



NAVSARI AGRICULTURAL UNIVERSITY

**DIRECTORATE OF RESEARCH**  
**NAVSARI AGRICULTURAL UNIVERSITY**  
NAVSARI - 396 450 (GUJARAT)

# RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS

2013



NAVSARI AGRICULTURAL UNIVERSITY

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**MESSAGE**

There is urgent need to evolve strategies to make agriculture truly globalize, emphasizing on techniques and technology to meet the challenges of small farmers and to ensure food security with sustainability. For that, there is a need to remold and refine our research in new direction in order to increasing land and crop productivity. I am happy to that our scientists have worked hard and developed new technologies which will help to enhance profitability of the farmers by improving productivity with superior quality as per demand.

I congratulate the Director of Research and Dean PG Studies and his team for compiling and bring out a booklet of "Research Accomplishment and Recommendations - 2013" emanated from research work done by various faculties is commendable. I also congratulate all the scientists for their contribution in the field of their specialization. I am sure that this booklet will serve as an extremely useful source to guide the extension agencies and farmers of the region.

Navsari (A. R. Pathak)

Vice- Chancellor





NAVSARI AGRICULTURAL UNIVERSITY

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## RESEARCH RESUME

The Navsari Agricultural University is working with the major mandates of education, research and extension education. The scientists of this University have developed location specific and need based technologies which have played very important role in propelling the growth of agriculture in south Gujarat in particular and state in general. During the year 2012-13, we have come out with new crop varieties viz., bio-fortified fine grain possessing red colour kernel and dwarf stature paddy variety GNR-4 which is a first of its kind promising culture with high iron and dietary fibre content; early maturing and high yielding with good juice quality variety of GN sugarcane -8; cotton variety GN Cot.-22 is a first of its kind variety developed through interspecific hybridization having immune to jassid infestation as well as high level of resistance to sucking pests; high yielding fodder sorghum variety CSV-21 F is the first single cut fodder variety possessing the lowest HCN content is endorsed for sorghum growing area of Gujarat.

Location specific and economically viable production technologies were recommended by NRM group that covered various aspects like intercropping in banana; cultural practices for aerobic rice, sugarcane and castor; nutrient management for cabbage, castor, onion, sugarcane, Bt. cotton, fodder sorghum, paddy- castor cropping sequence and fenugreek grown under shed net house; water management in sugarcane; weed management in aerobic rice; methods for preparation of good quality vermicompost and compost;

In the pursuit of increasing fruits, vegetables and flower production, recommendations emerged out were stage wise requirement of nutrients in banana and sapota, organic manures for organic cultivation of papaya and turmeric and varietal assessment of chrysanthemum.

The major achievement of plant protection group include insecticidal control of sucking pest of castor with safety to eri silkworm, pod borer complex of pigeon pea, pest complex of cashew, evaluation of native Acetobactor and PSB culture for 50 per cent saving of nitrogen and phosphorus in sugarcane and forewarning for powdery mildew in mango.

Under post-harvest technology project, technologies were developed to delay the initiation of ripening process up to 25 days of storage and



extend the shelf life of mango cv. kesar up to 35 days and standard method to prepare ready-to-eat pickle from immature dropped mango fruit.

Supplementation of garlic powder @ 0.5% in ration of broilers and supplement 50 % regular mixture with 50 % bypass protein (formaldehyde treated) containing concentrate mixture in the ration of growing surti buffalo heifers were recommended by Animal production and fisheries group for achieving better growth and more economical returns.

The recommendations for farmers and scientific communities were approved in the 9<sup>th</sup> combined Agresco meeting of SAUs held at SDAU, S.K.Nagar during on 6-8 May, 2013.

Sr. No.	Name of the Sub-Committees	Name of Convener	date of meeting	No. of Recommendations	
				Farmers	Scientific community
1	Crop Improvement	Dr. D. U. Patel	11 & 12-3-2013	5	0
2	Natural Resource Management	Dr. J. D. Thanki	5 & 6-4-2013	22	2+2*
3	Horticulture & Forestry	Dr. B. V. Padhiar	18 & 19-3-2013	5	2
4	Plant Protection	Dr. V. A. Solanki	4 & 5-3-2013	5	7
5	Agril. Engineering	Er. S. P. Shukla	26-2-2013	2	-
6	Basic Science	Dr. Pushpendra Kumar	25-2-2013	-	1
7	Social Science	Dr. H. R. Pandya	20-2-2013	-	-
8	Animal Health	Dr. J. N. Mistry	16-2-2013	-	2
9	Animal Production	Dr. A. B. Fulsunder	15-2-2013	2	3
	Total			<b>41</b>	<b>19</b>

\* Confirmation of earlier recommendation

Navsari



(A. N. Sabalpara)  
Director of Research & Dean  
Faculty of PG Studies

## Recommendations for Farmers

### I CROP IMPROVEMENT

#### 1. Paddy : Gujarat Navsari Rice-4 (GNR-4)

Bio-fortified fine grain rice variety was developed from a cross NAUR-1 x Lal Kada. It is a dwarf statured, fine grained culture possessing red colour kernel. From various categories of trials in south Gujarat over three years, it revealed that 103 % yield increased over Lal Kada and 11.2 % over GR-11 with an average yield of 3500-4500 kg/ha. The proposed strain had moderate resistance against major diseases and insect pests. It is a first of its kind promising culture with high iron and dietary fiber content and therefore it is recommended for transplanted area of south Gujarat.



