

**RESEARCH ACCOMPLISHMENTS
AND
RECOMMENDATIONS**

2012



**DIRECTORATE OF RESEARCH
ANAND AGRICULTURAL UNIVERSITY
ANAND 388 110**



Citation

Research Accomplishments and Recommendations, 2012
Anand Agricultural University
Anand- 388 110

Published by

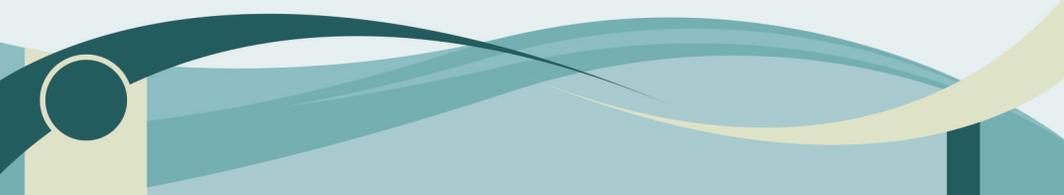
Directorate of Research
Anand Agricultural University
Anand - 388 110

Compiled by

Dr. S. N. Shah
Sh. G. R. Patel
Sh. R. B. Chauhan
Dr. D. M. Korat
Dr. M. M. Pathak

Year of Publication

November, 2012





**ANAND AGRICULTURAL UNIVERSITY
UNIVERSITY BHAVAN,
ANAND – 388110**

VICE-CHANCELLOR

MESSAGE

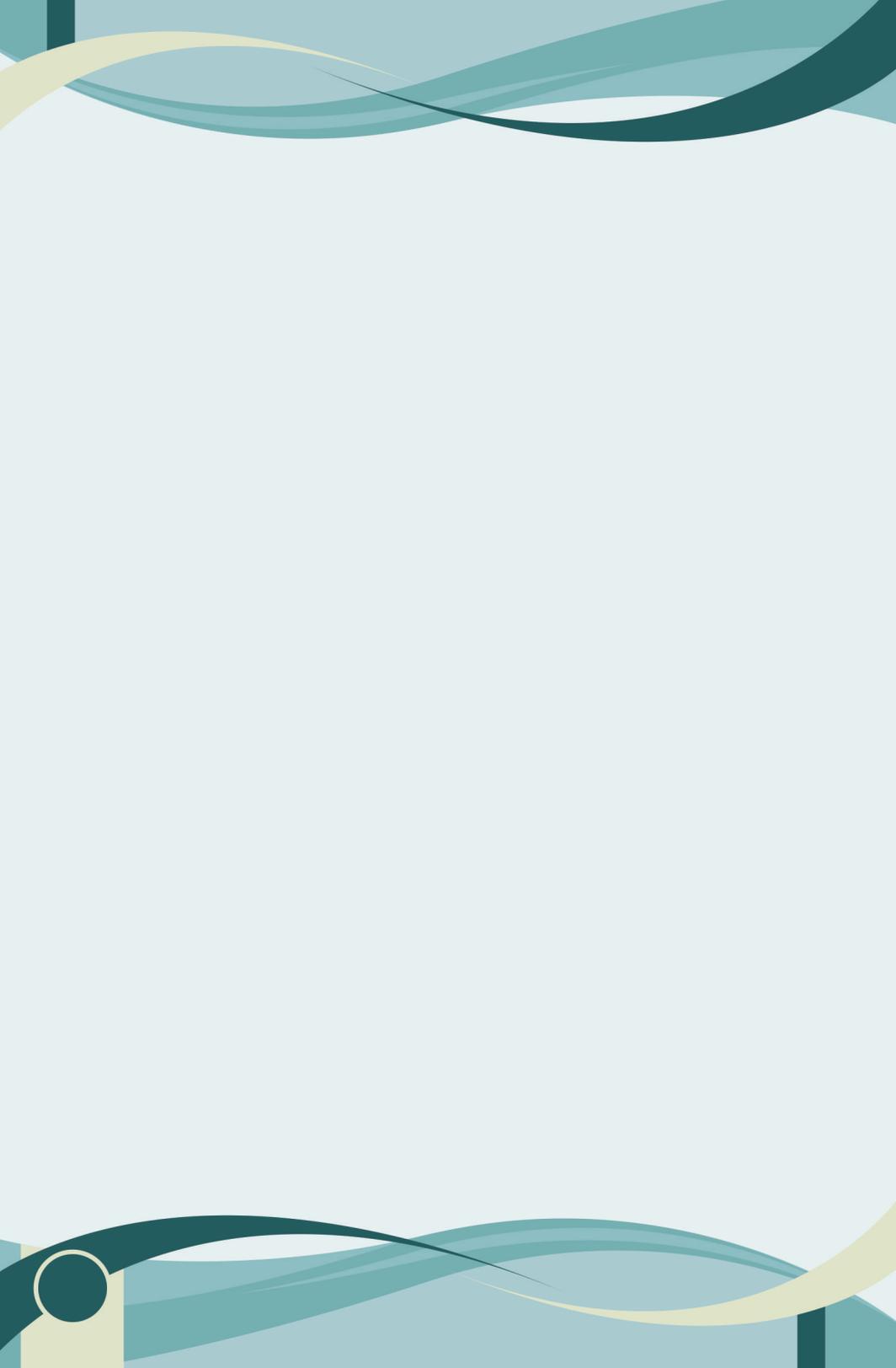
I am happy to know that the Anand Agricultural University, Anand is publishing a “Research Accomplishments and Recommendations 2012” which contains recent improved technologies developed by the university scientists to cater the needs of farming community of the state. I congratulate all the scientists whose valuable research findings have been included in this important publication of the university.



