

Research Accomplishments and Recommendations



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RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS

2015



DIRECTORATE OF RESEARCH ANAND AGRICULTURAL UNIVERSITY ANAND 388 110



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ANAND AGRICULTURAL UNIVERSITY UNIVERSITY BHAVAN ANAND - 388110



FOREWORD

Publication of 'Research Accomplishments and Recommendations' of the university is always a matter of conscientious satisfaction and happiness as through this, the dedicated efforts of the university are conveyed to the scientists, extension workers, farmers, industrialists, NGOs and policy makers for the necessary scientific inputs to augment agricultural production and prosperity. AAU has made a significant dent in agricultural research and has been the nerve centre for researchers and academicians. It is apt that as a reflection of their research endeavor, this publication is being released. I am sure that this booklet will be a very useful source of information to all those concerned for the welfare of agriculture and related sectors.

I appreciate the efforts made by the scientists of the university who contributed significantly for developing and recommending useful technologies and I believe that the flavour of success will give them ample reasons to rededicate themselves for the cause of farmers of the State and the Country. I also take note of the contribution of the Director of Research and his team for monitoring and strengthening the research activities and also for compilation of this publication.

> Rfetel (N. C. Patel)

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ANAND AGRICULTURAL UNIVERSITY UNIVERSITY BHAVAN ANAND – 388110



FOREWORD

DIRECTOR OF RESEARCH

the tenth publication of Puttina forward 'Research Accomplishments and Recommendations' of AAU for the year 2015 is indeed a matter of pride and pleasure. The booklet contains technologies developed by the AAU scientists for the benefit of farmers, scientists, veterinary/dairy professionals, extension workers, entrepreneurs and others associated with human and animal welfare through inputs of agricultural and related technologies. I place on record the zeal and enthusiasm of our scientific team, and congratulate them for the untiring efforts in bringing out these technologies. I am sure that this output of our research effort will help not only in boosting the progress in agriculture and allied sectors but will also give solutions to many problems and challenges faced at present.

I express my sincere thanks to the Hon'ble Vice Chancellor Dr. N. C. Patel for his guidance and useful inputs in improving the research outcome of AAU. I am also thankful to all the Conveners of AGRESCO Sub-committees and Deans of various faculties for their support in the process of monitoring, scrutinizing and executing the research projects of the University by conducting the AGRESCO meetings smoothly and meaningfully. The staff of the Directorate of Research deserves special appreciation for their untiring support to me to justify the role of my office.

I wish all the best to the scientists of AAU for their continuing efforts to improve research output and look forward for their rejuvenated spirit and strength next year in the services of agricultural science and of Indian farmers.

Alcetalari

(K. B. Kathiria)



PREFACE

The research work carried out in different fields of agricultural sciences during the year 2014-15 has been very well discussed by different AGRESCO sub-committees for bringing out useful and beneficial recommendations for farmers, scientific community, entrepreneurs and stake holders.

The recommendations made by different committees are listed below.

	No. of recommendations					
Name of the sub-committee	For farmers/	For scientific				
/ faculty	entrepreneurs	community				
Crop Improvement	06	03				
Crop Production	28	01				
Plant Protection	05	24				
Dairy Science / FPT&BE	18	01				
Agri. Engineering/AIT	02	04				
Animal Production	08	10				
Animal Health	-	04				
Social Science	-	03				

Recommendations for farming community CROP IMPROVEMENT PLANT BREEDING

1. Crop: Paddy or Rice

Variety : Mahisagar



Paddy variety Mahisagar yielded 5000-5500 kg/ha grain yield which is 29.8 and 6.6% higher over the checks GR-4 and GR-12, respectively. Further, per day productivity was 29.4 and 11.0% higher over the check varieties GR-4 and GR-12, respectively. It possesses more number of effective bearing tillers (8-11); number of filled grains /panicle, (350-375) and panicles/sq. mt, (289-299,) than the check varieties. For grain quality parameters, this variety had more hulling recovery (81.9%), milling percentage (71.1%) and head rice recovery (62.4%) than check varieties. This variety found resistant against leaf blast disease. Considering yield attributing characteristics and grain quality parameters, it is recommended for release in rice growing areas of the Gujarat State.

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

2. Crop : Ashwagandha

Variety : Gujarat Anand Ashwagandha - 1 (GAA-1)



This variety is tall (60 cm) and posseses dark green foliage with spad value of 47.5 of chlorophyll content. The branches habit is profusely stellate tomentose. The roots are dark brown in colour and comparatively thick, long and having more girth. The root cortex is thick and white coloured. This variety yielded 659 kg/ha dry root yield, which is 43.9 and 39.6 % higher than the national check RVA 100 and JA 20, respectively under state trials. Under coordinated trials in the state, it has produced 18.4, 39.9 and 21.4 % higher dry root yield than the checks RVA 100, JA 20 and JA 134, respectively. During five years of experimentation, this variety gave 652 kg/ha dry root yield which is 32.7 and 39.9 % higher over RVA 100 and JA 20 checks, respectively. Therefore, it is recommended for release in middle Gujarat.

(Research Scientist (M & AP), Medicinal and Aromatic Plant Project, AAU, Anand)

3. Crop : Desi Cotton

Variety: Gujarat Anand Desi Cotton - 2 (GADC-2)



The seed cotton yield was 1640 kg/ha, which is 39.9, 10.5, 5.8 and 2.8 per cent higher over V 797, G Cot 13, G Cot 21 and ADC 1, respectively. It gave 777 kg/ha lint yield which is 50.6, 17.7, 8.6 and 8.7 per cent higher than check varieties V 797, G Cot 13, G cot 21 and ADC 1, respectively. The fibre qualities like 2.5 % span length of 24.16 mm and fibre strength of 19.26 g/tex of this genotype reflects higher value than cultivated variety, G Cot 21 in which it recorded 22.45 mm span length and 17.24 g/tex strength. As far as ginning out turned is concerned, this variety recorded 45.4 % as compared to 44.2 % in G Cot 21. Two checks G Cot 21 and ADC 1 had produced average coarse fibre but this variety had average/medium micronaire value of 4.88. Therefore, this variety is recommended for desi cotton growing areas of north-west agro-climatic zone V and Bhal and Coastal Zone VIII.

(Associate Research Scientist, Regional Cotton Research Station, AAU, Viramgam)

4. Crop : Mungbean

Variety : Gujarat Anand Mungbean - 5 (GAM-5)



This variety yielded 1890 kg/ha grain yield which is 34.84 and 16.19 per cent higher over the check varieties GM 4 and Meha, respectively. This variety has bold seed size with more seeds per pod, attractive shiny grain appearance and less stony seeds. This variety had very low disease intensity of mungbean yellow mosaic virus (4.1%) as compared to the check GM 4 (66.8 %). The population of whitefly and pod borer damage was lower as compared to the check GM 4. It is recommended for release in Gujarat state for summer cultivation.

> (Research Scientist, Pulse Research Station, AAU, Vadodara)

5. Crop : Dill seed

Variety : Gujarat Anand Dill Seed - 1 (GAD-1)



This variety yielded 1561 kg/ha seed yield, which is 15.53 % higher over check variety GD-3 under rainfed condition, whereas it yielded 1885 kg/ha seed yield which is 12.02 % higher over check variety GD-3 under irrigated condition. It is 10 days early in maturity (133 days) as compared to GD-3 (143 days). The seeds are less flattened and medium in size. This variety has more number of umbels/ plant (12.1-51.4), more number of umbellate/umbel (21.5-50.1), number of seeds/umbellate (22.0-32.7) and shorter plant height (73-127cm) compared to check variety. Looking to advantages of above characteristics, it is recommended for release in north and middle Gujarat condition.

(Assistant Research Scientist, Castor & Seed Spices Res. Station, AAU, Sanand)

CROP PRODUCTION

CULTURAL PRACTICES

1. Effect of Pearl millet-Soybean row ratios on their productivity

The farmers of middle Gujarat Agro-climatic zone-III are recommended to grow two rows of *kharif* pearl millet and soybean alternatively at 45 cm row spacing with RDF to each crop for securing higher yield and net return.

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

2. Effect of planting time on yield and quality of bidi tobacco varieties

The farmers of middle Gujarat Agro-climatic Zone III are recommended to transplant *bidi* tobacco varieties MRGTH 1 and GT 7 from 1st to 3rd week of September to get higher yield and net return without affecting the quality.