#### 2. Sugarcane : Gujarat Navsari Sugarcane-8 (GNS-8)

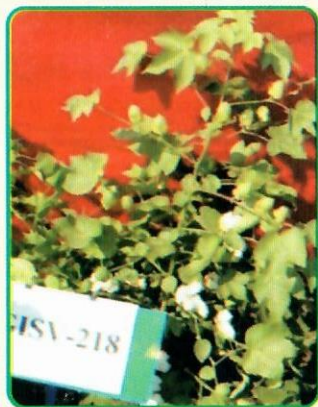


The early maturing sugarcane variety GNS-8 has been derived from a cross CoS 8436 X Co 86002. It registered 10.37 % cane yield increase over the check CoN 05071 in overall mean of eight plant and three ratoon trials. It is also found better in juice quality parameters over the check. It is moderately resistance to red rot, wilt and resistance to whip smut. It is recommended for cultivation in south Gujarat region.



### 3. Cotton : Gujarat Navsari Cotton-22 (GN. Cot.-22)

The variety is developed from cross of G.Cot.10 X GISV-140. The GISV-140 is developed through interspecific hybridization using *G. stocksii*, *G. armoria* and *G. anomlum*. It is a first of its kind variety developed through interspecific hybridization. It is immune to Jassid infestation. It was evaluated in beside several preliminary trials. On the basis of overall performance across the zones (47 replicated trials at nine locations for seven years in irrigated as well as rainfed conditions), it has recorded 8.1 to 45.7% yield superiority over different check varieties. It has showed high level of resistance to sucking pests. The variety is recommended for cotton growing areas of Gujarat.



### 4. Fodder Sorghum: Endorsement of CSV 21F



The fodder Sorghum culture CSV 21F (SRF 286) is a stable fodder variety identified by AICRP as national fodder sorghum variety in the year 2006. It has registered 20.9% higher green fodder and 18.9% higher dry fodder yield than the check GFS-5. It has showed very low HCN content. It has sweet and juicy stem capable of producing high biomass than GFS-5. As this is the first single cut fodder variety possessing lowest HCN content, it is recommended for sorghum growing area of Gujarat.

## II NATURAL RESOURCE MANAGEMENT

### [A] Cropping system

#### 1. Intercropping studies in banana under drip irrigation

The farmers of south Gujarat adopting drip irrigation in banana planted during September-October are recommended to take onion as intercrop for realizing higher net income.



Four rows of onion (*i.e.* 40 cm) should be planted on both sides of banana row by leaving about 20 cm space on all the sides of stem + 8 rows (80 cm) in between two rows of banana or 8 rows (80 cm) of onion only in between two rows of banana. This intercropping system also improves the land use efficiency.

They are further advised to apply respective recommended doses of fertilizer to both the crops.

#### 2. Identification and/or diversification of present crop sequence

The farmers of south Gujarat heavy rainfall zone (AES-III) are advised to adopt the paddy - sorghum(Grain) - sorghum ratoon(Grain) sequence or paddy - sweet corn - blackgram crop sequence for securing higher production and net income. However, for maintaining soil health and securing higher production farmers are advised to adopt paddy - greengram - groundnut crop sequence.



## [B] Cultural practices

### 1. Effect of pre-harvest production technology of banana (*Musa paradisiaca* L.) on yield and qualitative evaluation of various processed products

The banana growers of south Gujarat are recommended to follow integrated nutrient management system (PFDC package) for realizing more net profit than organic or inorganic alone nutrient management system. Further, adoption of INM or organic alone maintain the soil fertility also.

#### Recommendation for banana processing industries:

Based on the pooled results of physico-chemical quality parameters and shelf life, following variety and nutrient management are recommended for fruits and its processed products.

Fruit:

Criteria	Suitable Variety + NMS	Values
Shelf life	i. Basarai + Organic	14-15
	ii. Mahalaxmi + Organic	Days
Overall Acceptability	i. Basarai + Organic	8.7
	ii. Mahalaxmi + Organic	8.5
	iii. Grand Naine + Organic	8.2
	iv. Basarai + PFDC package	8.2

Processed products:

Products	Suitable Variety + NMS	Value (O.A.)
Wafer	i. Grand Naine + Organic > INM > Inorganic	>7
	ii. Basarai + Organic	
Flour	i. Grand Naine + Organic	>8
	ii. Basarai + Organic	
	iii. Mahalaxmi + Organic	

Fig	i. Grand Naine + Organic	~ 8
	ii. Mahalaxmi + Organic	
	iii. Basarai + Organic	
Ketchup	i. Grand Naine + Organic	~ 8
	ii. Basarai + Organic	
	iii. Mahalaxmi + Organic	
Puree	i. Grand Naine + Organic	~ 8
	ii. Mahalaxmi + Organic	
	iii. Basarai + Organic	
Cheese	i. Grand Naine + Organic	~ 8
	ii. Mahalaxmi + Organic	
	iii. Basarai + Organic	

O.A.: Overall Acceptability

### 2. Study on seed rate and spacing in irrigated drilled paddy (Aerobic rice)



The farmers of south Gujarat heavy rainfall zone (AES-III) intended to follow aerobic rice cultivation are advised to use 40 kg/ha seed rate and sow their crop at 30 cm row spacing for getting higher yield and net return.