Since the inception of Anand Agricultural University, Anand, it has made significant contribution in the development of agricultural sector of Gujarat state. The technologies developed by the agricultural scientists of this university will definitely be satisfied the need of the farming community of the state. I compliment Dr. K. B. Kathiria, Director of Research and his team for making untiring efforts in bringing out this scientific publication.

I hope this excellent publication will be very useful for scientific fraternity, line departments, NGOs and agricultural extension agencies who are directly or indirectly engaged in dissemination of technologies among the farmers of the state.

(A. M. SHEKH)





ANAND AGRICULTURAL UNIVERSITY
UNIVERSITY BHAVAN,
ANAND – 388110

Director of Research

FOREWORD

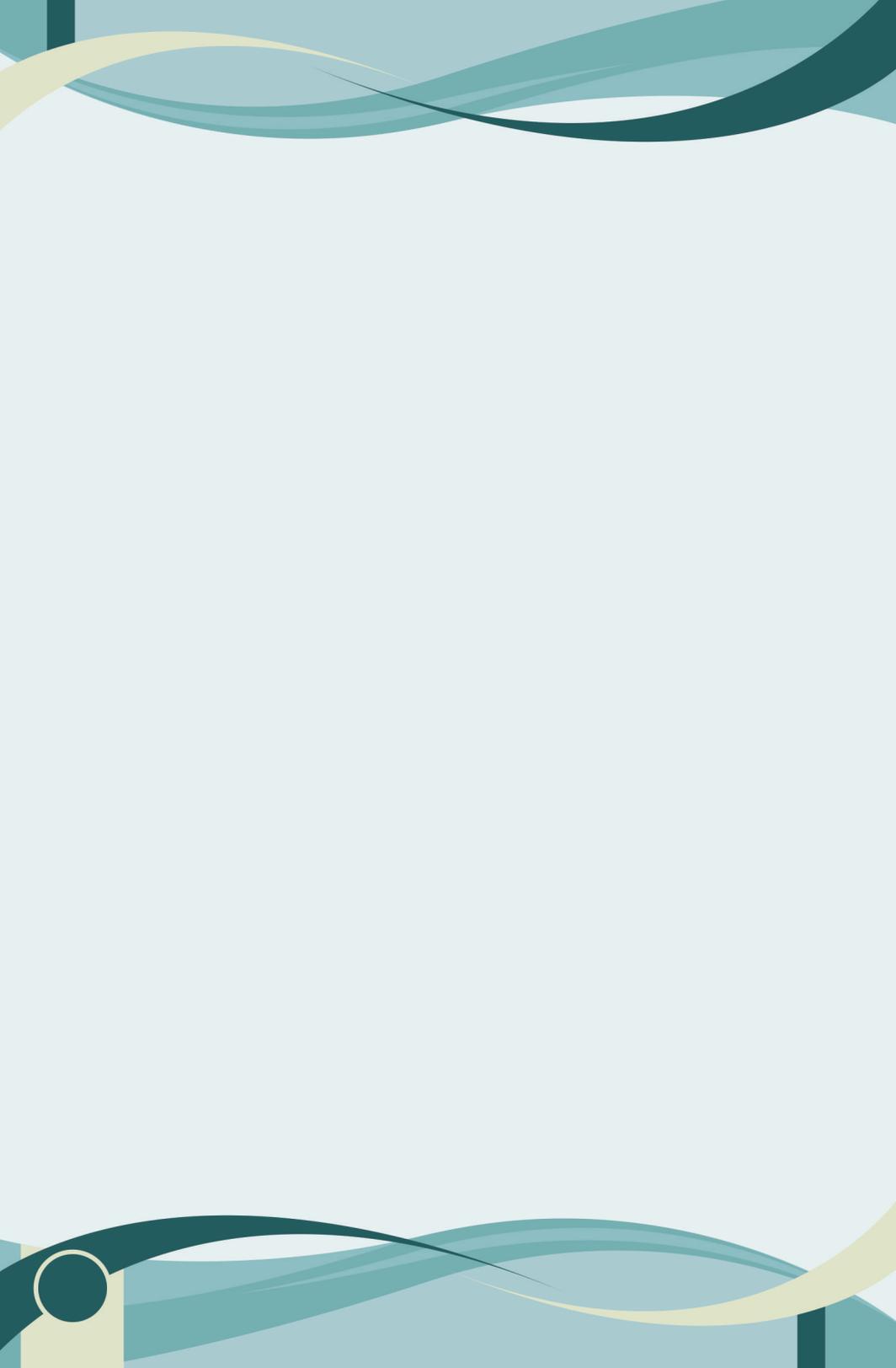
Agriculture is an important source of employment and livelihood in modern era as nearly 70% of our population depends on agriculture. Development of new technologies in agriculture is the prime need in present days to fulfill the requirements of the people depending on agriculture. In this context, it gives me immense pleasure to put the publication on “Research Accomplishments and Recommendations 2012” which contains different technologies developed by scientists of all faculties of Anand Agricultural University, Anand. I am highly indebted to Hon’ble Vice Chancellor of this university Dr. A. M. Shekh for providing all kinds of guidance and support for bringing out this informative publication.



At this juncture, I would like to thank all the conveners of respective Agresco sub-committee for compiling research recommendations emerged out during the year 2011-12. I take this opportunity to congratulate and thank to the scientists for their untiring and dedicated efforts made by them in developing the new technologies for the farming community of the state. I am also thankful to university officers and staff members of Directorate of Research for their help in bringing out this booklet.

I am sure that the information provided in this booklet will be very much helpful to the officers of line departments, NGOs, private agencies, agricultural scientists, students and others who are associated with agriculture. I hope that the efforts made by scientists will definitely helps for betterment of farming community of the state.

K.B. Kathiria
(K.B. Kathiria)



PREFACE

The research work carried out in different fields of agricultural sciences during the year 2011-12 has been very well discussed by different AGRESKO sub-committees for bringing out useful and beneficial recommendations for farmers, scientific community, entrepreneurs and stake holders.

