RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS 2022

NAVSARI AGRICULTURAL UNIVERSITY

DIRECTORATE OF RESEARCH

NAVSARI AGRICULTURAL UNIVERSITY

NAVSARI - 396 450 (GUJARAT)

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:: MESSAGE ::

Navsari Agricultural University extends its excellence in tripartite activities *viz.* education, research and extension in agricultural and allied science. As per the mandate of SAUs, the University undertakes research based on the feedback from farmers of seven districts of South Gujarat. Scientists of NAU have achieved success in developing sustainable technologies to enhance productivity and to improve quality of produce which would play a pivotal role towards Doubling the Farmers Income by 2022.

NAU has constituted 9 AGRESCO Research Sub-Committees to review, monitor and supervise research work annually and thereafter, approved research outline and progress is scrutinized at state level in the presence of experts from all SAUs of Gujarat (Combined AGRESCO) before taking varieties/ recommendations/ technologies to farmers.

It is my pleasure to present "Research Accomplishments and Recommendations-2022" covering six new varieties and 78 need based recommendations/ technologies developed by scientists for the farming and scientific communities during the year 2021-22.

I appreciate the efforts of scientific faculty members and supporting staff of university and congratulate them for developing useful varieties/ recommendations/ technologies for benefitting farming community. I heartily congratulate Director of Research and Dean P.G. Studies and his team for compiling and publishing this booklet.

Date : --/--/2023
Place : Navsari

(Z. P. Patel)
Vice- Chancellor


NAVSARI AGRICULTURAL UNIVERSITY

Navsari Agricultural University
Navsari - 396 450

:: FOREWORD ::

It is a matter of immense pleasure for me to put forth the publication of "Research Accomplishments and Recommendations-2022". The prestigous booklet contains new varieties and technologies developed by the scientists of various Research Sub-Committees of Navsari Agricultural University. These varieties/ technologies were critically discussed at length and approved in the 18th Combined AGRESCO meeting held at Junagadh Agricultural University, Junagadh during 4th May to 18th May, 2022 in virtual mode.

I congratulate all the scientists of NAU for their continuing efforts to improve the research output of the University and developing new varieties and technologies for the benefit of farming and scientific community. I am also thankful to all the conveners of various sub-committees of Agicultural Research Council of Navsari Agricultural University for their enthusiastic contribution.

I express my sincere thanks to Hon'ble Vice Chancellor, Dr. Z. P. Patel for his constant guidance and useful inputs in improving the research outcome of NAU. I also take this opportunity to appreciate the efforts made by technical staff of Directorate of Research for publishing farmer centric booklet.

Date : --/--/2023
Place : Navsari

(T. R. Ahlawat)
Director of Research & Dean
Faculty of P.G. Studies


NAVSARI AGRICULTURAL UNIVERSITY

RESEARCH RESUME

The research work carried out in different fields of agricultural sciences during the year 2021-22 were deliberated upon and discussed in detail by different AGRESCO sub-committees of Navsari Agricultural University, Navsari for bringing out useful and beneficial recommendations for farmers and scientific community. Finally, 44 and 34 recommendations for farmers and scientific communities , respectively were approved in the 18th Combined AGRESCO meeting of SAUs and Kamdhenu University held at Junagadh Agricultural University, Junagadh during 4th May to 18rd May, 2022 in virtual mode.

In the Crop Improvement group, total 6 high yielding varieties were identified for release from NAU including 2 varieties of rice and 1 each from Cowpea (Cowpea 9), Sunhemp (GSUN 1), Finger millet (CFMV3) and Sorghum (GNJ-1) .

Location specific and economically viable production technologies were recommended by NRM sub-committee that covered various aspects *viz* . fertigation, integrated nutrient management, intercropping and irrigation, weed management and tillage practices in different crops.

The achievements of Plant Protection group include efficacy of bio pesticides against tea mosquito bug in mango, management of of mango malformation, pollination by bees *etc.*

In the pursuit of increasing fruits, vegetables, flower and forest tree production, recommendations which emerged out were related to nutrients management, net house cultivation of papaya, application of liquid fertilizers in the Horticulture & Forestry sub-committees.

In Agricultural Engineering group, development of Zero Energy Evaporative Cooling Storage Structure (ZEECSS) for Tribal Region of Dediapada and Design, development and performance evaluation of mixed mode cabinet solar dryer were approved for farming community .

The details of different sub-committees, conveners and number of approved recommendations for farmers and scientific communities and approved new technical programmes are as under.