### 3. Moisture management in sugarcane

Sugarcane growers of south Gujarat heavy rainfall zone (AES III) are advised to prepare land by mould board plough and plant at a row spacing of 75 cm in combination with recommended practices of irrigation for getting higher cane yield and net return.

### 4. Optimization of castor production under resource constraints

Farmers of south Gujarat heavy rainfall zone (AES-III) growing irrigated castor (GCH-7) during *rabi* season are advised to follow recommended practices of weed



management, fertilizer application and need based plant protection to achieve higher yield and net profit. However, under the situations of resource constraints, the resources should be prioritized in order of 'Weed management > Fertilizer application > Plant protection.

## 5. Effect of spacing on the performance of castor



Farmers of south Gujarat heavy rainfall zone (AES-III) growing irrigated castor (GCH-7) during *rabi* season are advised to sow the crop at 120 cm x 90 cm spacing.

## [C] Nutrient management

### 1. Response of cabbage to graded doses of fertilizers under different levels of soil organic carbon



Farmers of south Gujarat having soil containing organic C from 0.4 to 0.6 and 0.8 per cent and above are advised to apply N:P:K @ 150:75:75

kg/ha and 125:62.5:62.5 kg/ha, respectively, to cabbage for achieving higher yield and net profit. Adoption of this package of fertilizer application also improves physico-chemical properties of soil.

#### **Schedule of fertilizer application:**

Fifty per cent of N and 100% P and K of fertilizer should be applied as basal. The remaining 50% N should be applied in two equal splits at 25 and 50 DATP.

## 2. Study on levels and schedules of N fertigation in *rabi* castor

The farmers of coastal areas of south Gujarat heavy rainfall agro climatic zone (AES-IV) growing *rabi* hybrid castor are advised to apply N @ 120 kg/ha through drip in 8-12 splits at an interval of 10-15 days starting from 20 days after sowing. By adopting this fertigation schedule, farmers can get higher yield and net profit over control (N @ 80 kg/ha through drip in 4 splits at an interval of 20 days). Basal dose of P<sub>2</sub>O<sub>5</sub> should be applied.



#### **The system details are:**

Type of drip system	: On line
Lateral spacing (cm)	: 180
Lateral diameter (mm)	: 16
Dripper discharge rate (lph)	: 8
Dripper spacing (cm)	: 120
Operating pressure (kg/cm <sup>2</sup> )	: 1.20
Operation frequency	: Alternate day
Schedule for drip irrigation	: November - January : 75-105 minutes February - April : 90-140 minutes

### 3. Optimization of manuring in organically grown onion in coastal area of south Gujarat



Farmers of coastal areas of south Gujarat heavy rainfall zone (AES-IV) can grow onion profitably during *rabi* season either organically (under drip



method of irrigation) or under INM system (surface irrigation). For organic cultivation, they are advised to apply 40 kg N/ha through biocompost as basal and 40 kg N/ha through castor cake at 40 DAT. Adoption of organic nutrient management systems also improves soil properties.

#### Schedule of irrigation:

##### Drip irrigation method:

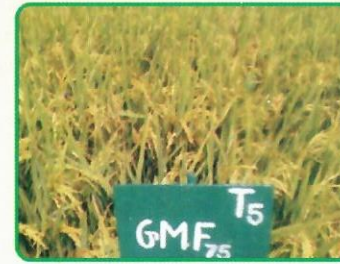
Type of drip system	: On line
Lateral spacing (cm)	: 120
Lateral diameter (mm)	: 16
Dripper discharge rate (lph)	: 4
Dripper spacing (cm)	: 60
Operating pressure (kg/cm <sup>2</sup> )	: 1.20
Operation frequency	: Alternate day
Schedule for drip irrigation	: December-February : 50-75 minutes March- April : 90-140 minutes

##### Surface irrigation method :

Total 7 to 8 irrigation (0.8 IW/CPE, Depth: 60 mm)	<b>Irrigation interval:</b> December : 19 days Jan.- Feb. : 11-17 days March : 9-15 days
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#### 4. Effect of organics on productivity of paddy (*kharif*) - castor (*rabi*) sequence in presence and absence of fertilizer in coastal areas

The farmers of coastal areas of south Gujarat (AES-IV) intended to follow paddy (*kharif*)-castor (*rabi*) sequence are advised to take *dhaincha* as green manure crop before *kharif* paddy along with application of 75 per cent recommended dose of fertilizer (90:30:0 NPK kg/ha) to paddy crop only for getting higher yield and net realization.



#### 5. Response of castor to fertilizers



Farmers of south Gujarat heavy rainfall zone (AES-III) growing irrigated castor (GCH 7) during *rabi* season are advised to apply 120 kg N/ha in three equal splits for achieving higher seed yield and economic returns. One-third nitrogen should be applied as basal and remaining at 35-40 and 75-80 DAS. Phosphorous and potassium application should be made on soil test basis.

#### 6. Response of castor to sulphur

Farmers of south Gujarat heavy rainfall zone (AES-III) growing irrigated castor (GCH 7) during *rabi* season on soil having medium to high status of available sulphur need not to apply sulphur as it was not found beneficial.