The recommendations made by different committees for adoption by the farmer's scientific community, entrepreneurs and stake holders in agriculture are listed below.

Name of the sub-committee	No. of recommendations	
	For farmers	For scientific community/ entrepreneurs
Crop Improvement	04 + 02*	-
Plant Physiology	01	-
Crop Production	08	01
Plant Protection	12	02
Dairy Science	-	03
Agri. Engineering	-	-
Food Processing Technology	-	02
Animal Production	04	15
Animal Health	-	05
Social Science	01	01

* Pre released



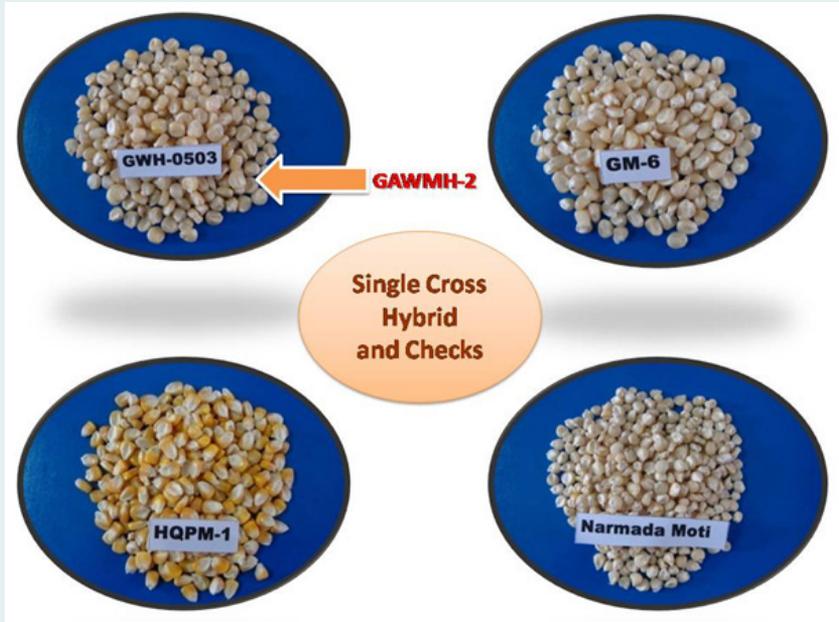
Gujarat Anand White Maize Hybrid - 2

Recommendations for farming community

I. CROP IMPROVEMENT

[A] PLANT BREEDING

1. Maize: Gujarat Anand White Maize Hybrid - 2 (GAWMH-2)



The single cross hybrid derived from a cross of CML-251 X GWL-10. It recorded 3.9 t/ha grain yield revealing 25.9, 24.0 and 13.8 % yield superiority over Narmada Moti, GM-6 (composite varieties) and HQPM-1(single cross hybrid), respectively under kharif - rainfed conditions. It showed moderate tolerant to stem borer and resistant against Maydis Leaf Blight (MLB).

(Research Scientist (Maize), Main Maize Research Station, AAU, Godhra)



Gujarat Anand Bidi Tobacco - 11

2. Tobacco: Gujarat Anand Bidi Tobacco – 11 (GABT-11)



This variety is derived from a cross of ABD-65 x ABD-10 possesses shy suckering habit, short internodes and more number of leaves (33). The plant stature is medium with round, stout and thick stem. This variety gave 4175 kg cured leaf yield which is 87 and 11 % higher over existing check varieties A 119 and MR GTH 1 under irrigated condition at Anand, respectively. It showed profuse spangling and desirable leaf thickness with better smoke taste than both the checks.

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



Gujarat Anand Forage Sorghum-11

3. Forage Sorghum: Gujarat Anand Forage Sorghum-11 (GAFS-11)



This culture showed tall stature with non lodging thin stem. It showed higher green forage yield to the tune of 32.9, 11.1 and 23.5 % and higher dry matter yield to the tune of 25.5, 24.0 and 23.1 % over checks S-1049, GFS-5 and C-10-2, respectively. The crude protein yield and keeping quality were found better than the checks. For plant height, tillers, number of leaves, leaf length and leaf width, the variety was found better than checks. This genotypes was found comparable for anthracnose, zonate leaf spot and leaf blight diseases with checks. This variety is recommended for cultivation in the Middle Gujarat, Bhal and North-West zone under rainfed conditions.

**(Research Scientist (Forage),
MFRS, AAU, Anand)**



Gujarat Anand Tomato-4

4. Tomato: Gujarat Anand Tomato-4 (GAT-4)



The variety exhibited 269 q/ha fruit yield which was 16.4 and 30.9% higher over the checks GT-2 and AT-3, respectively. The genotype has determinate type plant growth habit with dark green foliage and dark green shoulder on fruit at breaker stage. The fruits are red in color, big in size and circular in shape. The fruits possess higher Vitamin C, acidity and pulp/juice ratio as compared to both the checks. The variety GAT-4 showed low incidence of whitefly and fruit borer damages as well as TLCV as compared to GT 2 and AT 3.

**(Research Scientist (Vegetables),
MVRs, AAU, Anand)**

Pre-release

1. Maize : Gujarat Anand Yellow Maize Hybrid-1 (GAYMH-1)

The single cross hybrid derived from a cross CML 307 x GYL-11 is an early maturing and yellow grain hybrid suitable for North Gujarat Agro Climatic Zone-IV under rainfed conditions. It revealed 3.6 t/ha grain yield which was 23.9 and 20.6 % higher over checks HQPM-1 (single cross hybrid) and GM-2 (variety) under kharif-rainfed conditions, respectively. It showed moderate tolerance to stem borer and resistant against Maydis Leaf Blight (MLB) when compared to check GM-2 under natural field conditions.

