Rs.136/kg.

(Prof. & Head, Dept. of FPT, FPT&BE, AAU, Anand)

11. Standardization of moringa pulping technique using brush type pulper

The entrepreneurs and food processors interested in extraction of Moringa pod pulp are recommended to adopt the technology developed by Anand Agricultural University, Anand. This technology involves selection of matured moringa pods, cleaning, cutting pods of 65 mm length followed by hot water blanching at 95°C for 9 min. The pulp can be extracted from blanched pods using brush type pulp extractor with 2.7 kg/min feed rate, 1260 rpm shaft speed and 3 mm pore size sieve, which gives extraction efficiency of 97.70%

(Prof. & Head, Dept. of FPT, FPT&BE, AAU, Anand)

12. Production technology for defatted pumpkin seed flour

The entrepreneurs and food processors interested in producing protein rich pumpkin seed powder are recommended to adopt the production technology developed by Anand Agricultural University, Anand. The technology involves sprouting of pumpkin seed at controlled temperature and relative humidity for 4 days followed by drying to a moisture level of 15-16 %. The ground seeds are defatted and dried at controlled temperature to get powder with less than 3% moisture. The powder packed in aluminum laminate bags can be stored for 90 days at

ambient temperature ($30\pm 2^{\circ}\text{C}$). The pumpkin seed powder contains 66 % protein which can be used as a protein supplement.

(Prof. & Head, Dept. of FPT, FPT&BE, AAU, Anand)

13. Development of low fat omega fatty acid enriched cake

Satisfactory omega fatty acid rich cake can be prepared by adding 7.5g of chia seed, 12.5g of flaxseed, 60g of walnut, 10ml of oil, and 50g of flaxseed gel in 70g of refined wheat flour using a technology developed by the Anand Agricultural University, Anand. The product has 5.25% less fat and ratio of ω -6 to ω -3 is 4.92 whereas ratio of control cake is 43.82. The bakery industry and entrepreneurs interested in production of such cake are recommended to follow the same.



Omega fatty acid rich cake

***(Principal, Polytechnic College in Food Science & Nutrition,
AAU, Anand)***

1. Development and evaluation of mini tractor operated strip till multi crop planter cum fertilizer applicator

The farmers are recommended to use the mini tractor operated multi crop planter cum fertilizer applicator developed by Anand Agricultural University to sow the seeds of different crops like green gram, black gram, castor, maize, soybean and pigeon pea. The planter has provision to adjust the row to row and seed to seed spacing as per crop requirement. The maximum speed to operate the machine, and respective effective field capacity, percentage saving in time and cost of sowing over conventional methods for different crops would be achieved as shown in Table:

Crop	Speed of operation, km/h	Effective field capacity, ha/h	Saving over conventional method, %	
			Time	cost of operation
Green Gram	3	0.321	85.96*	67.16*
Black Gram	3	0.324	86.09*	67.47*
Castor	2	0.278	96.40**	68.81**
Maize	3	0.389	76.87*	45.81*
Soybean	3	0.353	83.02*	60.19 *
Pigeon pea	3	0.378	76.15*	44.23*

* Bullock drawn plough with funnel type seeding attachment

** Manual dibbling method

(Principal & Dean, CAET, AAU, Godhra)

2. Performance evaluation of seedbed preparation implements for wheat crop in *Bhal* Agro-climatic Condition

The farmers of the *Bhal* region are recommended to use one pass of cultivator followed by one pass of rotavator to save cost of tillage operation (up to 68.38%) and saving in time (up to 37.11%) without change in yield as compared with traditional tillage practice (two pass of cultivator plus two pass of *Bhal Kaliya*) for seedbed preparation in wheat cultivation.

(Senior Scientist & Head, KVK, AAU, Arnej)

AGRICULTURAL INFORMATION TECHNOLOGY

---NIL---

ANIMAL PRODUCTION AND FISHERIES

1. Effect of feeding bypass fat on reproductive and productive performance of lactating Surti buffaloes around parturition.

Farmers are recommended to supplement bypass fat 130g/day for 30 days prepartum followed by 30 g/kg milk yield/day for 90 days postpartum to Surti buffaloes for enhancing milk production and net realization.

(Research Scientist, RBRU, Vet. College, AAU, Anand)

2. Effect of supplementation of Solid State Fermentation (SSF) Biomass on growth performance of crossbred heifers:

The cattle owners are advised that supplementation of Solid State Fermented biomass @ 3 % in TMR for crossbred

heifers improves daily growth rate by 12 % with 7 % reduction in feed cost per kg gain in weight.