S. N.	Name of the Sub-Committees	Name of Convenvener	No. of Recommendations		NTP
			Farmers	Scientific	
1.	Crop Improvement	Dr. D. A. Chauhan	06	00	00
2.	Natural Resource Management	Dr. H. M. Viradiya	16	02	22
3.	Plant Protection	Dr. Abhishek Shukla	04	08	09
4.	Horticulture	Dr. Alka Singh	13	01	29
5.	Forestry	Dr. Minal B. Tandel	04	03	21
6.	Agril. Engineering	Dr.S. H. Sengar	02	00	07
7.	Basic Science	Dr. Sanjay Jha	00	05	08
8.	Social Science	Dr. R. M. Naik	00	05	20
9.	Animal Science	Dr. Sanjay Pradhan	05	10	00
		Total	**50**	**34**	**116**

RECOMMENDATIONS FOR FARMERS

I CROP IMPROVEMENT

1. COWPEA: Gujarat Vegetable Cowpea 9 (Shakambhari)

The farmers of Gujarat cultivating kharif and summer vegetable cowpea are recommended to grow Gujarat vegetable Cowpea 9 (Shakambhari) variety. The average green pod yield of this variety in kharif season was 6020 kg/ha with overall yield advantage of 31.4, 10.2 and 11.7 % over the checks Pusa Phalguni, GDVC-2 and AVCP-1, respectively. In summer, this variety recorded 5431 kg/ha green pod yield with overall yield advantage of 49.3, 22.5 and 37.8 % over the checks Pusa Phalguni, GDVC-2 and AVCP-1, respectively. It matures within 80-90 days (seed to seed). This variety possesses high protein content in greenpods (25.4 %) as compared to checks. The green pods are thin with medium size and white seeds. Days for first green pod picking is 55-60 days and it is highly resistant to YMV disease.

(*Associate Research Scientist, PCRC, NAU, Navsari*)

2. RICE: GR 23 (Navsari Paushtik)

The farmers of Gujarat state are recommended to grow biofortified rice variety GR 23 (Navsari Paushtik) in transplanted condition during *kharif* season. The proposed variety recorded average grain yield of 5631 kg/ha in Gujarat, which was 25.3, 37.6, 10.9 and 12.9 % higher over the check varieties GNR-2, GR-11, GAR-13 and GNR-7, respectively. It has medium slender grain,

long panicle, more productive tillers and more number of grains per panicle. It has high protein content (12.18 %), intermediate amount of zinc content (20.40 ppm) and amylose content (24.80 %) with high head rice recovery (60.80%). The variety is moderately resistant against bacterial leaf blight, grain discoloration and leaf blast diseases whereas tolerant reaction against brown plant hopper and leaf folder pests.


(Associate Research Scientist, MRRS, NAU, Navsrai)

3. RICE: GR 24 (Navsari Parimal)

The farmers of Gujarat state are recommended to grow early maturing, non-lodging rice variety GR 24 (Navsari Parimal) in transplanted condition during *kharif* season. The proposed variety recorded average grain yield of 5038 kg/ha in Gujarat, which was 21.8 and 9.0% higher over the check varieties GR 7 and GAR 3, respectively. Long slender grain rice variety, GR 24 contains intermediate amylose (24.8%) and high head rice recovery (58.2%). The proposed variety showed moderately resistance against leaf blast disease, brown plant hopper and white backed plant hopper pests.


(Associate Research Scientist, RRRS*, NAU, Vyara)*

4. SUNNHEMP: GNSUN 1 (Vijay)

The farmers of Gujarat are recommended to grow sunnhemp variety GNSUN 1 (Vijay) for green manuring. It has recorded 30.75 t/ha average green biomass yield in Gujarat. It exhibited overall 38.20 and 44.37 % green biomass yield superiority over check varieties K-12 (B) and Swastik, respectively. It possesses higher initial vegetative growth, fresh weight of plant, plant height, primary branches per plant, leaf length, leaf width, leaves per plant along with medium late in days to 50% flowering, which are highly beneficial for green manuring. It also possesses longer root length coupled with higher number of root nodules per plant as well as fresh weight of root nodules, which helps to fix higher amount of atmospheric nitrogen into soil. It adds higher organic C, available N, available P_2O_5 and available K_2O into soil after green biomass soil incorporation. The lower C : N ratio of the variety favours faster decomposition of green biomass into soil. The proposed variety is moderately resistant to damping off.

(Prof. & Head, Dept. of GPB, NMCA, NAU, Navsari)

5. FINGER MILLET: CFMV 3 (Ekvijay)

Finger millet variety CFMV 3 (Ekvijay) is recommended for endorsement in finger millet growing regions of Gujarat. This finger millet variety produced average grain yield of 3429 kg/ha which was 12.45 % higher over local check GNN-6 and 30.88 % higher over national check VL-352. The variety has attractive reddish brown colour with bold grain, uniform maturity and having non-lodging plant type. It is moderately resistant to foot rot as well as leaf, neck

and finger blast diseases. It is also tolerant to stem borer and aphids under field condition.