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

2. Dill Seed: Gujarat Anand Vegetable Dill Seed-1 (GAVDS-1)

This vegetable Dill Seed culture is a selection from local germplasm. It showed vigorous vegetative growth with more number of branches as compared to other cultures. The dark green colour foliage revealed 180-190 q green biomass/ha which was 8.4, 21.2 and 8.2 % higher than check varieties GD-1, GD-2 and GD-3 respectively. Due to its late flowering habit, it can be utilized for leafy vegetable purpose for a longer period. It possesses good aroma and volatile oil content.

(Asstt. Res. Sci., Castor and Seed Spices Research Station, AAU, Sanand and Research Scientist (Vegetables), MVRS, AAU, Anand)

[B] PLANT PHYSIOLOGY

1. Effect of ethereal and gibberellic acid (GA3) on fruit ripening in chilli crop cv. GVC-111

Farmers of Middle Gujarat, Agro climatic Zone-III planting chilli variety GVC-111 for seed production purpose are advised to spray GA3 @ 50 mg/l at 45 days after transplanting for getting higher seed yield and quality seed.

(Research Scientist (Pl. Phy.), Main Vegetable Research Station, AAU, Anand)

II CROP PRODUCTION

[A] CULTURAL PRACTICES

1. Effect of sowing dates on yield and quality of forage sorghum

The farmers of middle Gujarat agro climatic zone-III are advised to sow fodder sorghum var. GFS-5 upto 30th June to get higher yield and net profit.

(Associate Research Scientist, MFRS, AAU, Anand)

[B] NUTRIENT MANAGEMENT

2. Response of irrigated Bt cotton to N, P and micronutrients

The farmers of middle Gujarat agro climatic zone-III (AES-2) growing irrigated Bt cotton are advised to apply 10 t FYM/ha and 240 kg N/ha, i.e., 60 kg N/ha as a basal and remaining 180 kg N/ha in three equal splits at one month interval after sowing for securing higher yield.

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

3. Response of chickpea (GG-1) to nitrogen, phosphorus and sulphur with and without biofertilizers under supplementary irrigation in Bhal region

Farmers of Bhal area growing chickpea under limited irrigation facility are advised to apply *Rhizobium* as a seed treatment (30 g/kg seed) and 20 kg N + 20 kg S/ha as a basal and remaining 20 kg N/ha at the time of first irrigation to obtain higher seed yield and net return.

(Research Scientist, ARS, AAU, Arnej)

4. Influence of integrated nutrient management on yield of soybean

The farmers of middle Gujarat agro climatic zone-III (AES-II) growing soybean (*kharif*) are advised to apply 50% of RDF i.e. 15 kg N and 30 kg P₂O₅/ha along with seed treatment with PSB + *Rhizobium* (each of @ 5 ml/kg) to get higher yield and net return.

(Associate Research Scientist, TRTC, AAU,
Devgadhbaria)

5. Effect of organic manures, sulphur and phosphorus on growth and yield of black gram

The farmers of middle Gujarat agro climatic zone- III (AES-2) growing black gram (var. Guj. Urid 1) during *kharif* season are advised to apply vermicompost @ 2 t/ha or FYM @ 5 t/ha and 20:40:40 NPS kg/ha as a basal dose to get higher yield and net realization.

(Associate Research Scientist, PRS, AAU, Vadodara)

[C] WATER MANAGEMENT

6. Effect of spacing, drip irrigation and nitrogen on late *Kharif* castor

The farmers of middle Gujarat agro climatic zone-III (AES-II) are recommended to sow castor seed in paired row (60x60x180 cm) and irrigate as well as fertigate through drip at 0.8 PEF. The 30% of RDN (22.5 kg/ha) and full dose of P (50 kg/ha) should be applied as basal and remaining N in three equal splits at an interval of one month through drip.

System details:

Lateral spacing	: 2.4 m
Dripper spacing	: 0.6 m
Dripper discharge	: 4 lph
Operating pressure	: 1.2 kg/cm ²
Operation frequency	: Alternate day
Operating time	: 100-150 min

(Associate Research Scientist, ARS for IC, AAU, Thasra)

7. Comparative evaluation of SRI with different methods of rice cultivation

The farmers of middle Gujarat agro climatic zone III (AES-II) having assured irrigation and drainage facility are advised to grow rice var. GR 12 in *kharif* season by adopting SRI/Modified SRI technique for obtaining higher yield and saving of 50% chemical fertilizer over conventional practices. The farmers should adopt either one of the

following two modified SRI techniques.

Sr. No.	Practices to be followed	Modified SRI	Modified SRI (Under paucity of labours)
1	Seeding	Seeding of near sprouted seeds on well drained leveled soil after puddling	
2	Seed rate (kg/ha)	5	20
3	Spacing (cm)	25 cm x 25 cm	25 cm between two rows
4	Nutrient management	(1) FYM@ 5 t/ha as basal (2) <i>Azotobacter chroococcum</i> ABA 1 +PSB <i>Bacillus coagulans</i> PBA 16 (10^8 cfu/ml) each @ 1 litre/ha at the time of seeding along with well sieved FYM (50 kg/ha) (3) Fertilizers 40-12.5-0 NPK kg/ha* (a) Basal: 40% N & 100% P ₂ O ₅ (16-12.5-0 NPK kg/ha) (b) At the tillering stage: 40% N (16 kg N/ha at 30 DAS) (c) At Panicle initiation (PI) stage: 20% N (8 kg N/ha one week before PI stage)	
5	Water management	No flooding of water upto PI stage, maintain the soil moist condition and 5 cm submergence of water from Panicle initiation (PI) to dough stage.	
6	Weed management	Use rotary / cono weeder for weeding / interculturing 4 times at 10 days interval starting from 25 days after seeding.	