(Research Scientist, ANRS, Vet. College, AAU, Anand)

3. Effect of feeding Ashwagandha and Shatavari roots on growth of Surti kids

The goatkeepers are recommended to feed total mixed ration incorporated with combination of 1.25% Ashwagandha roots & 1.25% Shatavari roots to growing Surti male kids during 9-12 months of age to improve body weight gain by 62%, feed conversion efficiency by 64% with 38% higher return over feed cost.

(Research Scientist, ANRS, Vet. College, AAU, Anand)

4. Methane mitigation in lactating crossbred cows under different feeding regimes.

Livestock owners are recommended that feeding crossbred cows with total mixed ration with 60% concentrate mixture, 20% wheat straw and 20% soyabean *gotar* reduces daily methane emission by 21%.

(Research Scientist, ANRS, Vet. College, AAU, Anand)

5. Methane mitigation by dietary interventions and its effect on growth performance of buffalo calves

Livestock owners are advised that along with Total Mixed Ration (50:50), feeding 500 g green neem leaves daily to buffalo calves increases growth rate by 15 % and reduces daily methane emission by 11 %. Moreover, feeding Total Mixed Ration (50:50) with 5 % sea weeds (*Sargassum johnstonii*) to buffalo calves reduces daily methane emission by 12 %.

(Research Scientist, ANRS, Vet. College, AAU, Anand)

6. Effect of feeding maize on growth and coloration of Molly fish (*Poecilia sphenops*)

It is recommended to ornamental fish farmers that the inclusion of GAYMH-1 maize variety @ 4% in the feed of orange molly fish is optimal for weight gain and body color enhancement.

(Senior Scientist & Head, KVK, Devataj, AAU, Anand)

ANIMAL HEALTH

-----NIL-----

SOCIAL SCIENCE

-----NIL-----

RECOMMENDATIONS FOR SCIENTIFIC COMMUNITY

CROP IMPROVEMENT

-----NIL-----

BASIC SCIENCE

1. Green synthesis of metallic nanoparticles and their antimicrobial activity against plant pathogens

Green synthesis of zinc oxide nanoparticles using plant leaves extract and a pH based reduction (pH maintained by 0.1 N NaOH) has been standardized by Anand Agricultural University. Sunlight exposure for 20 mins effectively synthesized zinc oxide nanoparticles using 0.1M zinc sulphate as a substrate and 2.5 mL of 5% Neem leaves extract as a reducing agent. The size of green synthesized zinc nanoparticles ranges from 157.6 to 336.0 nm following sunlight exposure. Further reduction of size and large scale production of nanoparticles achieved at basic pH ranging from 9.5 to 11.0. The size for pH mediated synthesized

ZnO nanoparticles ranges from 6.12 to 172.15 nm with poly dispersity index ranges from 0.221 to 0.315 and zeta potential ranges from -54.0 to -63.8 mV. These synthesized nanoparticles possessed excellent anti-microbial activity as revealed by *in vitro* growth inhibitory studies against various bacterial (*Xanthomonas oryzae*, Date palm isolate 9 and 11) and fungal (*Macrophoemina sp.*, *Sclerotium sp.*, *Fusarium sp.*, *Alternaria burnsii* and *Alternaria solani*) plant pathogens.

(Unit Head, Department of Agril. Biotechnology, AAU, Anand)

2. Synthesis and characterization of hydroxyapatite nanoparticles and its potential applications as phosphorous fertilizers

A wet chemical synthesis method of hydroxyapatite nanoparticles as a source of phosphorus fertilizer has been standardized by Anand Agricultural University. Calcium hydroxide and phosphoric acid of analytical grade can be used for the synthesis of HAP nanoparticle. The particle size of synthesized nanoparticle ranges from 227.5 to 1565.0 nm with poly dispersity index ranging from 0.288 to 1.000. The zeta potential of synthesized stabilized nanoparticle was found to be -46.7mV. Among different treatment combinations, 0.04% CMC is best suited for providing coating to overcome aggregation of particles. The synthesized HAP particles exhibited growth stimulatory effects on soybean plant and could be used as a solubilised P fertilizer in enhancing plant yield and biomass production.

(Unit Head, Department of Agril. Biotechnology, AAU, Anand)

3. **Marker assisted selection for RKN resistance in Tobacco**

In bidi tobacco, SSR markers namely, PT20149, PT30346 and TM11008 found linked with leaf thickness trait and TM10083, TM10820, PT20213 and TM10816 found linked with RKN resistance can be successfully used to transfer both the traits from A119 and ABT10, respectively. In addition, these markers can be successfully used to screen the germplasm at seedlings stage to identify genotypes having thickened leaf and RKN resistance.