#### 7. Management of leaf reddening in *Bt* cotton

Farmers of south Gujarat agro climatic zone- II (AES 2) growing *Bt* cotton are advised to apply recommended dose of fertilizer based on soil test value + FYM 10 t/ha +



one spray of 2% urea at flowering stage and one spray of 1% urea + 1% MgSO<sub>4</sub> during boll development stage for minimizing leaf reddening and obtaining higher seed cotton yield and net return.

#### 8. Response of single cut fodder sorghum genotypes to different levels of NPK

The farmers of south Gujarat agro climatic zone- II (AES-II) growing *kharif* fodder sorghum are advised to apply 120:60:00 kg NPK/ha (50% N and whole P as basal and remaining 50% N at 30 DAS) for getting higher fodder yield and net profit.

#### 9. Effect of different proportion of organics on productivity of pit planted sugarcane under organic farming system

The farmers of south Gujarat who have adopted organic farming in sugarcane with pit method of planting (diameter 0.6 m and depth 0.45 m spaced at 2.4 m x 1.2 m) are advised to apply 1.4 kg vermicompost + 0.43 kg castor cake or 0.4 kg neem cake per pit at the time of filling the pits and 0.7 kg vermicompost + 0.215 kg castor cake or 0.2 kg neem cake at the time of tillering as first split and repeat the same dose at the time of earthing up as second split.

##### Note:

- Plant two eye budded 8 setts/pit treated with *Trichoderma viride* (Navsari isolate) and *Pseudomonas fluorescens* (Navsari isolate).
- Apply 100 ml/pit of 0.5% *Azotobacter* (Navsari isolate) and 0.5% PSB (Navsari isolate) (each 1x10<sup>8</sup> cfu/ml) at the time of planting and 0.5% *Acetobacter* (Navsari isolate) (1x10<sup>7</sup> cfu/ml) at the time of earthing up.

Apply two combine spray of cow urine and butter milk each @ 2% at tillering and cane development stage.

## [D] Water management

### 1. Optimizing irrigation schedule in sugarcane under different planting methods (For tropical region)

Sugarcane growers of south Gujarat heavy rainfall zone (AES-III) are advised to plant sugarcane crop with paired cum trench planting (at 30:150 cm row spacing) and to irrigate the crop with 15 irrigations each of 80 mm depth (0.9 IW/CPE). The first irrigation should be given at the time of planting and the rests at 19-20 days interval during winter season and 13-14 days interval during summer season for getting higher cane yield and net return.

## [E] Weed management

### 1. Weed management in irrigated drilled paddy (Aerobic rice)

The farmers of south Gujarat heavy rainfall zone (AES-III) growing irrigated drilled paddy (aerobic rice) are advised to apply pendimethalein @ 1.0 kg/ha as pre emergence for effective weed control or hand weeding followed by interculturing at 20 and 40 DAS or Bispyribac sodium @ 45 g/ha as post emergence at 20 DAS for effective weed control and realizing higher net income.



### 2. Study of critical period of crop-weed competition in *rabi* castor under south Gujarat conditions

The farmers of south Gujarat heavy rainfall zone (AES-III) are advised to keep the *rabi* castor field weed free



from 45-90 days after sowing which is critical period for crop weed competition for getting higher yield and profit.

## [F] Shed net house

### 1. Effect of growing conditions and P fertilizer scheduling with and without application of banana pseudostem enriched sap on biomass yield of fenugreek



Farmers of south Gujarat growing fenugreek - fenugreek in sequence under shade net house during November-December are advised to prefer the following practices for higher yield and net income.

1. They should prefer cultivation of fenugreek under open field or 30 % shade net house condition, if available.
2. They should apply recommended dose of P (@ 20 kg  $P_2O_5$ /ha) as basal to individual crop.
3. Apply two sprays (I-10 DAS and II-20 DAS) of 2% enriched sap (banana pseudostem based).

### 2. Influence of different growing conditions on yield of leafy vegetables during summer season

Farmers of south Gujarat growing leafy vegetables under different shade net house during summer season are advised to select leafy vegetables in following preferential order for realizing higher income.



Shade net (%)	Suitable crop (Summer)
75	Fenugreek > Coriander
50	None (fenugreek, coriander, amaranthus and spinach)
30	Amaranthus > Spinach
Open field	Amaranthus

## [F] Others

### 1. Preparation of quality vermicompost and compost through use of varying nutrient-rich substrates

#### 1) Preparation of vermicompost



Farmers of south Gujarat specially those cultivating banana are advised to utilize banana pseudo stem for preparing quality vermicompost by mixing it with cattle dung in the ratio of 1:1 (w/w) = cattle dung: banana pseudostem (chopped to 2 to 3 cm size) with addition of 5% rock phosphate through process of partial decomposition of raw materials by good decomposing culture for one month and subsequently by vermicomposting through use of earthworm (*Eudrilus euginae*) for about 2 months to obtain superior quality vermicompost with C:N ratio of 16:1 and total N, P and K content of about 2.4%, 1.4% and 0.7%, respectively. Further, farmers are advised to make alternate layers (5 to 6 layers each with 6 to 7 cm depth) of cattle dung and banana pseudo stem.