(Research Scientist, BTRS, AAU, Anand)

3. Effect of covering materials on growth and transplantable seedlings in bidi tobacco nursery

The farmers of middle Gujarat Agro climatic Zone III raising *bidi* tobacco nursery are recommended to cover their nursery with green shade net having 75% shading for 15 days from sowing to obtain higher transplantable seedlings per unit area and net return.

(Research Scientist, BTRS, AAU, Anand)

4. Effect of spacing, nitrogen and topping levels on yield and quality of bidi tobacco variety GABT 11

The farmers of middle Gujarat Agro climatic Zone III are recommended to transplant *bidi* tobacco variety GABT 11

at spacing of 105 cm x 90 cm and fertilize with 200 kg N/ha (25 % as basal from ammonium sulphate and remaining 75 % in 3 equal splits from urea at an interval of 30 days after transplanting) and topping at 24 leaves/ plant to obtain higher yield and net realization.

(Research Scientist, BTRS, AAU, Anand)

5. Effect of different spacing and time of sowing on dry biomass yield of bhoyambli (*Phyllunthus fraternus*)

The farmers of middle Gujarat Agro climatic Zone III interested to grow *bhoyambli* (*Phyllunthus fraternus*) are recommended to sow *bhoyambli* in first week of July with broadcasting or 15 cm spacing apart for securing higher dry biomass yield and net return.

(Research Scientist, Medicinal & Aromatic Crop Research Station, AAU, Anand)

6. Effect of land configuration and seed rate on yield of cumin (GC 4) in Bhal region

The farmers of *Bhal* and Coastal Agro-climatic Zone-VIII growing cumin (GC 4) crop are recommended to prepare broad bed of 90 cm and furrow of 30 cm width keeping seed rate @ 20 kg/ ha through broadcast for obtaining higher yield and net return.

(Research Scientist, ARS, AAU, Arnej)

7. Study of cotton-castor relay cropping in sandy loam soil of middle Gujarat conditions

The farmers of middle Gujarat Agro-climatic zone-III following Bt cotton-castor relay cropping system are recommended to sow Bt Cotton in first week of June at 180 cm x 60 cm spacing and castor (GCH 7) in the last week of

August in between two rows of cotton keeping 60 cm intra row spacing and fertilize with 75:50 kg NP/ha (25:50 kg/ha NP as basal and remaining 50 kg/ha N in two equal splits at 30 and 70 DAS) to achieve higher yield and net return.

(Associate Research Scientist, ARS, AAU, Thasra)

8. Performance of different varieties of pigeonpea under different plant geometry

The farmers of middle Gujarat Agro-climatic zone-III growing pigeonpea are recommended to sow variety AGT-2 at spacing of 120 cm x 45 cm for getting higher yield and net return. The farmers growing Vaishali variety are recommended to adopt 120 cm x 30 cm spacing.

(Research Scientist, Pulse Research Station, AAU, Vadodara)

9. Effects of sowing dates and spacing on summer green gram.

The farmers of middle Gujarat Agro-climatic Zone-III growing summer green gram are recommended to sow the crop during first week of March at 45 cm spacing for obtaining higher yield and net return.

(Research Scientist, Pulse Research Station, AAU, Vadodara)

10. Effects of agronomic practices on growth and yield of cluster bean

The farmers of middle Gujarat Agro-climatic Zone-III are recommended to sow cluster bean variety GG 2 in summer during 1^{st} week of February at 60 cm \times 15 cm spacing for getting higher yield and net return.

(Research Scientist, ARS, AAU, Derol)

NUTRIENT MANAGEMENT

11. Assessment of Natural Organic Liquid (NOL) and inorganic nutrient supply system on yield and quality of summer groundnut.

The farmers of middle Gujarat Agro-climatic zone III growing summer groundnut are recommended to apply RDF (25-50-00 NPK kg/ha) along with application of FYM @10 t/ha and seed treatment with AAU PGPR consortium* @ 5 ml/kg of seed for securing higher yield and net return. Application of NOL** was not found beneficial.

Note : *PGPR Consortium : [*Azotobcater choococcum* (ABA-1) + *Azospirillum lipoferum* (ASA-1) + *Bacillus coagulans* (PBA-16) + *Bacillus* sp.

** NOL : Cow dung + cow urine + jaggery + buttermilk + pulse flour + soil under Baniyaan tree

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

12. Response of *kharif* and *rabi* crops to urea phosphate foliar application in pearl millet-wheat cropping system

Farmers of middle Gujarat Agro-Climatic zone – III following pearl millet-wheat crop sequence are recommended for foliar application of 2% DAP or Urea Phosphate (17:44:00) to only pearl millet at pre flowering and 15 days after first spray along with 75% RDF to both the crops (Pearl millet 60:30:00, Wheat 90: 45: 00 NPK kg/ha) for getting higher yield and net return.

(IFFCO Chair, AAU, Anand)

13. Response of *kharif* and *rabi* crops to urea phosphate foliar application in maize- cabbage cropping system.

Farmers of middle Gujarat agro-climatic zone – III adopting maize-cabbage sequence are recommended for foliar application of 2% DAP or 2% urea phosphate (17:44:00) at tasseling in maize and at head formation in cabbage followed by second spray 15 days after first spray along with RDF (Maize 100:50:00, Cabbage: 200 : 75 : 00 kg NPK/ ha + FYM 25 t/ha) for getting higher yield and net return.

(IFFCO Chair, AAU, Anand)

14. Evaluation of liquid biofertilizer *viz; Azotobacter, Azospirillium* and phosphate culture in brinjal nursery.

Farmers of middle Gujarat Agro climatic Zone-III interested to raise good quality brinjal seedlings are recommended to apply 70 kg FYM and 75 % RDF chemical fertilizer (Basal @ 375 g N+ 375 g P_2O_5 ; Top dressing @ 375 g N at 15 DAS) in soil per *guntha* (100 m²) along with seed treatment @ 5ml/kg of biofertilizers *viz.* Nitrogen fixer *Azospirillum lipoferum* (ASA-1) mixed with Phosphate solubilizer *Bacillus coagulans* (PBA-16), followed by foliar application @ 5 ml/l of water of each biofertilizer at 15 DAS to reduce fertilizer by 25 %.

(Research Scientist, Dept. of Microbiology & Bio fertilizer, AAU, Anand)

15. Evaluation of liquid Biofertilizer *viz; Azotobacter, Azospirillium* and phosphate culture in chilli nursery.

Farmers of Middle Gujarat Agro climatic Zone-III interested to raise good quality chilli seedlings are recommended to apply 70 kg FYM and 75 % RDF chemical fertilizer (Basal @ 375 g N+ 375 g P_2O_5 ; Top dressing @ 375 g N at 15 DAS) in soil per *guntha* (100m²) along with seed treatment @ 5 ml/kg of biofertilizers *viz.* Nitrogen fixer *Azospirillum lipoferum* (ASA-1) mixed with Phosphate solubilizer *Bacillus coagulans* (PBA-16), followed by foliar application @ 5ml / lit. of water of each biofertilizer at 15 DAS to reduce fertilizer by 25 %.

(Research Scientist, Dept. of Microbiology & Biofertilizer, AAU, Anand)

16. Yield and quality of hybrid napier varieties as affected by nitrogen levels

The farmers of middle Gujarat Agro-climatic Zone III growing hybrid napier are recommended to grow variety Co 3 and fertilize with 75 kg N/ha after each cut upto three years along with common dose of 50 kg N/ha + 50 kg P_2O_5 / ha as basal to obtain higher green forage, dry matter, crude protein yields and net return.

(Research Scientist, MFRS, AAU, Anand)

17. To study the effect of nitrogen and phosphorus on yield and quality of multi cut sorghum cv. CoFS 29

The farmers of middle Gujarat agro climatic zone - III growing multicut forage sorghum cv. CoFS 29 are recommended to apply 160 kg N/ha along with phosphorus @ 60 kg ha⁻¹ for higher green forage, dry matter, crude protein yields and net realization. Nitrogen should be applied in four equal splits at basal, 30 DAS, after first cut (55 DAS) and second cut (100 DAS) and entire dose of phosphorus as basal.