(Unit Head, Department of Agril. Biotechnology, AAU, Anand)

4. **Development of colchiploid in *desi* Cotton (*Gossypium herbaceum* L)**

The scientific community involved in induction of polyploidy through colchicine treatment in genotypes of *desi* cotton (*Gossypium herbaceum* L) namely ALF-1027, 4011 and V-797 through various methods viz. treatment after germination, cotton swabbing method and seed soaking method with different colchicine concentrations (0.2%, 0.4%, 0.6%, 0.9%, 1.0% and 1.5%) is recommended to use the seed soaking method with 0.2% colchicine concentration and water soaking and colchicine soaking for 24 hrs and 16 hrs, respectively, for better induction of polyploidy among the three methods.

(Unit Head, Department of Agril. Biotechnology, AAU, Anand)

CROP PRODUCTION

1. Calibration and validation of SUBSTOR model (DSSAT 4.6) for three cultivars of potato under different sowing time

SUBSTOR-potato model of DSSAT family was calibrated and validated for Kufri Badshah, Kufri Pukhraj and Kufri Laukar cultivars of potato. The model simulations of tuber yield of potato were validated with less than 10 percent error. The genetic coefficients are recommended for use in optimization for crop management and yield prediction of potato crop as under.

Symbol	Description	Kufri Badshah	Kufri Pukhraj	Kufri Laukar
G2	Leaf area expansion rate in degree days ($\text{cm}^2 \text{ m}^{-2} \text{ d}^{-1}$)	2000	1910	2000
G3	Potential tuber growth rate ($\text{g m}^{-2} \text{ d}^{-1}$)	25.0	22.0	24.0
PD	Index that suppresses tuber growth during the period that immediately follows tuber induction	0.8	0.5	0.6
P2	Index that relates photoperiod responses to tuber initiation	0.7	0.5	0.5
TC	Upper critical temperature for tuber initiation ($^{\circ}\text{C}$)	15.0	15.0	15.0

(Prof. and Head, Dept. of Agril. Meteorology, BACA, AAU, Anand)

2. Evaluation of heavy metals tolerant native bacterial culture for bioremediation of heavy metals using multi-cut forage sorghum

Multi-bacterial consortium (combination of *Pseudomonas azotoformans*, *Bacillus infantis*, *Bacillus megaterium* and *Micrococcus terreus*) was found beneficial to alleviate the adverse effect of heavy metals in soil and plant thereby, improving growth, dry matter yield and root growth of multi cut forage sorghum.

(Associate Research Scientist, Micronutrient Research Project, AAU, Anand)

3. Assessment of Nitrate-N and Fluoride content in underground well water of middle Gujarat region

The NO_3 and F contents in well water samples of Ahmedabad, Anand, Kheda and Vadodara districts were found higher before monsoon as compared to after monsoon conditions.

% Samples above permissible limit*			
NO_3		F	
Before Monsoon	After Monsoon	Before Monsoon	After Monsoon
19.8	15.1	17.4	10.5

* As per WHO guidelines for drinking purpose

None of the well water sample was found above the permissible limit for heavy metals in all districts except Cd in few villages of Vadodara district and Cr in few villages of Ahmedabad and Vadodara districts (As shown below).

% Samples above permissible limit					
Vadodara			Ahmedabad		
Cd		Cr		Cr	
Before Monsoon	After Monsoon	Before Monsoon	After Monsoon	Before Monsoon	After Monsoon
47.6	28.6	47.6	47.6	10.0	5.0

No contamination of pesticide residues was found in well water samples of all districts.

Majority of well water samples fell under C_3S_1 class (34.9% in before monsoon and 39.5% after monsoon condition). While, none of the well water samples were found suitable for irrigation purpose (C_1S_1 class).

(Prof. & Head, Dept. of Soil Sci. and Ag. Chem., BACA, AAU, Anand)

PLANT PROTECTION

AGRICULTURAL ENTOMOLOGY

1. Evaluation of different bio-pesticides against fall armyworm, *Spodoptera frugiperda* (J.E.Smith) (Lepidoptera: Noctuidae) in maize

Application of *Bacillus thuringiensis* NBAIR strain –BtG4 (1% WP - 2×10^8 cfu/g), 50 g/10 litre water or *Bacillus thuringiensis* AAU strain -AAUBt1 (1% WP - 2×10^8 cfu/g), 50 g/10 litre for three times at ten days interval, with the initiation of the pest found effective for the management of fall armyworm, *Spodoptera frugiperda* in maize.

(Principal Res.Sci., AICRP on Biological Control of Crop Pests, AAU, Anand)

2. Assessment of Rose-ringed parakeet (*Psittacula krameri*) depredations to guava fruits

Yield loss due to parakeet depredation recorded was 11.66 per cent in guava orchard of Gujarat. Fruit damage and number of parakeet bird was higher in morning hours than evening hours.