## 2) Preparation of compost

Farmers of south Gujarat specially those cultivating banana are advised to utilize banana pseudostem for preparation of good quality compost (with about C:N ratio of 18.8:1 and total N, P, and K content of about 2.1 %, 1.6 % and 0.8 %, respectively) by mixing it (banana pseudostem chopped to 2 to 3 cm size) with cattle dung in the ratio of 1:1 (w/w) with addition of 5 % rock phosphate and completely saturating with “spraying solution of microbial consortium” consisting *Lactobacillus sp.*, *Rhodopseudomonas sp.* and *Saccharomyces sp.* for quick process of microbial decomposition of raw materials for 53-55 days i.e. in about 35 days less time as compared to duration for preparation of vermicompost. Further, farmers are advised to make alternate layers (5 to 6 layers each of 6 to 7 cm depth) of cattle dung and banana pseudostem saturated with “spraying solution of microbial consortium”.

### Procedure for preparing “spraying solution of microbial consortium” from stock solution.

It involves two steps. Firstly for multiplication of microbial population, 1 lit stock solution consisting *Lactobacillus sp.*, *Rhodopseudomonas sp.* and *Saccharomyces sp.* is mixed with 2 lit molasses or 2 kg jaggery and 17 lit of water. The prepared solution is kept in an air tight clean plastic container leaving no air inside the container. Then the container is stored in shade, away from sunlight at ambient temperature. Gas is allowed to be released by opening the cap of the container for few seconds once in 24 hours. When whitish layer of yeast starts to appear on surface of the solution after 7-10 days

with a pleasant smell and pH drops below 3.5, the solution is ready. In the 2<sup>nd</sup> step, 500 ml of above prepared solution is mixed with 300 g of jaggery and 30 lit of water in a plastic bucket for preparation of about 30 lit of “spraying solution of microbial consortium”.

## III HORTICULTURE AND FORESTRY

### [A] Fruit crops

#### 1. Effect of different proportion of organic manures on yield and quality of organically grown papaya.

The farmers of south Gujarat heavy rainfall agro-climatic zone who have adopted organic cultivation of papaya are advised to apply biocompost, vermicompost and castor cake in equal proportion to supply N @ 200 g/plant and banana pseudostem sap @ 8 l/plant for achieving higher and better quality of papaya fruit. The schedule of applying organics is as under.

- Apply 222 g/plant biocompost + 256 g/plant vermicompost + 76 g/plant castor cake + 1.6 g/plant each of *Azotobactor* (Navsari isolate) and PSB (Navsari isolate) at the time of planting.
- Apply 111 g/plant biocompost + 128 g/plant vermicompost + 38 g/plant castor cake at 2 months of planting and repeat this dose at four months after planting.
- Banana pseudostem sap is to be applied @ 8 l/plant in 8 equal splits at an interval of one month, starting from two months after planting.

#### Note:

- Grow maize as trap crop i.e. 2 rows of maize after every 4 rows of papaya.
- Drench 0.5% solution each of *Trichoderma* (Navsari isolate) and *Pseudomonas* (Navsari isolate) @ 500 ml/plant



- Spray solution containing 1.5% cow urine + 1.5% butter milk + 0.5% jaggery at 3, 6 and 9 months after planting.

## 2. Standardization of stage wise requirement of nutrients in banana



The farmers of south Gujarat heavy rainfall zone growing banana cv. Grand Naine in clay loam soils and similar climatic conditions are recommended to apply 80 per cent recommended dose of 240 g N and 160 g K<sub>2</sub>O /plant, i.e. (1) 96 g N and 40 g K<sub>2</sub>O at 3<sup>rd</sup> month (vegetative stage), (2) 72 g N and 56 g K<sub>2</sub>O at 5<sup>th</sup> month (flower bud initiation stage), (3) 72 g N and 40 g K<sub>2</sub>O at 7<sup>th</sup> month (flowering stage) and (4) 0 g N and 24 g K<sub>2</sub>O at 9<sup>th</sup> month (bunch development) after planting. FYM 10 kg/plant and total dose of P<sub>2</sub>O<sub>5</sub> @ 90 g/plant should be applied at planting. It gives higher yield with 20 per cent fertilizer saving.

## 3. Standardization of stage wise requirement of nutrients in sapota.

The farmers of south Gujarat heavy rainfall zone having sapota cv. Kalipatti orchard in clay loam soils are recommended to apply 100 percent recommended dose of fertilizers (1000-500-500 g NPK/tree/year) to adult trees in three ratio of NPK i.e. 25:100:25 (250-500-125 g NPK), 50:00:50 (500-00-250 g NPK) and 25:00:25 (250-00-125 g NPK) percent during June, August and October, respectively instead of two equal split i.e. June and October.



## [B] Vegetable crops

### 1. Effect of different organic manures on growth, yield and quality of organically grown turmeric (*Curcuma longa*).

The farmers of south Gujarat who adopted turmeric cultivation under organic farming are recommended to apply biocompost and neem cake in equal proportion to supply 60 kg N/ha for achieving higher yield and better quality turmeric. Organics i.e. biocompost @ 830 kg/ha + neem cake @ 290 kg/ha should be applied twice, first at the time of planting and the second dose 3 months after planting.