(Associate Research Scientist, HMRS*, NAU, Waghai)*

6. SORGHUM: GNJ 1

Farmers of Gujarat state are recommended for endorsement of sorghum variety GNJ 1 in irrigated condition during *Rabi* season. The variety GNJ-1 produced average 2920 kg/ha grain yield and 7355kg/ha dry fodder yield with grain yield increment of 33.7, 20.8, 14.7, 31.8 and 21.6% over check varieties Nizer Goti, BP-53, Phule Revati, CSV 216R and CSV 29R, respectively. It contains starch 63.7%, protein 10.1%in grain and Crude Protein 4.76%, Neutral Detergent Fiber 56.37% in dry fodder. The proposed variety showed moderately resistant reaction to grain mold, anthracnose, leaf blight and sugary disease. This variety showed low infestations of stem borer.

(Research Scientist, MSRS, NAU, Navsari)

II NATURAL RESOURCE MANAGEMENT

1. Fertigation study in cauliflower grown on clay soils of South Gujarat

The farmers of South Gujarat zone growing cauliflower under drip irrigation system are recommended to apply 5 t/ha biocompost and recommended dose of fertilizer (100-50-50 kg N-P_2O_5 - K_2O/ha). Apply 100 % N in the form of urea (217 kg/ha) and K in the form of muriate of potash (83 kg/ha) through fertigation and 100 % P in the form of single super phosphate (320 kg/ha) as basal for getting higher yield and net income.

Or

Fertigate N, P and K through 100 % water soluble fertilizers, 17:44:00 urea phosphate (114 kg/ha) for N and P and remaining N through urea (175 kg/ha) and K in the form of muriate of potash (83 kg/ha).

Fertigation schedule:

Growth period (Week)	No. of splits	% of total N & K / P
2 to 3	2	10 / 40
4 to 7	3	50 / 30
8 to 12	3	40 / 30

System details:

Lateral spacing: 1.20

Dripper spacing: 0.60 m

Dripper discharge: 4 lph

Operating pressure: 1.20 kg/cm^2

Operating time (alternate day):

October: 70 -75 min., November: 80-85 min., December: 90-100 min.

(Research Scientist, SWMRU, NAU, Navsari)

2. Effect of different methods of irrigation and tillage practices on sweet corn after *kharif* rice

The farmers of South Gujarat growing sweetcorn during *rabi* season are recommended to adopt No (Zero) tillage practice with drip irrigation for getting higher yield and net profit along with improvement in soil physical properties. Further, No (Zero) tillage practices also be followed in *kharif* rice.

System details:

Lateral spacing: 1.20
Dripper spacing: 0.60 m
Dripper discharge: 4 lph
Operating pressure: 1.20 kg/cm^2
Operating time (alternate day): Dec.: 85 - 90 min., Jan.: 80-85 min.
Feb.: 90-100 min., March: 100-115 min.

(Research Scientist, SWMRU, NAU, Navsari)

3. Response of brinjal to integrated nutrient management under coastal salt affected soils of South Gujarat

The farmers of coastal areas of South Gujarat are recommended to transplant brinjal following ridge and furrow method (90 cm x 60 cm) with application of biocompost @ 10 t/ha + 125-50-37.5 kg NPK/ha (50 % N and 100 % P & K as basal and 50 % N at 30 DATP) along with application of biofertilizers *Azospirillum+ PSB, 10^8 CFU/ml, each 1.25 L/ha in soil* for achieving higher yield and net returns with improvement in availability of N and P_2O_5 of coastal salt affected soils.

(Research Scientist, SWMRU, NAU, Navsari)

4. Response of different fodder grasses to gypsum application under coastal saline-sodic soil

The farmers of coastal areas of South Gujarat are recommended to grow Hy. Napier grass or guinea grass and apply gypsum @ 75% of GR before sowing for getting higher green fodder yield, net returns and decrease soil sodicity.

(Research Scientist, SWMRU, NAU, Navsari)

5. Effect of integrated nutrient management on *rabi* vegetable crops in rice-based crop sequence in clay soils of South Gujarat

The farmers of South Gujarat following *rabi* vegetable crops after *kharif* rice are recommended to adopt rice–radish cropping sequence. Apply bio compost @ 10 t/ha to radish crop as basal and foliar spray of enriched novel organic liquid nutrients 1% at 20 and 40 DAS for achieving higher yield and net realization.