(Ornithologist, AINPVM: Agril. Ornithology, AAU, Anand)

3. Role of insectivorous birds in suppression of fruit borer, *Helicoverpa armigera* (Hubner) Hardwick in tomato

The insectivorous bird community i.e. red vented bulbul in tomato crop found effective in suppression of larval population of tomato fruit borer, *Helicoverpa armigera* (Hubner). The mean larval population observed in treatment plots was lower, perch plot (6.00 larva/10 plant) and open plot (7.24 larva/10 plant) and resulted in increase the yield. It is recommended to install "T" shaped bird perches to promote birds activity.

(Ornithologist, AINPVM: Agril. Ornithology, AAU, Anand)

4. Decontamination study of pesticides in green chilli

Dipping green chilli fruits in 5% aqueous solution of sodium bicarbonate for 10 min effectively removed acephate (17.9%), cypermethrin (53.52%), acetamiprid (20.51%), imidacloprid (27.10%), thiamethoxam (30.49%), carbendazim (81.07%) and fipronil (92.71%). Even IHR product, Arka Herbiwash was found effective as dipping green chilli fruits for 15 seconds in 0.02% aqueous solution, followed by washing under running tap water for 1 min. removed cypermethrin (93.66%), acetamiprid (15.38%), profenophos (23.18%), chlorpyrifos (39.15%), carbendazim (90.85%) and fipronil (92.71%).

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

5. Residues and persistence of fluopyram 250 g/L + trifloxystrobin 250 g/L SC in chilli

Two foliar applications of ready-mix fungicide fluopyram 250 g/L + trifloxystrobin 250 g/L SC in chilli @ 150 + 150 g a.i./ha starting at fruiting stage followed by 10 days resulted in the residues below the fluopyram MRL of 3.0 mg/kg (CODEX) in green chilli fruits 3rd day after the last spray. As MRL for trifloxystrobin in chilli fruits is 0.40 mg/kg (FSSAI) and 3rd day value of the last application is exceeding the MRL, the mixture cannot be recommended in chilli. However, residues of both the fungicides were below their MRLs in dry red chilli.

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

6. Residues and persistence of fluopyram 400 g/L SC in chilli

Single soil drench application of fluopyram 400 g/L SC in chilli @ 500 g a.i./ha at 3 days after transplanting resulted residue below the Codex MRL (CODEX) of 3.0 mg/kg in chilli fruits if harvested 81 days after the last application. Therefore, PHI of 81 days could be suggested if fluopyram is registered in chilli.

OR

First soil drench application of fluopyram 400 g/L SC in chilli @ 250 g a.i./ha at 3 days after transplanting followed by 21 days after first application resulted residue below the Codex MRL (CODEX) of 3.0 mg/kg in chilli fruits if harvested 60 days after the last application. Therefore, PHI of 60 days could be suggested if fluopyram is registered in chilli.

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

7. Residues and persistence of fosetyl-aluminium 80 WP in banana

Five applications of fosetyl-aluminum 80 WP as soil drenching in banana at one month interval starting from two months of planting @ 1.2 g/L water/plant resulted in its residue below the limit of quantitation of 0.05 mg/kg and/or EU MRL of 2.0 mg/kg in banana fruits if harvested from 67 days after the last application.

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

8. Residues and persistence of cyantranilprole 7.3% + diafenthiuron 36.4% SC in okra

Two foliar applications of the ready-mix insecticide cyantranilprole 7.3% + diafenthiuron 36.4% SC in okra at 10-day interval @ 60 + 300 g a.i./ha at fruiting stage resulted in cyantranilprole and diafenthiuron residues below their MRLs (FSSAI) of 0.5 and 0.6 mg/kg in okra fruits if harvested one day after the last application. Therefore, PHI of 1-day could be proposed if cyantranilprole 7.3% + diafenthiuron 36.4% SC is registered for okra.

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

9. Residues and persistence of fluopyram 200 g/L + tebuconazole 200g/L SC in banana

Three foliar applications of the ready-mix fungicide fluopyram 200 g/L + tebuconazole 200g/L SC in banana at 10-day interval @ 120 + 120 g a.i./ha at fruit development stage resulted in its residue below the MRLs 0.8 (CODEX) and 1.5 (FSSAI) mg/kg in immature and mature banana as well as pulp of mature banana for fluopyram and tebuconazole, respectively, if harvested from the day of last application.

Therefore, PHI of 1-day could be proposed if fluopyram 200 g/L + tebuconazole 200 g/L SC is registered for banana.

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

10. Residues and persistence of fosetyl-aluminium 80 WP in/on chickpea

Two applications of fosetyl-aluminium 80% WP at 15 days interval as soil drenching @ 2400 g a.i./ha in chickpea one month after sowing resulted in the residues of fosetyl-aluminium and phosphonic acid below limit of quantification of 0.05 mg/kg in immature pods on the day of last application. The fosetyl-aluminium 80% WP application in chickpea 45 days after sowing as soil drench was found safe from residue point of view. Therefore, PHI of 45-day could be suggested if fosetyl-aluminium 80% WP is registered in chickpea.