#### Note:

- Apply *Azotobacter* (Navsari isolate) and PSB (Navsari isolate) each @ 2 kg/ha at the time of planting.
- Apply spray mixture of cow urine (1.5%) + butter milk (1.5%) + jaggery (0.5%) 2 month after planting.
- Drench 0.5% solution each of *Trichoderma* (Navsari isolate) and *Pseudomonas* (Navsari isolate) at 2 months after planting.

## [C] Flower crops

### 1. Varietal assessment of chrysanthemum under South Gujarat agro-climatic conditions



Ratlam (White)



Red Gold (Red)



CS-16 (Yellow)

The farmers of south Gujarat Heavy Rainfall Zone cultivating flower crops are advised to grow chrysanthemum variety Ratlam Selection (white) which has higher market



demand due to white colour and good quality. Moreover, there is market demand for red and yellow colour which can be met by growing Red Gold (red) and CS-16 (yellow) varieties which produce better quality flowers.

## IV PLANT PROTECTION

### [A] Agricultural Entomology

#### 1. Efficacy of different insecticides against sucking pests and their safety to eri silkworm (*Samia cynthia ricini*. Hutt)

The farmers rearing eri silkworm are advised that if dichlorvos 76 EC @ 0.05 % is used for the pest management in castor crop, leaves from such crop can be used only after 10 days of spraying for safe rearing of eri silkworm.

#### 2. Studies on effectiveness of newer insecticides on pod borer complex of pigeon pea.

For effective management of pod borer and pod fly in pigeon pea, farmers of south Gujarat are advised to apply two sprays of flubendiamide 20 WDG @ 50 g a.i./ha (5 g/10 litre water) first spray at the time of pod setting and second spray at 15 days after first spray for higher yield and better return. The pre-harvest interval (PHI) of 10 days is recommended for flubendiamide.

#### 3. Chemical control of pest complex in cashew

The cashew growers of south Gujarat are recommended to spray acetamiprid 20 SP @ 0.004 % (2 g/10 l water) at flushing, flowering and fruiting stages for effective control of tea mosquito bug to gain higher raw nut

yield. The pre-harvest interval of 47 days is recommended for acetamiprid.

### [B] Plant Pathology

#### 1. Evaluation of native *Acetobacter* ACN-1 and PSB PBN-1 with graded chemical fertilizers for the growth and yield of sugarcane

Sugarcane growers of south Gujarat are advised to treat the setts with native *Acetobacter*-each ACN-1 & PSB-PBN-1 @ 300 ml/ha (each  $1 \times 10^8$  cfu/ml) by mixing together in one per cent jaggary solution as required for 30 minutes before planting and soil applications of native *Acetobacter*-ACN-1 & PSB-PBN-1 each @ 000 ml/ha ( $1 \times 10^8$  cfu/ml) mixed in pulverized soil (100 kg/ha); first at the time of planting and the second at the time of earthing up along with 50:50:100 % recommended dose of NPK fertilizers to realize higher cane yield and save 50 per cent nitrogen and phosphorus in plant crop.

#### 2. Forewarning for powdery mildew caused by *Oidium mangiferae* in mango



Mango growers of south Gujarat are forewarned that powdery mildew infection in cv. Kesar occurs during third week of November to second week of December i.e. elongation of inflorescence still protected by bracts stage.



Therefore, they are advised to adopt recommended plant protection measures at aforesaid time to avoid losses due to powdery mildew.

## V AGRICULTURAL ENGINEERING

### 1. Effect of pre-cooling treatments and packaging materials for extending the initiation of ripening and shelf-life of mango cv. Kesar.

Farmers and merchants are advised to pre-cool the Kesar mango fruit at 10°C in pre-cooling chamber with air movement of 300-350 m<sup>3</sup>/min for 8 hr. and pack them in 75 micron polypropylene bag and store at 11±1°C with 90-95% RH. This would delay the initiation of ripening process up to 25 days of storage and extend the shelf life up to 35 days.

### 2. Standardization of ready-to-eat pickle(Moriya) from immature dropped mango(Marva).

Farmers are recommended to prepare ready-to-eat pickle (*Moriya*) from the immature dropped mango (*Marva*) through the process of washing, cutting and subsequently dipping in hot water (50 °C) for 5 min, 2% brine solution for 5 min and 5% acetic acid (vinegar) for 5 min, and finally mixing with the groundnut oil (2.5%)-spices-mix and packing of in 75 micron HDPE bag to achieve shelf life of 6 days and 15 days at ambient and refrigerated storage condition, respectively.

## VI ANIMAL PRODUCTION AND FISHERIES

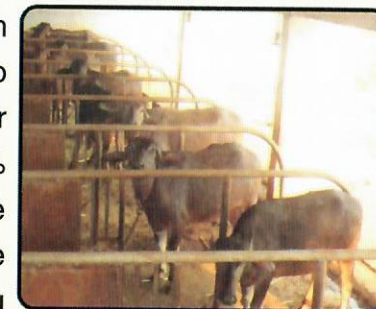
### 1. Studies on supplementation of herbal feed additives on growth performance and gut microbial health of broilers.



Supplementation of garlic powder @ 0.5% in ration of broilers increases final body weight (8.5%) at 6 weeks of age resulting in more return per bird.

### 2. Effect of dietary supplementation of bypass protein on growth and reproductive performance in Surti buffalo heifers.