(Research Scientist, MFRS, AAU, Anand)

18. Integrated nutrient management in Maize-Amaranthus cropping sequence

The farmers of middle Gujarat agro climatic zone III adopting maize – *amaranthus* crop sequence are recommended to apply 100 % RDF (i.e. 60: 40: 00 kg NPK/ha) along with 1 ton castor cake or 10 ton FYM/ha to maize and 100 % RDF (i.e. 40: 20: 00 kg NPK/ha) to *amaranthus* to get higher yield and net return.

(Research Scientist, Regional Research Station, AAU, Anand)

19. Assessment of Natural Organic Liquid (NOL) and inorganic nutrient supply system on yield and quality of wheat

The farmers of middle Gujarat Agro-climatic zone III growing wheat are recommended to apply RDF (120-60-00 kg NPK/ha) along with application of FYM @10 t/ ha and seed treatment with AAU PGPR consortium @ 5 ml kg⁻¹ of seed for securing higher yield and net return. Application of NOL was not found beneficial.

Note : *PGPR Consortium : [*Azotobacter choococcum* (ABA-1) + *Azospirillum lipoferum* (ASA-1) + *Bacillus coagulans* (PBA-16) + *Bacillus sp.*

** NOL : Cow dung + cow urine + jaggery + buttermilk + pulse flour + soil under Baniyaan tree

(Research Scientist, Regional Research Station, AAU, Anand)

20. Effect of organic manures on dry biomass yield of dodi (*Leptadenia reticulata*)

The farmers of middle Gujarat Agro-climatic zone-III growing *dodi* crop (*Leptadenia reticulata*) in *kharif* are recommended to manure the crop with 10 t FYM/ ha at the

time of land preparation for securing higher dry biomass yield and net return.

(Research Scientist, Medicinal & Aromatic Crop Research Station, AAU, Anand)

21. Assessment of organic and inorganic nutrient supply system on yield and quality of paddy - wheat crop sequence

The farmers of middle Gujarat Agro-climatic Zone-III adopting paddy - wheat crop sequence are recommended to apply fertilizers to get higher production and net realization from this crop sequence as follow.

	Paddy		Wheat
•	100 % RDN (100 kg N/ha)	•	100 % RDN (120 kg N/
	10 t/ha) + 25 % from ver-		ha) from fertilizer $+ 25$
	micompost (about 1.50 t/		% from vermicompost
	ha) + 25 % from castor cake $(about 0.60 \text{ t/ha})$ or		(about 1.80 t/ha) or
		٠	100 % RDF (120:60:0 kg
٠	100 % RDN from FYM		NPK/ha) from fertilizer
	(about 20.0 t/ha) to paddy.		to wheat.

(Research Scientist, MRRS, AAU, Nawagam)

- 22. Nutrient management in pigeonpea based intercropping system.
- The farmers of middle Gujarat Agro-climatic zone-III growing pigeon pea are recommended to adopt inter cropping system involving one row of black gram or soybean as an intercrop after two rows of pigeonpea at uniform inter row spacing of 60 cm by applying recommended dose of fertilizer to both the crops for getting higher yield and net return.

(Research Scientis, Pulse Research Station, AAU, Vadodara)

23. Response of drilled paddy to graded levels of nitrogen and phosphorus

The farmers of middle Gujarat Agro-climatic Zone-III growing drilled paddy are recommended to apply 75 kg N and 12.5 kg P_2O_5 per hectare in soils having low available nitrogen and high available phosphorus for getting higher yield and net return.

Entire quantity of phosphorus and 50% nitrogen should be applied as basal and remaining 50% nitrogen should be applied one month after sowing, when there is sufficient moisture in the soil.

(Research Scientist, Agricultural Research Station, AAU, Derol)

24. Assessment of Natural Organic Liquid (NOL) and inorganic nutrient supply system on yield and quality of potato cv.K. Badshah

The farmers of middle Gujarat Agro-climatic zone III growing potato are recommended to apply RDF (220-110-220 kg NPK ha⁻¹) along with application of FYM @ 20 t ha⁻¹ and seed treatment with AAU PGPR consortium @ 1 lit/ha of seed for securing higher yield and net return. Application of NOL was not found beneficial.

Note : *PGPR Consortium : [*Azotobacter choococcum* (ABA-1) + *Azospirillum lipoferum* (ASA-1) + *Bacillus coagulans* (PBA-16) + *Bacillus sp.*

** NOL : Cow dung + cow urine + jaggery + buttermilk + pulse flour + soil under Baniyaan tree

(Associate Research Scientist, ARS, AAU, Khambholaj)

25. Effect of nitrogen and phosphorus on growth and flower yield of jasmine (*Jasminum sambac* Ait) cv. Double

The farmers of middle Gujarat Agro-climatic zone-III growing jasmine (*Mogra*) crop are advised to apply 20 t/ha FYM as basal dose and 75 g nitrogen with 30 g phosphorus per plant in three equal splits at 15, 45 and 90 days interval after pruning (2nd week of January) at 30 cm plant height from ground level for getting higher flower yield and net realization.

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

WATER MANAGEMENT

26. Water and nutrient management through fertigation in sapota (*Achras sapota* Mill) cv. Kalipatti

The farmers of middle Gujarat Agro-climatic zone III growing sapota (cv. Kalipatti) are advised to irrigate the crop through drip at 7 hours and 30 minutes during October, 6 hours and 5 minutes during November to February at an alternate day and 7 hours and 10 minutes during March to June daily and apply 75% NPK of RDF (675+337.5+337.5 g NPK/tree) through fertigation as 25% each in 2nd and 4th week of June and 25% each in 2nd and 4th week of October for getting higher yield and net return with saving of 25% fertilizer.

The system should be laid out in sapota orchard planted at 10 x 10 m with lateral of 16 mm and having 12 drippers (8 LPH) per tree. The system should be operated at a pressure of 1.2 kg/cm^2 .

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

27. Performance evaluation of guava under drip system of irrigation

The farmers of middle Gujarat Agro-climatic zone-III growing guava (cv. L 49) are advised to adopt drip method of irrigation at 0.7 FPE for saving 34 % water without adverse effect on fruit yield as compared to surface irrigation. The system should be operated 3.0 hrs in October and February and 2.0 hrs 30 min from November to January at alternate day.

System details

1.	Main pipe size	75 mm
2.	Sub main pipe size	63 mm
3.	Lateral spacing	6.0 m
4.	Dripper spacing	60 cm
5.	No. drippers per plant	8
6.	Dripper discharge	8 lph
7.	Operating pressure	1.2 kg/cm
8.	Operating frequency	Alternate day

(Associate Research Scientist, ARS, AAU, Thasra)

28. Integrated nutrient management in potato var. Kufri Badshah

The farmers of middle Gujarat Agro climatic zone III growing potato crop are advised to fertilize their crop with 260-130-260 kg NPK /ha in addition to this apply poultry manure @ 3 t/ha and in case of unavailability of poultry manure, apply FYM @ 20 t/ha to get higher net return (50% Nitrogen as basal and remaining 50% at the time of earthing up and poultry manure should be applied 20 days before planting).

(Research Scientist (Veg), MVRS, AAU, Anand)

PLANT PROTECTION

AGRICULTURAL ENTOMOLOGY

1. Evaluation of effectiveness of auditory bird repeller (Gas canon) to scare birds

Gas (LPG) canon self operated as single blast of 100-125 decibels at 60 second interval in continuous mode is effective to repel the birds (blue rock pigeon) from the one acre area. For better efficiency, the gas canon should be installed at least at 1 m above the crop height in down wind direction and be kept operated on need base period.

(Res. Sci. (Ornitho.), AINP on Agril. Ornithology, AAU, Anand)

2. Evaluation of insecticide molecules against sucking pests of okra

For effective and economical control of jassid in okra, the farmers of middle Gujarat are advised to spray thiamethoxam 25 WG, 0.009%, 3.5 g/ 10 litres water (43.75 g a.i./ha) and for whitefly, spiromesifen 240 SC, 0.02%, 8 ml/ 10 litres water (96 g a.i./ha) first at the appearance of the pest and second at 10 days interval.