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

11. Residues and persistence of thiodicarb 75 WP in maize

Three foliar sprays of thiodicarb 75 WP in maize at 7 days interval @ 750 g a.i./ha starting from 50% cob formation stage resulted in its residue below the CODEX MRL of 0.02 mg/kg in maize from 1st day after the last application. Therefore, PHI of 1-day could be suggested if thiodicarb 75 WP is registered in maize.

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

12. Residues and persistence of tetraniliprole 200 g/L SC in maize

Three foliar sprays of tetraniliprole 200 g/L SC in maize at 7 days interval @ 50 g a.i./ha starting from 50% cob formation stage resulted in its residue below the limit of quantitation

of 0.01 mg/kg in maize cob from 1st day after the last application. Therefore, PHI of 1-day could be suggested if tetraniliprole 200 g/L SC is registered in maize.

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

13. Residues and persistence of flubendiamide 90 g/L + deltamethrin 60 g/L SC in maize

Three foliar sprays of ready-mix insecticide flubendiamide 90 g/L + deltamethrin 60 g/L SC in maize at 7-day interval @ 36 + 24 g a.i./ha starting from 50% cob formation stage resulted their residues below the CODEX MRLs of 0.02 and 2.0 mg/kg for flubendiamide and deltamethrin, respectively, in maize cob from 1st day after the last application. Therefore, PHI of 1-day could be suggested if flubendiamide 90 g/L + deltamethrin 60 g/L SC is recommended in maize.

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

14. Bio-efficacy of ready-mix insecticides against pest complex of Indian bean, *Lablab purpureus* (L.) Walp.

Application of one foliar spray of ready-mix insecticide thiamethoxam 12.6 % + lambda cyhalothrin 9.5 % ZC 0.005%, 2.5 ml/ 10 L water (27.63 g a.i./ha) when it cross ETL of aphid index-1 found effective against aphids infesting Indian bean. Application of one foliar spray of ready-mix insecticide chlorantraniliprole 9.3% + lambda cyhalothrin 4.6% ZC 0.006%, 4 mL/ 10 L water (27.80 g a.i./ha) when it cross ETL of 1 larva per plant found effective against pod borer complex i.e. *Helicoverpa armigera* and *Maruca vitrata* infesting Indian bean.]

*(Res. Scientist, Main Vegetable Research Station,
AAU, Anand)*

15. Evaluation of insecticides against aphid infesting chrysanthemum

Application of flonicamid 50 WG 0.019 % (3.75 g / 10 L of water), first at appearance of the pest and second at 15 days after first spray found effective against aphid in chrysanthemum.

(Principal, College of Horticulture, AAU, Anand)

16. Screening of inbreds, hybrids, released varieties as well as sweet corn hybrids of maize for resistance against fall armyworm, *Spodoptera frugiperda* (J.E. Smith)

Among 24 maize inbreds, hybrids and varieties screened, GAYMH-1 and GAYMH-3 found resistant against fall armyworm, *Spodoptera frugiperda* under field condition of middle Gujarat region.

(Research Scientist, MMRS, AAU, Godhra)

17. Screening of pigeonpea genotypes against insect pests and diseases under natural conditions

Out of 24 pigeonpea genotypes/cultivars screened, the genotype VPG-39 found moderately resistant against *Helicoverpa armigera* while, VPG-297 found moderately resistant against pod fly, *Melanagromyza obtusa*. The varieties AGT-2 and Vaishali still remained moderately resistant by remaining at par with the VPG-39 and VPG-297 against insect pests (*H. armigera* and *M. obtusa*).

*(Research Scientist, PRS, AAU, Vadodara and Assoc.
Research Scientist, ARS, AAU, Derol)*

18. Management of melon fruit fly, *Bactrocera cucurbitae* Coquillett infesting cucumber in river-bed area of Orsang

Field sanitation at weekly interval + installation of cue lure traps 16/ha at flowering stage of crop + application of bait

8 L/ha consisting of black jiggery, 5 % , 400 gram at five meter distance + spinosad 0.004 %, 3 ml at weekly interval starting from fruit setting (four sprays) was found effective against melon fruit fly, *Bactrocera cucurbitae* infesting cucumber grown in river-bed area.

(Principal, College of Agriculture, AAU, Jabugam)

19. Effect of different organic manures on incidence of gram pod borer, *Helicoverpa armigera* (Hubner) Hardwick infesting chickpea under Bhal region

Application of well decomposed FYM (2.0 t/ha) + castor cake (0.25 t/ha) as basal for minimizing the infestation of gram pod borer in the chickpea variety GJG-3, under an unirrigated condition.