*ZnSO₄ @ 25 kg/ha should be given as basal dose.

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

[D] HORTICULTURE

1. Effect of biofertilizers and chemical fertilizers on growth and flower yield of Deshi Red Rose

The farmers of middle Gujarat Agro Climatic Zone-III (AES-II) growing Deshi Red Rose are advised to apply 40 g nitrogen (87 g urea), 40 g phosphorus (250 g single super phosphate) and 25 g potash

(42 g murate of potash) per plant in three equal splits from third year onward in June, October and January and after two days of fertilizers application 1 ml/plant each in 3 equal splits of *Azospirillum* and PSB (*Bacillus coagulans*) should be applied as soil treatment mixing in 200 ml of water for getting higher flower yield, maximum shelf life of flowers as well as higher net realization.

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

III PLANT PROTECTION

[A] AGRICULTURAL ENTOMOLOGY

1 Evaluation of IPM module for the management of sucking pests in Bt cotton

Following IPM module found cost effective and safer to the natural enemies is recommended for the management of aphid, jassid, whitefly and thrips in Bt cotton (BG II) cultivated in middle Gujarat.

- 1) One need based (5 aphids or leafhoppers or whiteflies/leaf) application of *Beauveria bassiana* (2×10^8 cfu/g) @ 40 g/10 l water followed by need based application of thiamethoxam 25 WG 0.01% (4 g/10 l water) (50 g a.i./ha).
- 2) Need based (5 thrips/ leaf) application of acephate 75 SP 0.075% (1 g/l water) (375 g a.i./ha).
- 3) The waiting period of thiamethoxam 25 WG 0.01% (50 g a.i./ha) and acephate 75 SP 0.075% (375 g a.i./ha) should be maintained 21 and 15 days after application, respectively.

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

2. Evaluation-cum-demonstration of management strategies for the control of fruit flies (*Bactrocera cucurbitae* and *Dacus ciliatus*) in bitter gourd orchard

Bitter gourd growers of middle Gujarat are advised to install pheromone traps with Cue-lure impregnated wood blocks @ 16/ha at the initiation of the flowering followed by spot application of poisoned bait made by mixing of 400 g Jaggery + 8 ml of dichlorvos 76 EC in 10 litre of water at fortnightly (15 days)

interval. The spots should be spaced at 7 × 7m distance. The bait should also be applied on border/field boundaries.

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

3. Evaluation of different insecticides as seed treatments against leaf miner in cucurbitaceous vegetable crops

For effective management of leaf miner in early stage of the crops viz., cucumber, bottle gourd, ridge gourd and smooth gourd, the farmers of middle Gujarat are advised to treat the seeds before sowing with imidacloprid 70 WS @ 7.5 g/kg seeds or thiamethoxam 70 WS @ 4 g/kg seed.

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

4. Evaluation of some microbial insecticides against leaf defoliators and plant hoppers infesting paddy

Paddy growers of middle Gujarat are advised to give application of *Bacillus thuringiensis* (5×10^7 spores/mg) @ 1.0 kg/ha (20 g/ 10 l water) or *Beauveria bassiana* (2×10^6 cfu/g) @ 1.0 kg/ha (20 g/ 10 l water) or *Verticillium lecanii* (2×10^6 cfu/g) @ 1.0 kg/ha (20 g/ 10 l water) at initiation of leaf folder damage.

(Principal Research Scientist, Biocontrol Research Laboratory, AAU, Anand and Associate Research Scientist (Ento.), MRRS, AAU, Nawagam)

5. Evaluation and demonstration of IPM module against pest complex of paddy

Paddy growers of middle Gujarat are advised to use resistant paddy cultivar (Gurjari), transplanting of paddy seedlings during first fortnight of July and application of NSKE @ 5% (500 g/ 10 l water) to suppress the incidence of leaf folder and maintain the population of predatory spiders.

(Principal Research Scientist, Biocontrol Research Laboratory, AAU, Anand and Associate Research Scientist (Ento.), MRRS, AAU, Nawagam)

6. Impact evaluation of cow-urine and vermiwash on insect pests, their natural enemies and yield of brinjal

Farmers growing brinjal crop organically are advised to apply

two sprays (60 and 75 days after transplanting) of cow-urine @ 20% mixed with leaf extract of neem or custard apple or jatropha or lantana @ 10% for suppression of sucking pests (aphid, leafhopper and whitefly) as well as shoot and fruit borer.

**(Principal Research Scientist, Biocontrol Research Laboratory,
AAU, Anand)**

7. Evaluation of microbial insecticides formulations against fruit borer of tomato

Tomato growers are advised to spray HearNPV (1.0×10^9 POB/ml) @ 250 ml/ha (5 ml/ 10 l water) or *Beauveria bassiana* (1×10^8 cfu/g) @ 1.0 kg/ha (20 g/10 l water) or *Metarhizium anisopliae* (1×10^8 cfu/g) @ 1.0 kg/ha (20 g/10 l water) 85 days after transplanting for suppression of fruit borer, *Helicoverpa armigera* (Hubner).

**(Principal Research Scientist, Biocontrol Research Laboratory,
AAU, Anand)**

8. Bio-efficacy of some microbial insecticides against pests of cabbage

Cabbage growers are advised two sprays of *Beauveria bassiana* (2×10^6 cfu/g) or *Verticillium lecanii* (2×10^6 cfu/g) @ 1.5 kg/ha at 40 and 60 days after transplanting for suppression of aphid and head borer (*Helicoverpa armigera*).

**(Principal Research Scientist, Biocontrol Research Laboratory,
AAU, Anand)**

9. Standardization of number of pheromone traps for mass trapping of stem borer in paddy

The farmers of middle Gujarat growing paddy are advised to install pheromone traps with *Scirpophaga incertulas* lures equidistantly in the field one month after the transplanting of the crop @ 30 traps/ha for effective and economical management of stem borer (*Scirpophaga incertulas*). Lure should be changed at 3 weeks interval. The installation of pheromone traps helps the farmers to gain economic benefit.