Recomm	nendatior	n for PHI as	per CIB guideline	S:					
		rop Pest Pest		Dosage					Waiting
Year	Crop		Pesticides with formulation	g. a.	Quantity of	Conc. (%)	Dilution in	Appl. sched- ule	period /
	1			i./ ha	formulation		water		PHI (Dave)
					per na		(10 III)		(Days)
2015		Jassid	Thiamethoxam 25 WG 43.75 175 g 0.009 3.5 g plic	First foliar spray ap- plication at	3				
	Okra	Whitefly	Spiromesifen 240 SC	96	400 ml	0.02	8.0 ml	appearance of pests and second at 10 days after first application	5

(Assistant Research Scientist (Ento.), MVRS, AAU, Anand)

PLANT PATHOLOGY AND NEMATOLOGY

3. Management of root-knot nematodes in Mungbean by crop rotation

The farmers of middle Gujarat (AES III) growing mungbean during *Kharif* season in root-knot nematode infected soil are advised to adopt crop rotation of cabbage in *Rabi* and cluster bean (vegetable purpose) in summer for two years to manage root-knot nematodes effectively and economically.

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

4. Integrated management of root-knot nematode, *Meloidogyne* spp. infecting pomegranate

The farmers of middle Gujarat growing pomegranate are advised to apply *Paecilomyces lilacinus* $(2 \times 10^6 \text{ spores/g})@$ 20 kg/ha + castor cake @ 2 tonne/ha in root zone, 12 to 18 inch away from tree trunk in approximately 9 inch deep in soil at onset of monsoon and second application at interval of 6 months to manage root-knot nematode with higher fruit yield.

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

5. Management of damping off using fungicide in bidi tobacco nursery

Farmers of middle Gujarat (AES III) are advised to apply metalaxyl MZ 68 WP, 2.16 kg a.i./ha, 0.0432%, 6.4 g/10 litre waer using 5,000 litre water/ha under wet soil conditions, as spray drench with sprayer or 0.0108%, 1.6 g/ 10 litre water using 20,000 litre water/ha under dry soil conditions with rose cane on seedlings as and when required for effective and economical control of damping-off disease in bidi tobacco nursery.

(Res. Sci. (Patho.), BTRS, AAU, Anand)

BASIC SCIENCES

PLANT PHYSIOLOGY

1. Canopy manipulation to study yield and quality in Ashwagandha (*Withania somnifera*)

The farmers of middle Gujarat Agro-climatic zone-III growing ashwagandha crop are recommended for canopy manipulation of 50% leaf removal randomly at 75 days after sowing for getting higher dry quality root yield as well as net return

(Research Scientist, Medicinal and Aromatic Crop Research Station, AAU, Anand)

DAIRY SCIENCE / FPT&BE / AIT / Agril. Engineering

DAIRY SCIENCE

1. Manufacture of dairy/non-dairy processed cheese and Mozzarella cheese analogue

An acceptable quality Mozzarella cheese analogue (MCA) can be produced by utilizing rennet casein and vegetable fat employing the formulation and process technology developed by AAU, Anand. The MCA had required baking qualities when used as a pizza topping and was cheaper than natural cheese by 22%.

(Professor & Head, Department of Dairy Technology, DSC, AAU, Anand)

2. Studies on utilization of sweet cream buttermilk solids in the manufacture of frozen delicacies

The procedure developed for manufacture of acceptable quality Kulfi by Anand Agricultural University recommends replacing 20% of whole milk with sweet cream buttermilk

(SCBM) and adopting vacuum pan concentration instead of open pan concentration. Use of SCBM to partly replace whole milk led to reduction in the raw material cost by 7%.

(Professor & Head, Department of Dairy Technology, DSC, AAU, Anand)

3. Iron fortification in Kulfi

It is recommended to prepare acceptable quality iron fortified kulfi by addition of ferric ammonium citrate (30 ppm iron) just before freezing of kulfi mix and the product was acceptable up to 90 days at $-18\pm2^{\circ}$ C.

(Professor & Head, Department of Dairy Technology, DSC, AAU, Anand)

4. Preparation of 'Choco-cheese' ice cream

Acceptable 'Choco-cheese' ice cream can be produced by utilizing processed cheese shreds coated with chocolate syrup as flavouring and utilizing 'cheese flavour' as background flavouring according to the method developed by AAU, Anand.

(Professor & Head, Department of Dairy Technology, DSC, AAU, Anand)

5. Standardization of formulations for preparation of ice candy type frozen product using whey

The process technology developed by Anand Agricultural University, Anand is recommended for preparation of paneer whey candy by utilizing 70% whey. This candy had better quality than candy prepared from water.

(Professor & Head, Department of Dairy Technology, DSC, AAU, Anand)

6. Formulation of dried probiotic mix containing *Lactobacillus helveticus* MTCC 5463

A dried probiotic mix formulation of *Lactobacillus helveticus* MTCC 5463 (C) developed by AAU is recommended. It can be prepared by mixing it with L- ascorbic acid as reducing agent (R) and skim milk powder as bulking agent (B) in the ratio of C: R: B = 20: 20: 60 (w/w). The formulation when packed and stored in aluminium foil sachets showed shelf-life up to 18 months at $5\pm2^{\circ}$ C (8.90 log cfu/g) and up to 2 months at $25\pm2^{\circ}$ C (8.19 log cfu/g).

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

7. Development of probiotic/dahiculture dosage forms - tablets, sachets, capsules

Entrepreneurs and dairy processors interested in manufacturing culture in appropriate dosage forms (tablets, capsules, sachets) are advised to adopt the technology developed by Anand Agricultural University, Anand. Such dosage form contains dahi culture and probiotic culture as active ingredients, the live cells is >10⁷cfu/g having a shelf life of 6 months at refrigerated temperature. For making fermented milk, one unit of dosage form, i.e., 1 sachet/1 capsule/1tablet of 300 mg as inocula per 100 ml of milk requires overnight incubation at 37°C.

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

8. Iron fortification of buttermilk and selected fermented dairy products

Acceptable quality iron fortified probiotic fermented

milk can be manufactured by fortifying milk with ferric ammonium citrate (15 ppm iron) without adverse effect on probiotic count. The product has a keeping quality of 12 days when stored at $4\pm2^{\circ}$ C.

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

9. Drying behavior of carrots and its utilization in preparation of ethnic food products

Vacuum tray drying with blanching technique is recommended for drying of carrot (red variety) shreds over other methods of drying. Acceptable quality of carrot halwa can be prepared by using dried carrot shreds. Dried carrot shreds can be stored for about five months in HDPE or metalized polyester film bags at ambient conditions.

(Professor & Head, Department of Dairy Engineering, DSC, AAU, Anand)

10. Mechanization and optimization of parameters for the preparation of Burfi in multipurpose scraped surface heat exchanger

Burfi can be prepared from buffalo milk by using modified Scraped Surface Heat Exchanger (SSHE) having spring loaded Teflon scraper blade. The operating conditions of the SSHE required are 2.5 kg/cm² steam pressure, 30 rpm scraper speed, 30 kg loading per batch and 1 h 40 min time. The steam consumption during manufacturing of Burfi is 1.45 kg per kg of water evaporated and electricity consumption is 0.12 kWh per kg of product.

(Professor & Head, Department of Dairy Engineering, DSC, AAU, Anand)

FOOD PROCESSING TECHNOLOGY

11. Bottle gourd based blended juice

The entrepreneurs and food processors interested in production of bottle gourd based blended juice are advised to use technology developed by Anand Agricultural University. Developed technology involves blanching, formulation, thermal processing and storage stability. The technology enables production of blended juice from bottle gourd, aonla, lemon and ginger without addition of chemical preservatives. The formulated product can be stored up to 180 days under ambient conditions.

(Professor & Head, Department of PHE, College of FPT & BE, AAU, Anand)

12. Ohmic heating system for thermal processing of papaya pulp

The entrepreneurs and fruit pulp processors interested in preservation of papaya pulp are advised to use ohmic heating processing technology developed by Anand Agricultural University. The processing technology showed that the ohmic processed pulp could retain better nutrients was stable and acceptable upto 84 days of storage under refrigerated condition at $7\pm 2^{\circ}$ C.

(Professor & Head, Department of FE, College of FPT & BE, AAU, Anand)

13. Starter cultures for the production of superior quality Idli

The entrepreneurs and producers interested in production of uniform quality Idli batter are advised to use combination of *Lactobacillus rhamnosus* MTCC 5462 + *Leuconostoc mesenteroides* 029 + *Candida versatilis* NCIM 3431 + *Saccharomyces cerevisiae* starter cultures suggested by Anand Agricultural University for the controlled fermentation of idli batter.