(Research Scientist, ARS, AAU, Arnej)

PLANT PATHOLOGY AND NEMATOLOGY

20. Evaluation of efficient *Trichoderma asperellum* (Ta1 AAU isolate) against wilt and root rot in chickpea

Application of solid talc-based bioformulation of *Trichoderma asperellum* (2x10⁸ cfu/g) enriched FYM (10 kg/ ton) in furrow @ 1 ton/ha prior to 10 days of sowing in soil found effective in management of wilt and root rot in chickpea.

(Prof. and Head, Department of Plant Pathology, BACA, AAU, Anand)

21. Evaluation of new chemical molecules against *Meloidogyne* spp. infecting cucumber in polyhouse

Drenching of fluazaindolizine 500 SC, 0.025% (10 mL/ 20 L of water) at one day before transplanting (200 mL/

plant hole) found effective for management of root-knot nematodes, *Meloidogyne* spp. infecting cucumber in polyhouse.

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

22. Source of resistant against grain discolouration of rice

Rice genotypes viz., NWGR-11048 and NWGR-12016 found resistant against grain discolouration under natural conditions in the field.

(Res. Scientist, MRRS, AAU, Nawagam)

23. Source of resistance against bacterial leaf blight of rice

Rice genotypes viz., NWGR-14035, NWGR-14084 and NWGR-11002 shown resistant reaction against bacterial leaf blight (*Xanthomonas oryzae* pv. *oryzae*) under artificial inoculation and high disease pressure conditions in the field.

(Res. Scientist, MRRS, AAU, Nawagam)

24. Management of powdery mildew and cercospora leaf spot in black gram

Foliar spray of hexaconazole 5 EC, 0.1% OR azoxystrobin 23 SC, 0.023% first at the initiation of disease and second at 15 days after first spray found effective for the management of cercospora leaf spot in black gram.

(Principal, College of Agriculture, AAU, Jabugam)

25. Management of tikka disease of groundnut through fungicides

Spray ready-mix fungicide, pyraclostrobin 13.3% + epoxiconazole 5% SE, 0.025% (14 mL/10 L of water) first

at the initiation of the disease and second at 15 days after first spray for effective management of tikka (early and late leaf spot) disease of groundnut. PHI should be kept as 21 days.

(Prof. and Head, Department of Plant Pathology, BACA, Anand)

DAIRY SCIENCE

----NIL----

FOOD PROCESSING TECHNOLOGY

1. Studies on quality changes and aging effect in selected rice varieties under different storage conditions

Three popular local varieties of milled rice viz. GR-11, Ambika and Krishna Kamod were stored under ambient condition in two types of packaging material (bag and metalized bin) to study the effect of aging on rice. It was observed that for all three varieties of rice there was no significant change ($p < 0.05$) in physical properties (i.e., length, width, thickness, bulk density, true density, porosity, sphericity and weight of 1000 grains) and proximate composition (i.e., moisture, fat, fiber, protein, ash and carbohydrates) over the study period of 36 months. However, for both the packaging material it was observed that significant changes ($p < 0.05$) in total phenolic compound, cooking quality and pasting viscosity of rice of all selected varieties took place during initial eleven months of storage under ambient condition. The study revealed that phenolic compound and pasting viscosity increased, whereas water uptake and solid loss decreased with increase in the storage period. Over a period of time the rice structure changed to compact mass by filling up the cracks due to physical transformation

as observed from the SEM analysis. Therefore, the water uptake and solid loss decreased. Hence, for both packaging materials under ambient storage, aging of rice facilitated desired changes to improve quality of cooked rice.

(HoD, Dept. of PHET, FPT&BE, AAU, Anand)

AGRICULTURAL ENGINEERING

1. Development of rapid measurement system for angle of repose of grains

The educational institutes/ scientists/ entrepreneurs/ processors/ farm equipment manufacturers are advised to use low-cost angle of repose apparatus developed at Anand Agricultural University for measuring of angle of repose using any image analysis free software available for various grains at different moisture contents.

(Principal and Dean, CAET, AAU, Godhra)

2. Development of a web interface to analyze location specific rainfall data

The researchers and scientists are recommended to use text mining technique-based web tool developed by Anand Agricultural University for viewing and downloading taluka rainfall data (xls format) prepared from GSDMA data source for different research activities.

(Principal and Dean, CAET, AAU, Godhra)

3. Remote Sensing and GIS based approach for identifying prospective water harvesting sites in the Panam sub-watershed of Mahi River Basin, India

Using remote sensing (RS) & geographical information system (GIS) techniques several possible sites for Check

dams, Percolation tanks and Nala bunds structures for groundwater recharge were identified and are suggested as promising recharge structures in the Panam catchment. The results are useful to hydrologists, decision-makers and planners for quickly determining areas that have groundwater recharge potential. Information derived from this study can be used to suggest to farmers, government, NGO's and other stakeholders on best water conservation practices and sustainable use of the water resource.