The farmers of south Gujarat are recommended to supplement 50% regular concentrate mixture with 50% bypass protein (formaldehyde treated) containing concentrate mixture in the ration of growing



Surti buffalo heifers (15-17 months old) for a period of 6 months for achieving better growth by 17 % and 13% decrease in cost per kg body weight gain than fed cotton seed cake alone as a concentrate.



## Recommendations for Scientific Community

### I NATURAL RESOURCE MANAGEMENT

#### 1. Characterization of natural resources of Vanarasi area



Based on the characterization of natural resources of Vanarasi area, following conclusions are emerged.

##### • **Highly suitable existing crops:**

Field crops: Paddy, Pigeon pea, Sorghum, Okra and Cowpea

Horticultural crops: Mango, Ber and Aonla

Forest trees: Teak, Ain, Arjun, Kher, Mahuda, Katesavar and Palas

##### • **Existing crop but not suitable:** Sugarcane

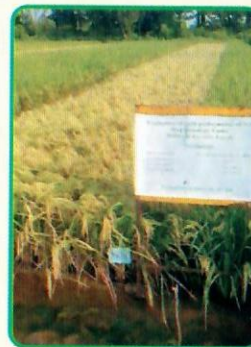
• **Highly suitable new crops/trees (proposed):** Soybean, Nizer, Moringa, Strawberry, White Jamun, Harida and Jackfruit.

#### 2. Integrated nutrient management in soybean (summer) under different land configurations

Growing soybean during summer season under south Gujarat condition was not found remunerative due to low yield levels.

#### Confirmation of earlier recommendations:

#### 3. Evaluation of yield performance of new rice genotype under different fertility levels



From the results and economics, it is concluded that for fine grain genotypes and NAUR-1 optimum dose of N is 100 kg N/ha which confirm the earlier recommendation for the same group of varieties.

#### 4. Studies on seed cane economy in sugarcane cultivation

Sugarcane growers of south Gujarat heavy rainfall zone (AES-III) are advised to plant sugarcane crop with two bud sett and 100 per cent of recommended seed rate (50,000 eye bud) for getting higher cane yield and net return.

### II PLANT PROTECTION

#### [A] Agricultural Entomology

#### 1. Population dynamics of sapota fruit mite *Tuckerella kumaoensis* Gupta (Acari: Tuckerellidae)

The sapota fruit mite *Tuckerella kumaoensis* Gupta (Acari : Tuckerellidae) remains active round the year under south Gujarat agro-climatic situation III with higher population in the 18<sup>th</sup> to 20<sup>th</sup> Standard Meteorological Week. The mite population showed a significant positive correlation with maximum temperature and a significant negative correlation with morning and evening Relative Humidity.



## 2. Screening of sugarcane genotypes for early shoot borer and top borer resistance

Sugarcane genotypes viz., CoSnk 05104, CoVSI 05122, 2004 N 492, CoVSI 05123 and Co 05001 were found less susceptible against early shoot borer and top borer under natural field conditions.

## 3. Screening of sugarcane genotypes for scale insect and mealy bug resistance

Sugarcane genotype 2004 N 492 was found less susceptible against scale insect whereas, genotypes 2004 N 492 and Co Snk 05101 were found moderately susceptible against mealy bug under natural field conditions.

## [B] Plant Pathology

### 1. Screening of sugarcane genotypes for wilt resistance

Sugarcane entries viz., Co 05001, Co 05008, Co 0403, CoSnk 03754, Co 0415, and Co 0416 exhibited moderately resistant reaction to wilt disease in wilt sick plot.

### 2. Screening of sugarcane genotypes for red rot resistance

Sugarcane entries viz., Co 05001, CoVSI 05121, CoVSI 05123, 2004 N 596 and 2004 N 663 were found to be moderately resistant to red rot in plug and nodal inoculation methods.

### 3. Forewarning of powdery mildew caused by *Oidium mangiferae* in mango (*Mangifera indica*)

As the powdery mildew infection in mango cv. Kesar occurs during 47<sup>th</sup> to 50<sup>th</sup> SMW (1.33 to 18.00 PDI) therefore, scientific community are herewith informed that

the following model should be used for timely forecasting of first appearance of disease in the benefit of farming community.

$$T_d = A_0 + \sum_{i=1}^p \sum_{j=0}^1 a_{ij} Z_{ij} + \sum_{i,i'=1}^p \sum_{j=0}^1 a_{ii'j} Z_{ii'j} + cT_f + e$$

$$Z_{ij} = \sum_{w=n_1}^{n_2} r_{iw}^j X_{iw}, \quad Z_{ii'j} = \sum_{w=n_1}^{n_2} r_{ii'w}^j X_{iw} X_{i'w}$$

Where

$T_d$  Time of first appearance of disease (week)

$T_f$  Week of flower bud initiation

$X_{iw}$  Value of  $i^{\text{th}}$  weather variable in  $w^{\text{th}}$  week

$r_{iw}$  Correlation coefficient between  $T_d$  and  $X_{iw}$

$r_{ii'w}$  Correlation coefficient between  $T_d$  and product of  $X_{iw}$  and  $X_{i'w}$

$p$  Number of weather variables considered

$n_1/n_2$  Initial/final week for which weather data are included in the model

$e$  error term distributed as  $N(0, \sigma^2)$

$A_0$ ;  $a_{ij}$ ;  $a_{ii'j}$ ;  $C$  are regression coefficients

$X_{i'w}$  is value of  $i'^{\text{th}}$  weather variable in  $w^{\text{th}}$  week.