(Associate Research Scientist (Ento.),MRRS, AAU, Nawagam)

10. Evaluation of various physical barriers to prevent damage of rose-ringed parakeet to wheat panicles

To prevent parakeet damage to the wheat panicles, farmers growing wheat under irrigated condition are advised to tie two parallel jute strings vertically, 20 cm apart by fixing it with the help of wooden stakes on the outer edge of the row; the strings to be fixed just 6 inches away from the panicles.

(Research Scientist, Ornithology, AAU, Anand)

[B] PLANT PATHOLOGY

11. Integrated management of phytonematodes, *Meloidogyne* spp. in mung by adding organic compounds

The farmers of middle Gujarat growing kharif mung are advised to apply neem cake @ 1000 kg/ha + *Trichoderma viride* (2×10^8 spores/g) @ 2.5 kg/ha, 10 days before sowing for effective and economical management of root knot nematodes (*Meloidogyne* spp.).

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

12. Management of wilt of pigeonpea through bio-agents and fungicides

Farmers of middle Gujarat growing pigeonpea are advised to treat the seeds first with carboxin (37.5%) + thiram (37.5%) @ 3 g/kg seeds followed by *Trichoderma viride* (2×10^8 cfu/g) @ 10 g/kg seeds for effective and economical management of wilt disease of pigeonpea.

(Assistant Research Scientist (Pl. Patho.), ARS, AAU, DeroI)

IV ANIMAL PRODUCTION

1. Development of coloured meat purpose crossbred birds

For development of coloured meat purpose chicken crosses suitable for rural farming, New Hampshire can be used as male line and Australorp as female line as New Hampshire crosses gained significantly higher weight (1253 g) at 8 weeks age whereas, Australorp has produced significantly higher egg numbers (80) upto

40 weeks with 55 g egg weight at 40 weeks age.

(Principal Scientist, Poultry Complex, Veterinary College, AAU, Anand)

2. The feed cost of raising weaner kids and lambs fed jowar hay (30%) and groundnut gotar (30%) based Total Mixed Ration

The feed cost of raising weaner kids and lambs fed jowar hay (30%) and groundnut gotar (30%) based Total Mixed Ration can be reduced by 25 to 30% compared to TMR based on jowar hay (60%) alone.

(Research Scientist, ANRS, Veterinary College, AAU, Anand)

3. Supplementation of concentrate mixture to buffaloes of Ahmedabad district

In Ahmedabad district buffaloes yielding 5-7, 7.5-9.5 and 10-12 kg milk/day, on an average received daily 3.0, 4.0 and 5.0 kg concentrate mixture, respectively. In order to fulfill their nutrient requirement, the farmers are advised to feed daily additional 1.0 kg compound concentrate mixture in summer to buffaloes yielding 5-7 kg milk and 0.5 kg compound concentrate mixture round the year to buffaloes yielding daily 7.5-12 kg milk.

(Research Scientist, ANRS, Veterinary College, AAU, Anand)

4. Effect of inclusion probiotics in broiler ration

The cost of feeding (₹/kg gain) in coloured broilers was reduced by 14.5% when probiotics was supplemented @ 100 g and 50 g/tonne of feed during starter and finisher phase, respectively.

(Research Scientist, ANRS, Veterinary College, AAU, Anand)

V SOCIAL SCIENCE

1. Economic analysis of tissue cultured and sucker propagated banana in middle Gujarat

In Middle Gujarat Agro-climatic Zone-III, tissue-cultured banana was found to be more profitable than sucker-propagated banana and the risk was also lower in tissue-cultured banana. Therefore, the farmers are recommended to grow banana by tissue-cultured plantlets.

(Prof. & Head, Dept. of Ag. Economics, BACA, AAU, Anand)

Recommendations for scientific community and entrepreneurs

I CROP PRODUCTION

WEED MANAGEMENT

1. Study on nitrogen stress detection in wheat crop using Spectroradiometer

It is advisable to use the NDRE (Normalized Difference Red Edge) vegetative index computed from narrow band spectral reflectance measured using spectroradiometer to detect the nitrogen stress in wheat during early growth stage (30 to 45 DAS) as NDRE is found the most sensitive index. Nitrogen deficiency can be computed using stepwise regression equation. Nitrogen deficiency (kg/ha) = $468.1 - 923.4 \times \text{NDRE}$ ($R^2:0.78^{**}$)

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

II PLANT PROTECTION

ENTOMOLOGY

1. Impact evaluation of cow-urine and vermiwash on insect pests, their natural enemies and yield of Brinjal

Cow-urine alone sprayed at higher concentrations (40 & 50%) on 60 and 75 days after transplanting of brinjal crop positively affects certain growth and yield attributing characters (plant height, fruit length and fruit diameter).

(Principal Research Scientist, Biocontrol Research Laboratory, AAU, Anand)

PLANT PATHOLOGY

2. Assessment of loss due to early blight disease in potato crop

Loss due to early blight disease in yield of potato tuber is estimated to the tune of 33% in middle Gujarat.

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

III DAIRY SCIENCE

1. Process standardization for the manufacture of *Thabdi*

A scientific method to manufacture *Thabdi* is developed from milk

standardized to 0.66 fat : SNF ratio and added with 8% (w/v) sugar at the time of first boiling. The boiling is to be continued till pat formation. The final heat treatment is imparted for 40 min in two parts; 20 min after pat formation to have graininess development accompanied by addition of ghee @1.2 per cent and continuing the heat desiccation for further 20 min to get desired moisture, colour and grainy texture. The yield of the *Thabdi* is 27 kg/100 kg milk which can be stored at $30 \pm 2^{\circ}\text{C}$ temperature for 9 days.