(Professor & Head, Department of FQA, College of FPT & BE, AAU, Anand)

14. Antioxidants for the keeping quality of fried banana chips

Food entrepreneurs interested in manufacturing banana chips are recommended to add Tertiary Butyl Hydro Quinone (TBHQ) as antioxidant in frying oil as suggested by Anand Agricultural University and advised to pack in MetPET pouches to enhance its shelf life by 4 weeks.

(Professor & Head, Department of FQA, College of FPT & BE, AAU, Anand)

15. Super critical fluid extraction of essential oils from ginger and turmeric

The entrepreneurs and food processors interested in production of volatile oils from ginger and turmeric are advised to use supercritical extraction technology developed by Anand Agricultural University. This technology involves better recovery of volatile oils using blanching, slicing, drying, sieving and supercritical fluid extraction at controlled pressure and temperature. The process results in better quality essential oils as compared to conventional extraction methods.

(Professor & Head, Department of FQA, College of FPT & BE, AAU, Anand)

16. Kajukatli with artificial sweetener/s

The sugar free kajukatli can be prepared satisfactorily using artificial sweetener sucralose and bulking agent isomalt by using technology developed by Anand Agricultural University.

(Professor & Head, Department of FQA, College of FPT & BE, AAU, Anand)

17. Development of nutri-rich health bar

The bakery industry and entrepreneurs interested in production of nutritious "Health Bar" using oat, barley and whole wheat flour as well as selected nuts and honey are advised to adopt the formula and procedure developed by Anand Agricultural University. The product packed in aluminium foil has a storage life of about 2 months at ambient temperature.

(Professor & Head, Department of PFSHE, College of FPT & BE, AAU, Anand)

18. Low cost millet based supplementary food

A millet based supplementary mix developed by Anand Agricultural University is nutritionally rich. Supplementary mix of 100 g per day is recommended to meet partly the nutritional requirement of infants. The product can be stored for 4 months under ambient conditions.

(Professor & Head, Department of PFSHE, College of FPT & BE, AAU, Anand)

AGRICULTURAL ENGINEERING AND AIT AGRICULTURAL ENGINEERING

19. Performance evaluation of different sowing methods for *rabi* maize (GM-3)

Farmers of middle Gujarat region are recommended to use tractor drawn multi crop planter having inclined plate type seed metering mechanism and 60 cm row to row distance for sowing of *rabi* maize crop to save time (@ 60 man-hours/ ha) and cost (67.9%) as compared to manual dibbling.

(Professor & Head, FMPE, CAET, AAU, Godhra)

AIT

20. Fertilizer dose recommendation for the Web Based Soil Health Card Portal (Adding one new module to existing application)

Soil Health Card portal developed by Anand Agricultural University is recommended for use of farmers of Gujarat, who are interested to supplement Nitrogen, Phosphorus and Potash (NPK) through use of urea, DAP and MOP fertilizers.

(Director, IT, AAU, Anand)

ANIMAL PRODUCTION

1. Effect of Feeding Milk Replacer on Holstein-Kankrej Crossbred Calves

There is a reduction of 39.73 and 33.91 per cent in feed cost per kilo gain in body weight of crossbred calves (HF X Kankrej) from birth to three months of age reared on self made milk replacer (1:10 dilution) consisting of 15 per cent milk, 11 per cent casein, 18 per cent maize, 18 per cent soya meal, 15 per cent soya seed, 8 per cent jaggery, 12 per cent

palm oil and 3 per cent minerals, vitamins and salt over milk feeding (control) and feeding commercially available milk replacer.

(Research Scientist & Head, LRS, AAU, Anand)

2. Study of nutritional status of dairy animals of Mahisagar district

The dairy farmers of Mahisagar district are recommended to feed daily additional 1.0 kg compound concentrate mixture (20% CP; 65% TDN) to crossbred cows yielding 12-14 kg during summer and monsoon in order to fulfill their nutrient requirement.

(Res. Sci., & Head, Animal Nutrition Research Station, A.A.U., Anand)

3. Study of nutritional status of dairy animals of Mahisagar district

The dairy farmers of Mahisagar district are recommended to feed daily additional 1.0 kg and 1.5 kg compound concentrate mixture (20% CP; 65% TDN) to buffaloes yielding 6-10 and 10-12 kg milk, respectively, throughout the year in order to fulfill their nutrient requirements.

(Res. Sci., & Head, Animal Nutrition Research Station, A.A.U., Anand)

 Studies on the effect of feeding bypass fat and yeast (*Saccharomyces cerevisiae*) supplemented total mixed ration to growing Surti kids under heat stress.

The goat keepers of middle Gujarat are recommended to feed a combination of yeast (*Saccharomyces cerevisiae*) and

bypass fat each @ 2% of total mixed ration (TMR) to weaned Surti kids during hot humid weather to reduce the impact of heat stress, improve daily gain and feed conversion efficiency with 24% reduction in feed cost per kg gain.

(Res. Sci., & Head, Animal Nutrition Research Station, A.A.U., Anand)

 Studies on the effect of feeding bypass fat and yeast (*Saccharomyces cerevisiae*) supplemented total mixed ration to Surti goats during hot summer

To reduce the impact of heat stress without any increment in the feed cost, the goat keepers of middle Gujarat are recommended to feed yeast (*Saccharomyces cerevisiae*) @ 2% of total mixed ration (TMR) to adult Surti goats during hot summer when they are facing extreme severe stress.

(Res. Sci., & Head, Animal Nutrition Research Station, A.A.U., Anand)

6. Studies on morphometric characteristics of udder and teats, milking practices followed by farmers and incidences of sub-clinical mastitis in crossbred cows maintained on commercial dairy farms in Anand district.

Pendulous and goaty udders are more susceptible to subclinical Mastitis (60 and 80% incidences) as compared to bowl and round shaped (46 and 36% incidences) udder in plueriparous crossbred cows. Therefore, dairy farmers are advised that crossbred cows with pendulous and goaty udder should not be selected / purchased.

(Asso. Prof.& Head, Dept. of Animal Science, BACA, AAU, Anand)

7. Studies on morphometric characteristics of udder and teats, milking practices followed by farmers and incidences of sub-clinical mastitis in crossbred cows maintained on commercial dairy farms in Anand district

Udder depth greater than 28 cm and teat diameter higher than 2.75 cm are the prominent risk factors (17 and 10 % higher incidences than udder depth <28cm and teat diameter <2.75cm, respectively) for subclinical mastitis (SCM). Therefore, dairy farmers are advised to consider udder and teat biometry as a useful parameters to reduce the risk of SCM in crossbred cows.

(Asso. Prof.& Head, Dept. of Animal Science, BACA, AAU, Anand)

8. Studies on morphometric characteristics of udder and teats, milking practices followed by farmers and incidences of sub-clinical mastitis in crossbred cows maintained on commercial dairy farms in Anand district.

Crossbred cows suffering from subclinical mastitis yielded 14 % less milk per day than the healthy cows. Therefore, the dairy farmers are advised to test their milking herd regularly for subclinical mastitis.

(Asso. Prof.& Head, Dept. of Animal Science, BACA, AAU, Anand)

Recommendations for scientific community and entrepreneurs CROP PRODUCTION

- 1. Weed management in *kharif* greengram
- Pendimethalin @ 500 g/ha as PE
- Imazethapyr @ 75 g/ha as POE (15-20 DAS) fb Interculturing at 30 DAS

(Agronomist & PI, AICRP-WM, AAU, Anand)

PLANT PROTECTION

AGRICULTURAL ENTOMOLOGY

1. Study on biodiversity of insect fauna through light traps

Among the different types of light used in the light trap, visible and ultra violet lights found more effective and efficient to monitor the insects under field conditions. The coleopteran and dipteran insects were maximum in ultraviolet light, while, hemipteran and hymenopteran insects in visible light.

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

2. Screening of *Brassica* species against aphid

The genotypes RAYAD 9602, NRCM 120, NRCM 353 (*Brassica juncea*) and PUSA SWARNIM (*B. carinata*) found highly resistant to aphid, *Lipaphis erysimi* Kalt. under field condition.

(Professor & Head, Department of Entomology, BACA, AAU, Anand) 3. Evaluation of jute string as physical barrier to prevent entry of Indian peafowl into the feeding site

In order to restrict the movement of peafowl in the fields, it is suggested to tie parallel two strings firmly, one above other at 30 and 50 cm above the ground.