(Research Scientist, SWMRU, NAU, Navsari)

6. Effect of zinc on hybrid rice under South Gujarat

The farmers of South Gujarat transplanting hybrid rice in *kharif* season are recommended to spray 0.05% Zn EDTA at tillering and panicle initiation stages for getting higher yield, net return and Zinc content.

(Research Scientist, SWMRU, NAU, Navsari)

7. Effect of different sulphur levels on yield of *bt* cotton

Farmers of South Gujarat growing *Bt* Cotton hybrid are recommended to apply sulphur 60 kg/ha through 250 kg phospho-gypsum/ha along with recommended dose of P_2O_5 (40 kg/ha) in form of single super phosphate (250 kg/ha) as basal dose and bio compost 5 t/ha at the time of land preparation and 240 kg nitrogen/ha in five equal splits (each of 48 kg N/ha) at 30, 60, 75, 90 and 105 days after sowing for achieving higher seed cotton yield and net income.

(Research Scientist, MCRS, NAU, Surat)

8. Studies on sowing dates and spacing on vegetable pigeonpea grown during pre-monsoon

The farmers of South Gujarat growing vegetable pigeonpea during *kharif* season are recommended that pre-monsoon to onset of monsoon sowing (30 April to 17 June) of pigeonpea gives comparable yield. Further, they are recommended to sow the crop at 180 cm x 45 cm for achieving higher net return and easy cultural operations.

(Associate Research Scientist, CRSS, NAU, Achhalia)

9. Studies on intercropping of grain legumes in sorghum

The farmers of South Gujarat growing sorghum during *kharif* season are recommended to sow the sorghum + blackgram in 2:1 proportion at 30 cm apart with plant to plant spacing of 15 cm for sorghum and 10 cm for blackgram to achieve higher yield and net return on system basis as well as efficient use of land.

(Associate Research Scientist, CRSS, NAU, Achhalia)

10. Effect of seed priming and irrigation on seed production of *rabi* sunnhemp under *kyari* land of South Gujarat

The sunnhemp seed producing farmers of South Gujarat are recommended to prime the seeds with *Rhizobium* or PSB or *Rhizobium* + PSB (1×10^8 cfu/ml) each of 10 ml/kg seed in 2 L water for 2 hrs and irrigate the crop immediately after sowing and second irrigation at 30 DAS in *rabi* season for obtaining higher yield and net return.

(Prof. & Head, Agronomy, NMCA, Navsari)

11. Weed management with pre and post emergence herbicides in linseed

The farmers of South Gujarat growing linseed are recommended to carry out interculturing followed by hand weeding at 20 and 40 days after sowing for effective weed management and obtaining economical yield.

(Prof. & Head, Agronomy, NMCA, Navsari)

12. Identification of cropping systems module for different farming systems

The farmers of South Gujarat are recommended to adopt the following cropping systems for different purposes.

Cropping systems	Purposes
Rice-fenugreek (V)-cluster bean (V) crop sequence	Yield and income enhancement
Rice- greengram- pearl millet crop sequence	Improve soil health
Rice-indian bean (V)-sesamum crop sequence	Family nutrition
Rice-lucerne(continue) crop sequence	Livestock nutrition

(Prof. & Head, Agronomy, NMCA, Navsari)

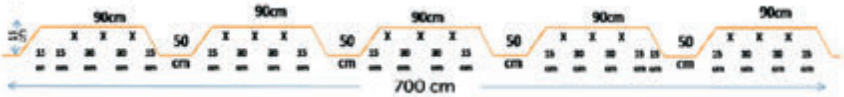
13. Effect of spacing and organic manure on growth, yield and quality of organically grown banana cv. Grand Naine

The farmers of South Gujarat growing banana organically are recommended to apply 300 g N/plant through NADEP compost (26.5 kg/plant NADEP compost containing 1.13 % N) in three equal splits at the time of planting, 30 and 60 days after planting either keep the spacing of 2.1 mx1.5 m or 1.8 mx1.5 m for achieving higher yield and net profit. Further, apply bio-fertilizers (*Azotobacter*, PSB and KMB, each having 10^8 CFU/ml @ 5 L/ha.) at the time of planting. Also drench jivamrut at monthly interval starting from planting in five equal splits (200 ml/plant/split).

(Asso. Prof. SSAC (Organic cell), ACHF, Navsari)

14 . Suitability of various turmeric varieties under organic farming

The farmers of South Gujarat growing turmeric (variety: Salem or Sugandhum) organically are recommended to apply 100% RDN through NADEP compost (5.5 t/ha NADEP compost containing 1.08 %N) for achieving higher yield and net profit. They have to plant turmeric at 30 cm x 20 cm spacing on 90 cm raised bed having 15 cm height and keep spacing 50 cm between the beds. Further, apply bio-fertilizers (*Azotobacter* and PSB, each having 10^8 CFU/ml @ 5 L/ha.) and sow dhaincha at the time of planting and used as a mulch. Also drench of jivamrut @1500 L/ha in three equal splits at 45, 60 and 75 DAP.