(Principal, CoA, AAU, Vaso)

AGRICULTURAL INFORMATION TECHNOLOGY

4. Study on the relationship between weather parameters and rice productivity for Kheda district Using Data Mining Approaches

The researchers and scientists are recommended to use “Correlation Attribute Eval” algorithm for feature selection and function based “Sequential Minimal Optimization (SMO)” algorithm for classification in data mining approaches of rice yield prediction using weekly weather parameters.

(Principal & Dean, CAIT, AAU, Anand)

5. Development of interface for Veterinary Microbiology Diagnostic Report Management System

The Veterinary Microbiology Diagnostic Report Management interface is developed for the Department of Veterinary Microbiology, College of Veterinary Science and Animal Husbandry, Anand Agricultural University, Anand. This system provides the online platform for the management of preparation of veterinary microbiology diagnostic reports.

It is recommended to use by the Veterinary Microbiology departments of SAUs of the state.

(Director, IT, AAU, Anand)

ANIMAL PRODUCTION

1. Study on progesterone profile of milk in buffaloes for early pregnancy diagnosis under farm and field

For early pregnancy diagnosis in buffaloes, progesterone assay by RIA on milk samples collected earliest by 19th day post-breeding gives 100 % accuracy for non-pregnancy and 88% accuracy for pregnancy.

(Research Scientist, RBRU, Vet. College, AAU, Anand)

2. Dietary interventions for designer milk production in dairy cattle

Feeding flax seed and mustard seed @ 4.5 % in total mix ration to dairy cows significantly increase concentration of oleic acid by 32 % and total unsaturated fatty acid up to 29. % While decrease concentration of palmitic acid up to 3.1 % and total saturated fatty acid up to 29.5 % in milk fat respectively.

(Research Scientist, ANRS, Vet. College, AAU, Anand)

ANIMAL HEALTH

1. Studies on sub-acute toxicity of Cinnamon oil (*Cinnamomum zeylanicum*) in rats

Repeated oral administration of cinnamon oil up to 200 mg/kg body weight once daily for 28 days did not reveal any toxic effects in Wistar rats.

*(Prof. and Head, Dept. of Vet. Pharmacology & Toxicology,
Vet. College, AAU, Anand)*

2. Study on Pharmacokinetic – Pharmacodynamic (PK-PD) integration of ceftiofame in sheep

Based on pharmacokinetic-pharmacodynamic integration, the recommended intramuscular dosage regimen of ceftiofame for sheep is 10 mg/kg body weight repeated at 12-hour interval.

(Prof. and Head, Dept. of Vet. Pharmacology & Toxicology, Vet. College, AAU, Anand)

3. In Vitro Embryo Production and Pregnancy Rates from OPU-IVEP using Sexed Semen in Cattle

3 HF crossbred cows yielded significantly ($p < 0.05$) higher number of oocytes (25.1 ± 3.3), cleavage rate ($83.4 \pm 2.2\%$), blastocyst rate ($40.2 \pm 3.8\%$) and number of embryos (9.5 ± 1.6) per ovum pick-up (OPU) than the Gir and Sahiwal cows. Grade 3 and grade 4 oocytes recovered through OPU converted in to good quality blastocysts when co-cultured with grade 1 and 2 oocytes and they had positive correlation with cleavage rate ($r = 0.3$) and blastocyst rate ($r = 0.4$, $p < 0.05$).

(Prof. and Head, Department of Gynaecology and Obstetrics, Vet. College, AAU, Anand)

4. In Vitro Embryo Production and Pregnancy Rates from OPU-IVEP using Sexed Semen in Cattle

Significantly ($p < 0.05$) higher cleavage rates were observed in both indigenous and crossbred embryos with conventional semen ($43.5 \pm 7.5\%$ and $67.8 \pm 7.5\%$) than sex-sorted semen ($39.2 \pm 7.1\%$ and $26.3 \pm 7.5\%$). The overall blastocyst rate ($22.6 \pm 3.9\%$ vs. $4.3 \pm 3.8\%$) and embryos ($n=35/200$ oocytes vs. $n=9/238$ oocytes) obtained were

also significantly ($p < 0.05$) higher using conventional semen as compared to sex-sorted semen. Higher pregnancies were achieved in crossbred cows than indigenous cows (40.0 vs. 17.6%). Pregnancy rates with embryos from conventional semen and sex-sorted semen were nearly similar (25.0 vs 28.6%).