### 4. Isolation and identification of lactic acid bacteria and their various biochemical activity

Fourteen microorganisms were isolated from *khira* of *dhokla* and *khaman* samples and preliminary study reveals that, among them ten isolates belongs to *Lactobacilli* and remaining were yeast.



### III HORTICULTURE AND FORESTRY

#### 1. Varietal trial in banana

Banana cultivar Gandevi Selection has proved higher productivity (97.20 t/ha) than Grand Naine (73.70 t/ha) under south Gujarat agro-climatic condition, however both the varieties are at par with each other on the basis of per day production i.e. 192.60 kg (Gandevi selection) and 189.87 kg (Grand Naine), which proves that inspite of longer crop period, Gandevi selection provides almost the same per day production and higher benefit in comparison to cultivar Grand Naine. Gandevi Selection is equally economically remunerative as Grand Naine on the basis of productivity per hectare per day.



Gandevi selection



Grand Naine

#### 2. Pruning trial in sapota cv. Kalipatti



The pruning treatments imposed on 20 years old sapota cv. Kalipatti planted at 10X5 m spacing under south Gujarat heavy rainfall zone could not show significant improvement in yield in comparison to conventional spacing (10X10 m). But pruning treatment heading back of scaffold branches 60 cm

away from the point of interlocking resulted in significantly higher fruit diameter and pulp skin ratio in terms of physico-chemical properties. Significantly higher TSS recorded in treatment topping the tree height above 4<sup>th</sup> tier. The increase in fruit weight also recorded in treatment combination heading back of scaffold branches and topping. Thus pruning treatment improved physico-chemical properties of fruit.

### IV BASIC SCIENCE

#### 1. Physiological parameters and productivity of rice varieties under saline water irrigation

Among the rice varieties (Dandi, NAUR 1, GNR 2 and IR 28) tested, NAUR 1 showed higher tolerance to salinity than rest of varieties and recorded higher seedling vigour, photosynthetic rate and yield upto 9 dS/m EC under saline water irrigated pot culture.

### V ANIMAL PRODUCTION

#### 1. Study on effects of non-genetic factors on milk composition in Surti buffaloes

The milk composition of surti buffalo varies with stage of lactation, parity and time of sampling. Higher fat % in milk is observed in multiparous animal, evening milk and advanced stage of lactation.

#### 2. Studies on supplementation of herbal feed additives on growth performance and gut microbial health of broilers

Supplementation of garlic powder @0.5% alone or in combination with fenugreek seed powder @0.5% in ration of broilers for 6 weeks results in 8.5 and 7.5% more body



weight, 9.5 and 7.5% less feed conversion ratio (FCR), 41.50 and 31.0% more nitrogen retention, respectively

**3. Effect of dietary supplementation of bypass protein on growth and reproductive performance in Surti buffalo heifers**

Replacement of 50% regular concentrate mixture with concentrate mixture containing formaldehyde treated protein (bypass protein) in the ration of growing Surti buffalo heifers (15-17 months old) for 6 months results in 13% more average daily gain, 15% better Feed Conversion Ratio and animal shows first estrus earlier as compared to animals kept on 100% regular concentrate mixture.

**V ANIMAL HEALTH**

**1. Standardization of rhino-pharyngeal endoscopic procedures in non-sedated farm animals.**

Naso-pharyngeal endoscopy with 1.0 cm diameter flexible endoscope under surface analgesia @ 5 ml of 2 % lignocaine HCl solution in each nostril is recommended for diagnosis of gross pathological conditions in standing cattle and buffaloes.”

**2. To study the incidence of intestinal obstruction and its surgical management in bovines.**

Entero-anastomosis through Schimeden’s technique using vicryl # 3/0 is recommended to achieve maximum lumen diameter of intestinal loops in bovine.

**Banana Products**



**Wafer**



**Fig**



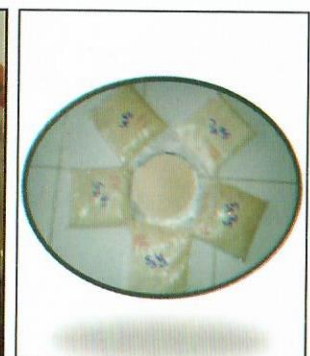
**Cheese**



**Ketchup**

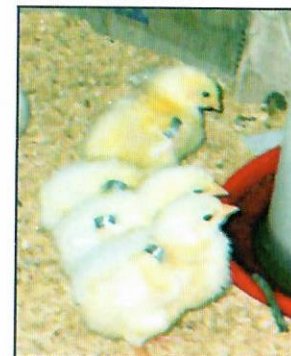


**Puree**



**Flour**

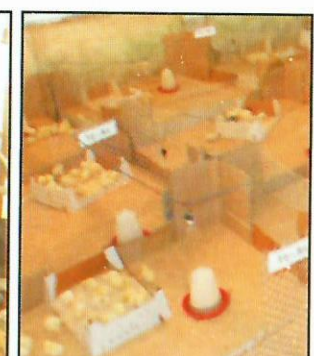
**Veterinary Science**



**Wing banding**



**Surti buffalo heifers**



**Poultry management**