(Asso. Prof. SSAC (Organic cell), ACHF, Navsari)

15 . Weed management in cotton

Farmers of South Gujarat growing cotton crop are advised to manage the weeds by adopting stale seedbed techniques by removing first flush of weeds (either by application of glyphosate 41 % SL 1.0 kg a.i./ha (49 ml/10 L) or through shallow tillage after 15 days of light irrigation) during off-season then application of pendimethalin 30 EC % 0.9 kg a.i./ha (60 ml/10 L) PE *fb* quizalofop-ethyl 5 % EC 50 g a.i./ha (20 ml/10 L) and pyrithiobac sodium 10 %

EC 75 g a.i./ha(15 ml/10 L) (tank mix) at 50 DAS during crop season for producing higher and profitable yield of cotton crop.

(Prof. Agronomy, CoA, Bharuch)

16. Response of cotton to tillage and different intercropping system under rainfed condition of South Gujarat

The farmers of South Gujarat are recommended to carryout sub-soiling (30 cm) or deep ploughing (22.5 cm) followed by cultivation with cultivator for obtaining higher and profitable yield of cotton. Besides, intercropping of blackgram or greengram was also found remunerative.

(Prof. Agronomy, CoA, Bharuch)

III PLANT PROTECTION

[A] Agricultural Entomology

1. Effect of pollination by stingless bees on yield and quality of musk melon fruits

The muskmelon growers of Gujarat are recommended to keep a stingless bee hive (2500-3000 stingless bees/hive/70 m^2) in a polyhouse for pollination.

(Prof. & Head, Dept. of Entomology, NMCA, Navsari)

2. Effect on augmentation of pollination by bees (*Apis cerana* F.) on yield of bitter gourd

The bitter gourd growing farmers of Gujarat are recommended to augment honey bee, *Apis cerana* @ 4 hives/ha in addition to natural pollination at 10% flowering for getting higher yield and profit.

(Principal, COA, NAU, Waghai)

3. Efficacy of bio pesticides against Tea Mosquito Bug (TMB), *Helopeltis antonii* signoret in cashew

The cashew growing farmers in South Gujarat are recommended to apply Beauveria bassiana 1.15% WP (1 x 108 cfu/g) @ 0.007% (60 g/10 l water) at flushing, flowering and fruiting stages to manage tea mosquito bug and increasing nut yield.

As per CIBRC format

Year	Crop	Pest	Pesticides with formulation	Dosage/Ha				Total Qty of Chemical suspension required/ha	Application schedule	Waiting period/ PHI (days)
				a.i. /ha	Qty of formulation Kg or ml/ha	Con. (%)	Dilution in water (10 lit.)			
2021	Cashew	Tea mosquito bug	*Beauveria bassiana* 1.15 WP (1x 10^8 cfu/g))	138	12 kg	0.007%	60 g	2000 litre	Spray at flushing, flowering and fruiting stages	NA

(Assistant Research Scientist (Ent.), AES, NAU, Paria)

[B] Plant Pathology

1. Management of mango malformation

The mango growers of Gujarat are recommended that after pruning of infected shoots spray of copper oxychloride 50% WP 0.15% @ 3 g/l water at the time of vegetative flush, subsequent spray carbendazim 50% WP 0.05% @ 1 g/l water at 20 days after first spray + spray propargite 57EC 0.11% @ 2.0 ml/l water at 20 days after second spray + spraying 200 ppm NAA@ 0.2 g/l water in second week of December followed by spraying of 500 ppm ethrel @ 0.5 g/l water at bud inception stage for the management of malformation in mango.

As per CIBRC format

Pesticides with formulation	a.i. (g)	Formulation (g/ml)%	Dilution in Water	Waiting period
Carbendazim 46.27 SC	46 g/100	1gm/ lit	0.1%o r100 ml/100l water	30
Copper oxychloride 50	0.12%or120g/100Ltr. water	0.24% or 240g	100Ltr. water	10
Alpha Naphthyl Acetic Acid 4.5% SL (Na salt) To control Mango malformulation- Before fruit bud differentiations approx. months before flowering	200ppm	-	20 ml in 4.5 ltrs	-
Ethephon 39 % SL	770-1025 200 ppm	1500-2000	26 ml in 10 lit of water	-

(Assistant Research Scientist, AES, NAU, Paria)

IV HORTICULTURE

1. Effect of liquid fertilizers foliar spray on growth, yield and quality of sapota cv. Kalipatti.

Farmers of South Gujarat growing sapota cv. Kalipatti are recommended to apply foliar spray of 1 % potassium nitrate (13:00:45) (100 g in 10 lit water) in adult orchard during second fortnight of September, November and January months along with RDF (100 kg FYM + 1000 : 500: 500 NPK g/plant) for obtaining higher yield and net return.