(Research Scientist, AINP on Agril. Ornithology, AAU, Anand)

4. Evaluation of effectiveness of acoustic device as bird repeller from feeding site

Acoustic device operated playing birds call of 3-5 khz frequency (Two calls : Predator – pigeon) per cycle at 1 minute interval is not effective to repell the birds from the one acre area.

(Research Scientist, AINP on Agril. Ornithology, AAU, Anand)

5. Residue and persistence of monocrotophos 36 SL in castor

Two foliar sprays of monocrotophos 36 SL in castor at 15 days interval @ 157.32 and 314.64 g a.i. ha^{-1} starting from flowering stage resulted in its residue below the limit of quantitation of 0.05 µg g⁻¹ in castor oil and cake if harvested 84 days after the second spray. Therefore, PHI of 84 days could be suggested if monocrotophos 36 SL is recommended on castor with MRL of 0.05 µg g-1 in oil and cake.

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

6. Residue and persistence of monocrotophos 36 SL in pigeon pea

Two foliar sprays of monocrotophos 36 SL in pigeonpea at 15 days interval @ 450 and 900 g a.i. ha^{-1} starting from pod formation stage resulted in its residue below

determination level of 0.05 μ g g⁻¹ in seeds 45 days after the last spray. Therefore, PHI of 45 days could be suggested if monocrotophos 36 SL is recommended on pigeon pea with MRL of 0.05 μ g g-1 in grains.

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

7. Residue and persistence of monocrotophos 36 SL in mustard

Two foliar sprays of monocrotophos 36 SL in mustard at 10 days interval @ 135 and 270 g a.i. ha^{-1} starting from pod formation stage resulted in its residue below the limit of quantitation of 0.05 µg g⁻¹ in mustard oil and cake if harvested 43 days after the second spray. Therefore, PHI of 43 days could be suggested if monocrotophos 36 SL is recommended on mustard with MRL of 0.05 µg g-1 for oil and cake.

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

8. Residue and persistence of phosphamidon 40 SL in mustard

Two foliar sprays of phosphamidon 40 SL in mustard at 10 days interval @ 200 and 400 g a.i. ha⁻¹ starting from flowering stage resulted in its residue below the limit of quantitation of 0.05 μ g g⁻¹ in mustard oil and cake if harvested 43 days after the second spray. Therefore, PHI of 43 days could be suggested if phosphamidon is recommended on mustard with MRL of 0.05 μ g g⁻¹ for oil and cake.

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

9. Residue and persistence of phenthoate 50 EC in cotton

Three foliar sprays of phenthoate 50 EC in cotton at 15 days interval @ 1000 and 2000 g a.i. ha^{-1} starting from flowering

and square formation stage resulted in its residue below the limit of quantitation of 0.05 μ g g⁻¹ in cotton oil, lint and cake if harvested 29 days after the third spray. Therefore, PHI of 29 days could be suggested if phenthoate 50 EC is recommended on cotton with MRL of 0.05 μ g g-1 for oil, lint and cake.

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

Residue and persistence of ipconazole 25 % + metalaxyl 20
% - 45 ME in maize

Seed treatment of a combination product ipconazole 25% + metalaxyl 20% - 45 ME in *rabi* maize @ 0.25 + 0.20 and 0.50 + 0.40 g a.i per kg seed did not result in their residues in immature grains with cob as well as matured grains at harvest. The residues persisted in the seedlings only up to the 20 days from the date of treatment. The combination product if registered for maize can be considered safe from residue point of view.

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

11 Residue and persistence of penflufen 154 + trifloxystrobin 154 - 308 FS in chickpea

Seed treatment of the combination product penflufen 154 + trifloxystrobin 154 - 308 FS @ 15.4 + 15.4 and 30.8 + 30.8 g a.i./100 kg seed in chickpea neither revealed residues of any molecule of the mixture nor the metabolite of trifloxystrobin above determination in the green pods collected at pod formation stage or matured grains and soil collected at the time of harvest.

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

12. Residue and persistence of flonicamid 15 % + fipronil 15 % - 30 WG in cotton

Two foliar applications of the combination product of flonicamid 15 % + fipronil 15 % - 30 WG @ 60 + 60 and 120 + 120 g a.i. ha⁻¹ in cotton at 15 days interval starting from flowering and boll formation stage revealed residues of either product below their determination levels in cotton seed, lint, oil and cake at 35 days after the last application. Therefore, the PHI of 35 days can be recommended if a mixture of flonicamid 15% + fipronil 15% - 30 WG is recommended in cotton.

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

13. Residue and persistence of spirotetramate 150 OD in brinjal

Three foliar applications of spirotetramate 150 OD in brinjal at 10 days interval @ 90 ga.i. ha⁻¹ starting from flowering stage resulted in its residue below determination level in brinjal fruits within one hour of the last application. Considering the MRL of spirotetramate at the limit of quantitation, i.e. 0.05 μ g g⁻¹, PHI of 1 day can be recommended if the insecticide is registered on brinjal.

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

14. Residue and persistence of chlorpyriphos 20 EC in okra

Two foliar sprays of chlorpyriphos 20 EC in okra at 10 days interval @ 300 g a.i. ha⁻¹ starting from fruiting stage resulted in its residue below the limit of quantitation of 0.01 μ g g⁻¹ in okra if fruits are harvested from 3 days after the second spray. Therefore, PHI of 3 days could be suggested if chlorpyriphos 20 EC is recommended on okra with MRL of 0.01 μ g g⁻¹.

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

15. Residue and persistence of quinalphos 25 EC in okra

Two foliar sprays of quinalphos 25 EC in okra at 10 days interval @ 250 g a.i. ha^{-1} starting from fruiting stage resulted in its residue below the limit of quantitation of 0.01 µg g⁻¹ in okra if fruits are harvested from 3 days after the second spray. Therefore, PHI of 3 days could be suggested if quinalphos 25 EC is recommended on okra with MRL of 0.01 µg g⁻¹.

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

16. Residue and persistence of ethion 50 EC in okra

Two foliar sprays of ethion 50 EC in okra at 10 days interval @ 500 g a.i. ha⁻¹ starting from fruiting stage resulted in its residue below the limit of quantitation of 0.01 μ g g⁻¹ in okra if fruits are harvested from 10 days after the second spray. Therefore, PHI of 10 days could be suggested if ethion 50 EC is recommended on okra with MRL of 0.01 μ g g⁻¹.

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

17. Residue and persistence of carbendazim 50 WP in okra

Two foliar sprays of carbendazim 50 WP in okra at 10 days interval @ 250 g a.i. ha⁻¹starting from fruiting stage resulted in its residue below the limit of quantitation of 0.01 μ g g⁻¹ in okra if fruits are harvested from 20 days after the second spray. Therefore, PHI of 20 days could be suggested if carbendazim 50 WP is recommended on okra with MRL of 0.01 μ g g⁻¹.

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

18. Residue and persistence of chlorpyriphos 20 EC in brinjal

Two foliar sprays of chlorpyriphos 20 EC in brinjal at 10 days interval @ 300 g a.i. ha⁻¹ starting from fruiting stage

resulted in its residue below the limit of quantitation of 0.01 μ g g⁻¹ in brinjal if fruits are harvested from 5 days after the second spray. Therefore, PHI of 5 days could be suggested if chlorpyriphos 20 EC is recommended on brinjal with MRL of 0.01 μ g g⁻¹.

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

19. Residue and persistence of quinalphos 25 EC in brinjal

Two foliar sprays of quinalphos 25 EC in brinjal at 10 days interval @ 250 g a.i. ha^{-1} starting from fruiting stage resulted in its residue below the limit of quantitation of 0.01 μ g g⁻¹ in brinjal if fruits are harvested from 5 days after the second spray. Therefore, PHI of 5 days could be suggested if quinalphos 25 EC is recommended on brinjal with MRL of 0.01 μ g g⁻¹.

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

20. Residue and persistence of ethion 50 EC in brinjal

Two foliar sprays of ethion 50 EC in brinjal at 10 days interval @ 500 g a.i. ha⁻¹ starting from fruiting stage resulted in its residue below the limit of quantitation of 0.01 μ g g⁻¹ in brinjal if fruits are harvested from 15 days after the second spray. Therefore, PHI of 15 days could be suggested if ethion 50 EC is recommended on brinjal with MRL of 0.01 μ g g⁻¹.