*(Prof. and Head, Department of Gynaecology and Obstetrics,
Vet. College, AAU, Anand)*

5. Evaluation of Cryoprotective and Capacitation Inhibitory Potential of Mifepristone, Sericin and Taurine in TFYG Extender for Bovine Semen

It is recommended to fortify Tris fructose yolk glycerol (TFYG) extender with Mifepristone (10 $\mu\text{g/mL}$), Sericin (5 mg/mL) and Taurine (4 mg/mL), particularly Mifepristone, as it improves significantly the post-thaw sperm progressive motility, viability and HOS reactivity (membrane integrity), with reduced percentages of capacitated (B pattern) and acrosome reacted (AR pattern) sperm and lipid peroxidation in respect of MDA, SOD and GPx activity with enhance in vivo fertility over the control TFYG extender in both Gir and Murrah bull semen.

*(Prof. and Head, Department of Gynaecology and Obstetrics,
Vet. College, AAU, Anand)*

6. Development of Rapid Multiplex PCR Method for Simultaneous Detection of Gram-Negative Foodborne Pathogens

Multiplex PCR standardized using a combination of following set of primers; including one set of primer developed by AAU, Anand can be employed for simultaneous detection of *Campylobacter* spp., *Escherichia coli*, pathogenic *Salmonella*

spp., and *Shigella* spp. from raw meat.

Organism	Primer Name	Primer Sequence (5'-3')	Amplicon Size (bp)
<i>Campylobacter</i> spp.	16S-F	ATCTAATGGCTTAACCATTA	851
	16S-R	GTAAC TAGTTTAGTATTCCGG	
<i>Escherichia coli</i>	uidA-F	GTCACGCCGTATGTTATTG	530
	uidA-R	CCAAAGCCAGTAAAGTAGAAC	
Pathogenic <i>Salmonella</i> spp.	invA-F	GTGAAATTATCGCCACGTTCCGGGCAA	285
	invA-R	TCATCGCACCGTCAAAGGAACC	
<i>Shigella</i> spp.	ipaH-F	TGATGCCACTGAGAGCTGTG	399
	ipaH-R	AGTACAGCATGCCATGGTCC	

(Prof. and Head, Dept. of VPH, Vet. College, AAU, Anand)

7. Studies on Ketamine-Medazolam, Isoflurane and Sevoflurane Induction and Maintenance with and without Butorphanol Premedication in Birds

- Administration of Ketamine (25 mg/kg b.wt.) and Midazolam (0.5 mg/kg b.wt.) (KM) mixture intramuscularly, is recommended for induction of anaesthesia based on quality of anaesthesia produced in injured birds
- Administration of Butorphanol (1.5 mg/kg) intramuscularly as premedication agent, is recommended for safer induction using inhalant anaesthetic agents Isoflurane and Sevoflurane in birds
- Sevoflurane 5-7% for induction & 3-4% for maintenance has quick and smooth induction and recovery as compared to Isoflurane 3-4% for induction & 1-2% for maintenance anaesthesia in birds

(Prof. & Head, Surgery & Radiology Dept., Vet. College, AAU, Anand)

SOCIAL SCIENCE

1. Evaluation and development of yardstick of CV % for rice crop experiments for Nawagam Center

The yard stick of CV% for accepting the results of rice crop experiment is 14 per cent for yield character.

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

2. Development and standardization of scale to measure the self-confidence of rural youth to work in farming

A scale of selected statements to measure the self-confidence of rural youth to work in agriculture

No	Statements	SA	A	UD	DA	SDA
1	I am confident on my working ability of modern farming(+)	5	4	3	2	1
2	I can handle farming without taking help of my father (+)	5	4	3	2	1
3	Package of practices of scientific farming is beyond my capacity to handle (-)	1	2	3	4	5
4	I am confident in selecting suitable varieties of field crops (+)	5	4	3	2	1
5	I have ability to produce vermicomposting (+)	5	4	3	2	1
6	Irrigation management in farming is beyond my capacity to handle (-)	1	2	3	4	5
7	I feel confident to carry out weed control measures (+)	5	4	3	2	1
8	I feel difficulty to handle plant protection tools (-)	1	2	3	4	5
9	I am self-reliant to handle post-harvest techniques of crop production. (+)	5	4	3	2	1
10	I consider myself as market smart person (+)	5	4	3	2	1

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

(Prof. and Head, Dept. of Agril. Extn. & Comm., AAU, Anand)



Fermented Milk Powder



Multi Grain Ladoo



**Indian gooseberry (aonla)
shredded murabba**



Omega fatty acid rich cake



**Vegetable based blended juice
from carrot and tomatoes**



**Ready-to-Reconstitute (RTR)
coffee mix powder**



Gujarat Anand Mungbean 8 (GAM 8: Hara Moti)



Gujarat Anand Urdbean 4 (GAU 4: Shyamal)



Ratlam Selection