(Research Scientist, RHRS, ACHF, NAU, Navsari)

2. Net house cultivation of papaya.

Farmers of South Gujarat are recommended to cultivate gynodioecious varieties of papaya under insect proof net house (40 mesh) for getting higher yield, net return and good quality fruits. Further, incidence of papaya ring spot virus (PRSV) can be prevented.

(Associate Scientist FRS, NAU, Gandevi)

3. Effect of paclobutrazol application before monsoon and efficacy of bud breakers on early season flowering and fruiting in mango.

Farmers of South Gujarat having adult trees of Alphonso mango are recommended to apply paclobutrazol (25 % v/v) four times of canopy radius (m) during second week of May in soil and foliar spray of 0.5% Thiourea (50 g/10 lit. of water) after 120 days of paclobutrazol application OR apply paclobutrazol during last week of April in soil and foliar spray of 0.25% commercial grade potassium nitrate (25 g/10 lit. of water) after 120 days of paclobutrazol application along with recommended dose of fertilizers for obtaining early flowering, higher fruit yield with improved fruit quality and higher net realization.

(Research Scientist, AES, NAU, Paria)

4. Effect of foliar application of novel organic nutrient and micronutrients on yield and quality of mango (*Mangifera indica* L.) cv. Kesar.

Farmers of South Gujarat growing mango are recommended to apply foliar spray of 2% Novel organic liquid nutrient (200 ml/ 10 l) along with 1 % calcium nitrate (100 g/10 l) at flower bud development stage and full bloom stage along with recommended dose of chemical fertilizers for getting higher yield and net returns.

(Prof. & Head, Dept. of Horti., CoA, NAU, Bharuch)

5. Effect of different colour shade nets on germination and seedling growth of papaya (*Carica papaya*) var. GJP-1.

Farmers and nurserymen of Gujarat are recommended to raise papaya seedlings in plug tray (media cocopeat: red soil: vermicompost, 4:1:1 v/v) under 50% white shade net during first week of March for early germination, better growth with higher net realization.

(Professor and Head, Dept. of Horti., NMCA, NAU, Navsari)

6. Response of okra to foliar application of Novel Organic Liquid Nutrients and Micronutrients.

Farmers of South Gujarat growing *kharif* okra are recommended to apply foliar spray of 1.5 % Novel Organic Liquid Nutrients (150 ml/10 litre water) at 30, 45 and 60 DAS along with recommended dose of fertilizer (100-50-50 N-P-K kg/ha) to obtain higher yield and net return.

(Professor,Vegetable Science, ACHF, NAU, Navsari)

7. Effect of sowing dates and spacing on off season okra.

Farmers of South Gujarat are recommended to cultivate off season okra by sowing in 2nd week of October with spacing of 45 cm x 10 cm to obtain higher net return.

(Professor, Vegetable Science, ACHF, NAU, Navsari)

8. Effects of boron and molybdenum on nodulation, growth and yield of cowpea (*Vigna unguiculata* L. Walp.).

Farmers of South Gujarat growing summer cowpea are

recommended to give seed treatment of molybdenum @ 2mg/l (Ammonium molybdate @2.40 mg/l) for 24 hours prior to sowing followed by foliar spray of boron @ 4mg/l (Boric acid @ 22.88 mg/l)at 30, 45 and 60 DAS to obtain higher pod yield. Moreover, seed treatment of molybdenum @ 4 mg/l increases nodulation.

(Professor,Vegetable Science, ACHF, NAU, Navsari)

9. Effect of different growing media on fern under benching system in polyhouse.

Farmers of Gujarat growing ferns for cut greens as secondary crop under benching system in naturally ventilated polyhouse are recommended to grow in media comprising of cocopeat for better plant growth, cut greens yield and net returns.

(Professor& Head, FLA, ACHF, NAU, Navsari)

10. Effect of different bio-chemicals for increasing suckers in Haworthia pot plant

Nurserymen of Gujarat growing haworthia as pot plant under naturally ventilated polyhouse are recommended to spray Benzyladenine @ 25 mg/l twice after two months of pot planting at 15 days interval to obtain early and more number of suckers for propagation.