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

21. Residue and persistence of carbendazim 50 WP in brinjal

Two foliar sprays of carbendazim 50 WP in brinjal at 10 days interval @ 250 g a.i. ha^{-1} starting from fruiting stage resulted in its residue below the limit of quantitation of 0.01 μ g g⁻¹ in brinjal if fruits are harvested from 23 days after the second spray. Therefore, PHI of 23 days could be suggested

if carbendazim 50 WP is recommended on brinjal with MRL of 0.01 $\mu g \ g^{\text{-1}}.$

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

22. Evaluation of insecticide molecules against sucking pests of chilli

Foliar application of milbemectin 1 EC 0.0003%, 2.5 ml/ 10 liter water (1.25 g a.i./ha) or abamectin 1.9 EC, 0.0006%, 3 ml/10 litre water (2.85 g a.i./ha) found effective against thrips and mite infesting chilli.

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

PLANT PATHOLOGY AND NEMATOLOGY

23. Management of early blight of potato

Treatment of cut tubers with mancozeb 75 WP @ 1 kg/ 100 kg potato + 5 kg talc powder as dry seed treatment before 12 hours of planting along with 5 sprays of propiconazole 25 EC, 0.025% first at the disease initiation at about 35 days after sowing and remaining sprays at 12 days interval found effective for the management of early blight of potato.

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

24. Screening of green gram genotypes against Bean Common Mosaic (BCMV) disease

LGG 460 and GM 02-19 genotypes of green gram found resistant against Bean Common Mosaic (BCMV) disease.

(Asst. Res. Sci. (Ento.), Agril. Research Station, AAU, Derol)

BASIC SCIENCE

1. Mining and validation of EST-SSR for gum (Galactomannan) in Guar

There is narrow genetic base and low genetic variability in cultivated varieties of cluster bean (guar) for gum content as revealed by EST-SSR markers and thus there is need to create variability artificially and further assess it in germplasm through Genomic-SSR markers.

(Professor & Head, Department of Agril. Biotechnology, AAU, Anand)

2. Mining and validation of EST-SSR for fibre development in Cotton

EST-SSR markers associated with fibre quality traits can easily distinguish *Gossypium herbaceum* from *Gossypium arboreum* and thus can be successfully utilized for identification of interspecific hybrids between these two species followed by their use in marker assisted breeding of desi cotton.

(Professor & Head, Department of Agril. Biotechnology, AAU, Anand)

3. Effect of Benzyl adenine (BA) on water deficit stress in wheat seedlings

It is recommended that to avoid adverse effects of drought stress, wheat seeds should be pre-soaked with 100 ppm benzyl adenine for 6 hours to retain higher drought tolerant molecules such as relative water content, total chlorophyll, and total carotenoids with low membrane injury at seven days after germination.

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

AGRICULTURAL ENGINEERING AND AIT

1. Energy assessment in onion dehydration plant

The cost of production of the dehydrated onion products largely depends upon the consumption of electricity during processing. An onion dehydration plant producing onion powder, onion kibbled and granulated dehydrated onion units are advised to carry out energy audit of their plants frequently and are advised to follow the electrical energy conservation measures like (i) frequent maintenance of existing machines (ii) avoiding higher HP units than required.

(Professor & Head, FE, FPT & BE, Anand)

2. Comparative study on various drying techniques of cluster bean

The scientists working in thin layer drying are advised to use following Midilli model (a = 0.97892, k=0.00422, n=1.04471, b=1.16502) as compared to Lewis, Hendersons and Pabis, Modified Hendersons and Pabis, Logarithmic, Two-term, Verma, Page, Parabolic, Weibull and Wang and Singh to predict the moisture ratio of vegetable cluster bean.

(Professor & Head, PAE, AAU, Dahod)

3. Investigation on Spatial & Temporal Variability of Infiltration under Real Field Conditions

Based upon experimental findings, the Horton's and Kostiakov'sinfiltrationmodelsare recommended as best choices for use by Hydrologist/Watershed Managers/NGO's and Command area/ Irrigation Engineers respectively for predicting soil infiltration rates (mm/hr) in middle Gujarat region. The regionalised parametric values of models are

given below, which could be utilized for alike ungauged locations in the region.

Soils/Test Location		Horton's Model $f = f_c + (f_0 - f_c)^* e^{-k^2 t}$				Kostiakov's Model $f = \alpha c t^{\alpha-1}$		
Soils	Test locations	f_0	f _c	k	Eff (%)	α	C	Eff (%)
Clay loam (Red)	Vadodara (Khandha, Mangrol, Atali, Bodaka, Handod, Ganpatpur, Sankheda, Bhildar, Novar, Jambusar, Kadana, Khank) Panchmahal(Godhra, Parvadi, Kotda, Chanchopa, Kansudi, Kakanpur, Thambhia, Aerandi, Dholakuva) Dahod(Zalod, Chotrodiya, Thekra, Dhevadiya) Kheda (Radhu, Kathvada, Mahij)	224.2	54.9	2.67	73	0.67	119	85
Sandy loam (Medium black)	Vadodara (Bhilapur, Dhabhoi, Bhilodiya, Asodara, Koked, Navapur, Sankheda, Ambapura, Bhatpur, Dhardi, Ganeshvad) Anand (Khambholaj, Boriavi, Vadod, Vasad, Napad) Panchmahal (Kakanpur, Padhiyar, Kaniyanamuvada, Harinamuvada, Andaranamuvada)	246.4	35.7	8.84	86	0.54	70.6	86
Loamy Sand (Black- Goradu)	Dahod (Pethapur, Ghamdi, Vagela, Chakaliya, Mundaheda, Vasiya, Karanba, Varod, Bajarvada) Gandhinagar (Zak, Vadod, Bahiyal, Karoli)	127	39.1	2.27	83	0.71	79.8	70

(Professor & Head, Department of SWE, CAET, AAU, Godhra)

4. Performance evaluation of canal irrigation in Panchmahal and Vadodara area

Irrigation managers, engineers and canal scheduling cooperatives of command areas of middle Gujarat region are advised to adopt deficit irrigation concept to mitigate the gap between supply and demand as the prevailing canal performance indices *viz.* adequacy, dependability, equity and efficiency, vary in the range of 0.69 - 0.81, 0.28 - 0.49, 0.29 - 0.44 and 0.79 - 0.95, respectively. For enhancing canal performance, suitable remedial measures are recommended because the command area in study region yields relatively less annual groundwater recharge, in the range of 246 to 704 mm with an average value of 463 mm. The recharge rate in the region could be taken in the range of 0.0007 - 0.0019 m/d with an average of 0.001 m/d.

(Professor & Head, SWE, CAET, AAU, Godhra)

5. Development of Online Objective/MCQ examination for students of Anand Agricultural University

Web based Online examination system is recommended for use at the State Agricultural Universities as it is easy to use, transparent, time saving and user friendly for faculties as well as students.

(Director of IT, ITC, AAU, Anand)

ANIMAL PRODUCTION

 Studies on the effect of feeding bypass fat and yeast (*Saccharomyces cerevisiae*) supplemented total mixed ration to growing Surti kids under heat stress

Weaned Surti kids during hot humid weather, when supplemented with a combination of bypass fat and yeast each @ 2% of total mixed ration (TMR) resulted in significant (P<0.05) reduction in rectal temperature, respiration rate and heart rate and thus reduced the impact of heat stress.

(Research Scientist & Head, Animal Nutrition Research Station, A.A.U., Anand) Studies on the effect of feeding bypass fat and yeast (*Saccharomyces cerevisiae*) supplemented total mixed ration to growing Surti kids under heat stress.

The combination of 2% each of bypass fat and yeast (*Saccharomyces cerevisiae*) when supplemented in total mixed ration (TMR) for weaned Surti kids during hot humid weather, the average digestibility coefficient of DM, OM, CP, EE and CF was increased (P<0.05). Similar was the trend for blood glucose. However, the enzyme and mineral profile studied was not affected due to supplementation.