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

2. Process standardization for the manufacture of *Halvasan*

Good quality *Halvasan* can be prepared using standardized milk having 0.66 fat: SNF ratio, 5% *fada* (sprouted dry *Bhalia* wheat, Duram), 17% sugar and heating at 90°C temperature for 2 h. The final desiccation is to be carried out for 30-40 min to have desired colour, moisture and proper grain size. The yield of *Halvasan* is 45 kg/100 kg milk which can be stored at $30 \pm 2^{\circ}\text{C}$ temperature for 9 days.

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

3. Development of self carbonated probiotic whey beverage

Self carbonated probiotic whey beverage could be prepared by fermentation of pasteurized paneer whey using yeast *Kluyveromyces marxianus* NCIM 3566, probiotic culture *Lactobacillus helveticus* MTCC 5463 and 7% sugar. The product could provide optimum dose of probiotic lactobacilli of 2.13×10^8 cfu/ml having organoleptically acceptable quality till 21 days of storage at $5 \pm 2^{\circ}\text{C}$ temperature.

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

IV FOOD PROCESSING TECHNOLOGY

1. Utilization of pumpkin powder for preparation of various food products

The pumpkin powder rich in carotene (Precursor of vitamin-A) can be used for manufacturing of various food items.

- (A) A carotene biofortified biscuits can be prepared by replacing refined wheat flour (maida) with pumpkin powder at the rate of 2.5% (w/w). This biscuit will be of a good dietary supplement of vitamin-A.

- (B) A carotene biofortified deep fried *bhajjiya* can be prepared by replacing gram flour (besan) at the rate of 10% (w/w) with pumpkin powder. The *bhajjiya* will be a good dietary supplement of vitamin-A.
- (C) A carotene biofortified ice-cream can be prepared with pumpkin powder incorporated at the rate of 1.5% (w/v). The ice-cream will be a good dietary supplement of vitamin-A.

(Dean, FPT and BE, AAU, Anand)

2. Puffing of grains (Parboiled Milled Rice) using microwave energy from Gurjari/Jaya rice

The entrepreneurs and food processors interested in production of instant puffed rice using microwave energy are advised to use Gurjari or Jaya variety following the protocol developed by AAU. The technology enables production of puffed rice in domestic convective-cum-microwave oven.

(Dean, FPT and BE, AAU, Anand)

V ANIMAL PRODUCTION

1. The effect of estrus synchronization protocols on estrus response and fertility in Gir cows

Estrus Synchronization protocols viz. I: CIDR protocol (CIDR+EV-Day 90-92; PGF2 α - Day 7, AI - day 9th (48 hr after PGF2 α injection),II: Ovsynch Protocol (GnRH -Day 0; PGF2 α - Day 7; GnRH- Day 9; AI - Day 22-24 hr after 2nd injection) or III: Covsynch Protocol(GnRH - Day 0; PGF2 α - Day 7; GnRH - Day 9 + AI - 12 & 18 hr) results in successful ovulatory estrus and conception within two cycles in postpartum infertile Gir cows.

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

2. Effect of IGF-II genotypes on feed consumption and egg production in Bantamized White Leg Horn

At IGF-II locus, AA genotype (*NlaIII* RFLP) has lower body weight and better feed conversion efficiency than AB and BB genotypes with egg number, egg weight and AFE at par in Bantamized White Leghorn birds suggesting A allele having favourable effect on feed conversion efficiency.

(Principal Scientist, Poultry Complex, Vet. College, AAU, Anand)

3. Effect of O CX-32 genotypes on egg production in Bantamized White Leg Horn

At OCX-32 ex2 and ex4 loci, AB and BB genotypes (*HpyCH4IV* and *NcoI* RFLP) has significant and favourable association with egg production without affecting egg weight as compared to AA genotype in Bantamized White Leghorn birds suggesting B alleles at both loci has favourable effect on egg production.

(Principal Scientist, Poultry Complex, Vet. College, AAU, Anand)

4. Developing egg purpose crosses for backyard poultry farming

For development of crossbred chicken suitable for rural poultry farming using Australorp, Naked neck and Rhode Island Red as male and White Leghorn as female parents, Naked neck and Rhode Island Red crossbred have shown significantly better egg number, egg mass, feed efficiency in term of feed consumption per egg, per kg egg and per dozen egg and return over feed cost up to 40 weeks of age as compared to Australorp crossbred.

(Principal Scientist, Poultry Complex, Vet. College, AAU, Anand)

5. Composition of Kachchhi camel milk

Kachchhi camel milk contains comparatively higher unsaturated fatty acids (Palmitoleic Acid 7.31%, Linoleic Acid- 0.78% and Linolenic Acid 0.57%), Minerals (Iron +0.30 ppm and Zinc +2.64 ppm) and Vitamin C (+5.88 mg/100 ml) than goat milk.

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

6. Technology for manufacturing camel milk medium fat ice cream

Pineapple flavoured medium fat ice cream (6% milk fat, 11% MSNF, 15% sugar, 1.5% whey protein concentrate, 0.2% sodium alginate and 0.15% glycerol monostearate) can be prepared from camel milk which has comparable acceptability to regular ice-cream (10% fat).

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

7. Genetic variability in Kachchi camel

Kachchi camel has low genetic variability as revealed by low observed and effective mean number of alleles (MNA=3.18 and 2.06 respectively), low observed and expected heterozygosity ($H_o=0.364$ and $H_e=0.421$) and low inbreeding coefficient (FIS = 0.1027) based on camel specific set of 16 microsatellite markers.