(Professor & Head, FLA, ACHF, NAU, Navsari)

11. Accessing compatibility of different scion to develop multi grafted adenium under soilless growing system

Nurserymen and amateurs gardners of Gujarat are recommended to develop multi grafted adenium on single local rootstock with scion combination as mentioned below:

1. For triple grafted adenium: G.Ad1 + G.Ad2 + Aabha to obtain maximum flowers/plant, flower clusters/plant and synchronization of flowering days with high overall quality score.
2. For dual grafted adenium with multipetalous flowers: G.Ad1 + Aabha or G.Ad2 + Aabha to obtain maximum synchronization of

days for flowering and number of flowers during most part of the year with higher aesthetic value.

3. For dual grafted adenium with single type flowers: NASDUS2 + NAPVW1 to obtain earliest flowering as well as more number of flowers/plant with high aesthetic value.

(Professor& Head, FLA, ACHF, NAU, Navsari)

12. Effect of foliar application of nutrients on growth and flowering of orchid (*Dendrobium*) under NVPH

The farmers of Gujarat growing Dendrobium orchid under naturally ventilated polyhouse are recommended to give foliar application of 400 ppm N, 200 ppm P and 400 ppm K (782.61 mg/l urea, 327.80 mg/l 12:61:00 and 800.00 mg/l 00:00:50) two times per week for getting higher yield and better flower quality.

(Professor& Head, FLA, ACHF, NAU, Navsari)

13. Standardization of technology for minimal processing of fresh cut cauliflower (*Brassica oleracea* var. botrytis L.).

It is recommended to the processors and entrepreneurs that minimally processed fresh cut cauliflower pieces (25 mm size) can be prepared followed by its blanching for 3 minutes at 95°C along with 1.0 % calcium chloride (CaCl2). Then keeping in the solution of 0.1 % citric acid and 0.1 % potassium meta bisulphate for 15 minutes. After removal of excess water, the pieces packed in 200 gauge LDPE (Low Density Poly Ethylene) bags can be stored successfully for 20 days at refrigerated temperature (5°C).

(Professor& Head,PHT, ACHF, NAU, Navsari)

V FORESTRY

1. Macro propagation of different bamboo species by culm cutting with different root hormone treatments.

Farmers/nursery entrepreneurs of Gujarat are recommended to use 2 to 3 years culms of bamboo in the month of February-March by making two holes between two nodes and inject 120 ml (60 ml + 60 ml) NAA 500 ppm in Bambusa balcooa, 120 ml (60 ml + 60 ml) IBA 500 ppm in Bambusa bambos and Dendrocalamus stocksii and

120 ml (60 ml + 60 ml) IBA 200 ppm in Bambusa vulgaris var. vulgaris followed by sealing of holes for large scale propagation by culm cutting technique in the following manner.

Culm cutting process:

↓

Select 2 to 3 years culms of bamboo having three nodes

↓

Make two holes at equal distance between three nodes

↓

Inject required quantity of rooting hormones

↓

Seal holes with cello tape

↓

Place culms horizontally in raised bed by keeping the holes upper side

↓

Uproot sprouted culms and transplant into polythene bags

(PI and HoD, Silviculture and Agroforestry, CoF, NAU, Navsari)

2. Development of volumetric equation for Eucalyptus (*Eucalyptus spp.)*

It is recommended that farmers, foresters and wood merchants of South Gujarat can use volumetric equation, V= 0.0621 + 0.000037 D2H - 0.0003D2 + 0.0009DH - 0.0104 H (R2=0.951) (V= Volume in m3 , D= Diameter at Breast Height in cm, H= Height in m) for 10-60 cm DBH and below given local volume table for estimation of volume of standing Eucalyptus trees.

(PI and HoD, Silviculture and Agroforestry, CoF, NAU, Navsari)

3. Effect of different pre-sowing treatments on germination of Red Sanders (*Pterocarpus santalinus* L. f.)

Nurseryman and forest dwellers/ farmers are recommended to soak pods of Red Sanders (*Pterocarpus santalinus* L.f.) in GA_3 @

500 mg/l for 1 day followed by sowing in the month of March in sand bed for sprouting and then after transplanting at two leaves stage in to growing media of Soil : Sand : FYM (2:1:2) to enhance seed germination and seedling growth.

Note: Dilute 500 mg of GA3. in 100 ml of water along with 5-10 ml of alcohol. Mix it properly till GA3 dissolved and make final volume upto 1 litre.

(PI and HoD, Silviculture and Agroforestry, CoF, NAU, Navsari)

4. Effect of Eucalyptus plantation on soil fertility in South Gujarat

It is recommended to farmers of Gujarat that under Eucalyptus plantation, Soil pH is reduced whereas organic carbon, available P_2O_5, available K_2O, soil bacterial and fungal population are increased. Moreover, soil EC and available nitrogen are not affected due to Eucalyptus plantation.