(Research Scientist & Head, Animal Nutrition Research Station, A.A.U., Anand)

3. Studies on the effect of feeding bypass fat and yeast (*Saccharomyces cerevisiae*) supplemented total mixed ration to Surti goats during hot summer

Adult Surti goats facing extreme severe stress during hot summer, when fed TMR supplemented with 2% bypass fat or with 2% yeast alone or with combination of bypass fat and yeast, the respiration rate and heart rate were significantly reduced during afternoon as compared to control group indicating thermal comfort

(Research Scientist & Head, Animal Nutrition Research Station, A.A.U., Anand)

 Studies on the effect of feeding bypass fat and yeast (*Saccharomyces cerevisiae*) supplemented total mixed ration to Surti goats during hot summer

The yeast (*Saccharomyces cerevisiae*) alone (2%) or combination of 2% each of bypass fat and yeast in total mixed ration (TMR) fed to adult Surti goats resulted in

better digestibility of DM, CP & CF. However, EE digestibility was better (P<0.05) in bypass fat supplemented (2%) group. The NFE digestibility was significantly (P<0.05) higher in supplemented group i.e. yeast and bypass fat alone or in combination. The treatment groups did not differ for serum total protein, albumin, globulin, cholesterol and blood glucose concentration. However, triglycerides concentration was higher in bypass fat alone and in combination groups. Conversely, blood urea nitrogen was significantly reduced in supplemented groups. The creatinine concentration was lower in control and yeast supplemented groups but bypass fat and combination groups recorded significantly (P<0.05) higher value. There was no difference in concentration of serum minerals, *viz.*, calcium, phosphorous, sodium, potassium and magnesium.

(Research Scientist & Head, Animal Nutrition Research Station, A.A.U., Anand)

5. Development of area-specific mineral mixture formulations for Vadodara district

Based on the prioritization of limiting minerals in Vadodara district, the area specific mineral mixture has been formulated which would make up the deficiency when fed @ 30g/head/day to dairy animals in addition to the current feeding practices.

(Research Scientist & Head, Animal Nutrition Research Station, A.A.U., Anand)

6. Development of recombinant viral vectored bivalent vaccine against Marek's and Newcastle disease virus in poultry

A new genotype XIII of Newcastle disease (ND) virus reported from other parts of the world is also circulating in India as ascertained by molecular phylogeny based on whole genome sequencing. Therefore, it is recommended to update currently used ND vaccines

(Professor & Head, Dept. of Animal Biotechnology, Vety. College, AAU, Anand)

7. Regulation of Activin receptor type IIB (ACVR2B) expression through RNA interference in Goat Myoblast Cells

Artificial micro RNAs under muscle specific promoter is recommended to down-regulate Activin receptor type IIB (ACVR2B) to enhance the muscle mass in goat.

(Professor & Head, Dept. of Animal Biotechnology, Vety. College, AAU, Anand)

8. SNP Detection and Validation in Squamous Cell Carcinoma of Horn in Kankrej Cattle (*Bos indicus*) using Next Generation Sequencing

Up-regulation of KRT6A, KRT6B, KRT6C, KRT14, SFN, KRT84, PI3, CA1, GJB2, COL17A1, ANLN, SERPINB5 genes and down-regulation of BoLA, SCGB1A1, CXCL17, KRT19, BPIFB1, NR4A1, ATF3, LRIG1, TFF3 genes recommended to be monitored in squamous cell carcinoma of horn (Horn Cancer) in Kankrej bullocks.

(Professor & Head, Dept. of Animal Biotechnology, Vety. College, AAU, Anand)

9. SNP Detection and Validation in Squamous Cell Carcinoma of Horn in Kankrej Cattle (*Bos indicus*) using Next Generation Sequencing

It is recommended to study deregulation of cell cycle pathways; NFKß and MAPKs pathways; LPS signalling pathway; EGF-R and PI3K-Akt pathways for squamous cell carcinoma of horn (Horn Cancer) in Kankrej bullocks.

(Professor & Head, Dept. of Animal Biotechnology, Vety. College, AAU, Anand)

 SNP Detection and Validation in Squamous Cell Carcinoma of Horn in Kankrej Cattle (*Bos indicus*) using Next Generation Sequencing

It is recommended to use SNP $[T \rightarrow C]$ at position 63251805 (dBSNP ID rs136870681) in BPIFA1 gene as a genetic marker in squamous cell carcinoma of horn (Horn Cancer) in Kankrej bullocks.

(Professor & Head, Dept. of Animal Biotechnology, Vety. College, AAU, Anand)

ANIMAL HEALTH

11. Study on Parasitic infestation of Goats in Anand District

It is advisable to have prophylactic deworming during pre-monsoon and post-winter seasons for Nematodes (*Trichostrongylus* spp.; *Trichuris* spp.) and *Cestode* (*Moniezia* spp.) infections in Goats of Anand District.

(Professor & Head, Dept. of Vet. Parasitology, Vet. College, AAU, Anand)

12. Abattoir studies on Amphistomosis of Buffaloes

It is advisable to have prophylactic antitrematodal treatment during pre-winter and pre-monsoon seasons for *Paramphistomum cervi, Cotylophoron cotylophorum* and *Gigantocotyle explanatum* infections in buffaloes of Anand and Ahmedabad districts.

(Professor & Head, Dept. of Vet. Parasitology, Vet. College, AAU, Anand)

13. Abattoir studies on Fasciolosis of Buffaloes

It is advisable to have prophylactic flukicidal treatment during pre-winter and pre-monsoon seasons for *Fasciola gigantica* infection in buffaloes of Anand and Ahmedabad districts.

(Professor & Head, Dept. of Vet. Parasitology, Vet. College, AAU, Anand)

14. Clinical application of standardized treatment protocols in different non-cataract surgical disorders of eye in animals

A 2.8 mm pointed tip 45° angled keratome is suggested for surgical removal of *Setaria* spp. worm from anterior chamber of horse eye by modified clear corneal stab incision.

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

SOCIAL SCIENCE

1. The yard stick of CV% for accepting the results of Medicinal and Aromatic crop experiments

The yard stick of CV% for accepting the results of Medicinal and Aromatic crop experiments is 23 per cent for economic characters at Anand.

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

2. The Scale to measure attitude of extension functionaries towards ATMA

The following scale to measure attitude of extension functionaries towards ATMA is recommended :

No	Statements	Responses & Scoring							
		SA	Α	UN	DA	SDA			
1	I think that ATMA is the perfect platform to coordinate agricultural research and extension activities at district level.	5	4	3	2	1			
2	I think that ATMA is impractical way to develop rural India	1	2	3	4	5			
3	I believe ATMA is in real sense bottom-up approach to develop rural India.	5	4	3	2	1			
4	I believe that ATMA means too many cooks spoil the broth.	1	2	3	4	5			
5	I feel that ATMA is an ideal instrument for the development of district.	5	4	3	2	1			
6	I feel that ATMA creates conflicts among neighbouring farmers.	1	2	3	4	5			
7	ATMA in real sense is a decentralized model of development.	5	4	3	2	1			
8	I feel that ATMA is more theoretical and less practical.	1	2	3	4	5			
9	I believe that ATMA is the best agency to encourage Farmer's Interest Groups.	5	4	3	2	1			
10	I feel that ATMA is an effective attempt joining all the stakeholders to develop district.	5	4	3	2	1			
SA: Strongly Agree, A: Agree, UN: Undecided, DA: Disagree,									
SDA	: Strongly Disagree								

(Professor & Head, Dept. of Extension Education, BACA, AAU, Anand) 3. The scale to measure attitude of farmers toward Kankrej cow

The following scale to measure attitude of farmers toward Kankrej cow is recommended :

No	Statements	Responses & Scoring				
		SA	A	UN	DA	SDA
1	Adopting Kankrej cow is the wise approach to get better income.	5	4	3	2	1
2	I understand that Kankrej cow keeping is expensive.	1	2	3	4	5
3	I think that Kankrej is competent cow to get higher milk production.	5	4	3	2	1
4	I visualize limited scopes of Kank- rej as compared to foreign breeds.	1	2	3	4	5
5	I believe that Kankrej is the best dual purpose breed for milch and agricultural work.	5	4	3	2	1
6	I think raising Kankrej cow is prac- tical only in the North Gujarat.	1	2	3	4	5
7	I think that wise animal keeper is one, who keeps Kankrej cow.	5	4	3	2	1
8	I feel that raising Kankrej cow is feasible to even common farmer.	5	4	3	2	1
SA: Strongly Agree, A: Agree, UN: Undecided, DA: Disagree, SDA: Strongly Disagree						

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





Bird Repeller (Gas canon)



Crop growth under Pearlmillet:Soybean row ratio 2:2



Nutritive Health Bar



S.D.-2

GAD-1



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