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

8. Growth performance of kids and lambs fed *jowar* hay and groundnut haulms based total mixed ration (TMR)

The weaner lambs fed *jowar* hay (30%) and groundnut gotar (30%) based Total Mixed Ration (TMR-T₂) resulted in significantly higher amount of total and protein nitrogen (95.56 & 66.16 mg/dl, respectively) compared to lambs fed TMR based on *jowar* hay (60%) alone (68.49 and 39.02 mg/dl, respectively). The higher availability of increased protein-N resulted in significantly higher growth rate in weaner lambs.

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

9. Compensatory growth in crossbred calves fed crop residue based TMR

Restricted feeding of 8-12 months old growing crossbred calves at the rate of 75% of the requirement as per NRC (1989) standards for 3 months followed by re-alimentation for 2 months at the rate of 125% of requirement is a feasible option since it resulted in 29% higher body weight gain without increase in feed cost per kg gain.

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

10 Area specific mineral mixture for Dahod district

Following area specific mineral mixture is recommended for Dahod district to makeup the deficiency when fed @ 30g/head/day to dairy animals in addition to the current feeding practices.

Sr. No.	Mineral element	Requirement (%)	Mineral salt	Quantity (kg)
1	Calcium	20.000	Dicalcium phosphate Calcite powder	12.177
2	Phosphorus	12.000	DCP	66.667
3	Magnesium	5.000	Magnesium oxide	9.259
4	Sulphur	2.700	Sodium thiosulphate	6.923
5	Copper	0.100	Copper sulphate	0.400
6	Zinc	0.900	Zinc sulphate	2.727
7	Manganese	0.130	Manganese sulphate	0.419
8	Iron	0.400	Ferrous sulphate	1.333
9	Cobalt	0.012	Cobalt sulphate	0.060
10	Iodine	0.026	Potassium iodide	0.034
			Total	100.000

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

11. Nutritional evaluation of detoxified *Jatropha curcas* meal on milk production in buffaloes

The replacement of soyabean meal protein with detoxified *Jatropha curcas* meal at 50% level in the concentrate mixture for buffaloes had no any adverse effect on total milk yield, gross milk composition, nutrient utilization, feed conversion efficiency and blood biochemical profile viz glucose, total protein, albumin, globulin and activities of alanine-aminotransferase and aspartate aminotransferase.

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

12. Effect of GHR gene SNPs on production in Jaffarabadi and Mehsana buffalo

Two SNPs in Exon 8 of GHR gene (G1961T and T1972C) have significant and favourable association with milk fat% in Jaffarabadi and Mehsana buffalo, where allele T and allele C respectively have favourable effects.

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

13. Novel SNPs in Leptin gene in Jaffarabadi and Mehsana buffaloes

Three novel SNPs one each in Promoter (C287A), Intron-1 (A321G)

and Exon-3 (A498T) in Leptin gene are discovered in Jaffarabadi and Mehsana buffalo.

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

14. Effect of Leptin gene SNPs on production in Jaffarabadi and Mehsana buffalo

An SNP (C310T) in intron 1 of Leptin gene has significant association with milk fat% in Jaffarabadi buffalo. Allele C was found to have favourable effect.

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

15. Effect of Pit gene SNPs on production in buffalo

Seven new SNPs discovered in Pit 1 gene of buffalo, one in Exon 1 (T264A), three in Intron-1 (C461T, G472A and C603G), one in Exon 2 (C720T) and two in Intron 2 (T771C and G772A) have no association with the milk yield and milk fat %.

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

VI ANIMAL HEALTH

1. Evaluation of immunomodulatory activity of a topical herbal drug in the treatment of bovine subclinical mastitis

Topical application of 5 g of a gel based herbal drug {containing *Curcuma longa* (0.04 g), *Paedaria foetida* (0.04 g), *Glycyrrhiza glabra* (0.1 g), *Eucalyptus globulus* (0.2 g), *Cedrus deodara* (1.0 g) and *Shudh gandhaka* (1.0 g) in each 10 g} on sub-clinically infected udder quarters twice daily after milking for 5 consecutive days results in significant reduction in bacterial load and immunomodulation till day 21 post-treatment, hence suggested as an effective herbal therapy against bovine sub-clinical mastitis.

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

2. Anticancerous efficacy of *Semecarpus anacardium* on N-Nitrosodiethylamine induced Hepatocellular Carcinoma in Wistar Rats

The Nut milk extract of *Semecarpus anacardium* (Bhilamo) at the dose rate of 2.5 g/kg body weight orally once a day for seven

weeks has anticancerous effect on N- nitroso diethylamine induced hepatocellular carcinoma in wistar rats.

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

Influence of different categories of follicles on quantity and quality of oocytes with respect to their in vitro maturation in Surti buffaloes

3. For better maturation rate of oocytes in Surti buffaloes, oocytes with more number of cumulus layers should be selected.
4. In Surti buffalo, better quality and quantity of oocytes are retrieved in absence of corpus luteum.

(Prof. and Head, Dept. of Animal Reprod., Gynaecology & Obstetrics, Vet. College, AAU, Anand)

5. Rabbit model based on histomorphometry and monopolar electrocoagulation

In the rabbit model, based on histomorphometry, monopolar electrocoagulation (24 W and 3 sec) caused greater thermal damage than bipolar (56 W and one sec), advocating low power output and less duration of application.

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

VII SOCIAL SCIENCE

1. **Economic analysis of tissue cultured and sucker propagated banana in middle Gujarat**

The total cost of cultivation was found to be higher in tissue-cultured banana (TCB) by ₹ 36,649/- per hectare than sucker-propagated banana (SPB), in which higher cost of tissue-cultured plantlets alone contributed to about 70 per cent. In adoption of TCB, high cost of tissue-cultured plantlets was the main constraint expressed by about 73 per cent of SPB farmers. Therefore, to popularize TCB, the trustworthy tissue-cultured plantlets should be made available to the farmers at reasonable price.

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