(PI and HoD, Silviculture and Agroforestry, CoF, NAU, Navsari)

VI AGRICULTURAL ENGINEERING

1. Development of Zero Energy Evaporative Cooling Storage Structure (ZEECSS) for Tribal Region of Dediapada.

The farmers and entrepreneurs of dry tribal region of South Gujarat are recommended to use Zero Energy Evaporative Cooling Storage Structure (ZEECSS) having 50 kg capacity consisting of bricks cooling pad having 10 cm thickness, to store yellowish red fresh tomatoes up to 10 days without loss with 11±2 $^{\circ}$C temperature drop, 87% Relative humidity, 677.89 W/m^2 solar radiation and 2.39 m/s wind speed towards the wind direction.

(Head, PPE, CAET, NAU, Dediyapada)

2. Design, development and performance evaluation of mixed mode cabinet solar dryer.

Farming community and entrepreneurs are recommended to use the 20 kg capacity mixed mode cabinet solar dryer (2m² solar collector and 0.8 m^3 drying chamber with glass cover) for:

(i) Tomato drying (from 94 % moisture content to 8 % moisture

content) cut in to 8 mm thick slices and 7 kg/m^2 tray load in 10 hours in summer and 14 hours in winter, which saves 22 hours and 34 hours respectively in summer and winter, compared to open sun drying.

(ii) Onion drying (from 85 % moisture content to 8 % moisture content) cut in to 8 mm thick slices and 7 kg/m^2 tray load in 9 hours in summer and 13 hours in winter, which saves 20 hours and 29 hours respectively in summer and winter, compared to open sun drying.

(Head, REE, CAET, NAU, Dediapada)

VII ANIMAL PRODUCTION AND FISHERIES

1. Impact of bedding material on performance of commercial broilers.

The broiler farmers of South Gujarat region are recommended to use black sand (1.5 inch thickness) as bedding material during winter season for economic rearing of broilers in comparison to shredded paper.

(PI through Head LFC, College of Vety. Sci. & AH, Navsari)

2. Estimation of genetic trend for growth related traits in Surti goats.

A) The Surti kids born during monsoon season (July to October) fetches more body weight during the age of 6 to 12 months as compared to other seasons. So the Surti goat keepers of South Gujarat are recommended to breed the females so that birth of kids takes place during monsoon season.

B) The body growth of Surti goats born as twins and triplets becomes at par with that of singlet born kids after 9 months of age. So the goat keepers of South Gujarat are recommended to keep the Surti goats giving birth to twins and triplets.

(PI through Research Scientist, LRS, NAU, Navsari)

3. Effect of steaming-up on growth performance of grazing Surti goats and their kids in high rainfall zone of South Gujarat.

The Surti goat rearing farmers of South Gujarat are recommended that feeding of concentrate (18 % CP) 60 days before kidding up to 60 days after kidding @ 200 g/d increases milk yield and milk fat in goats, higher birth weight and improved growth rate in Surti kids.

(PI through Research Scientist, LRS, NAU, Navsari)

4. Studies on effect of different ecbolic agents on post-partum reproductive performance in Surti buffaloes.

Surti buffalo owners are recommended to give oral ayurvedic liquid ecbolic preparation @ 100 ml for 10 days, immediately after parturition to improve the reproductive efficiency.

Composition of Herbal Liquid Ecbolic:

Each 10 ml contains extract derived from (in mg) *Aloe barbadensis Lx.-80, Aristolochia indica Rt.-160, Citrullus colocynthis Rt.- 20, Cyperus rotundus Rz.- 120, Caesalpinia crista Sd.- 120, Desmodium Gangeticum Wh. Pl.- 60, Gardinia gummifera Ex.- 80, Gloriosa superba Rt.- 120, Gossypium herbaceum Rt.- 160, Inula racemosa Rt.-60, Leptadenia reticulata St.- 160, Lepidium sativum Fr.- 100, Plumbago zeylanica Rt.- 160, Peganum harmala Sd.- 160, Piper longum Rt.- 80, Rubia cordifolia Rt.- 160, Saraca indica Bk.-120, Tribulus terrestris Fr.- 40, Uraria picta Wh. Pl-40, Excipients-q.s.*

(PI through Research Scientist, LRS, NAU, Navsari)

5. Study of Sillago sihama fish growth under varying salinities.

The brackish water fish growing farmers of Gujarat are recommended to rear *Silago sihama* fry in 30 ppt salinity of water for better survival, growth and economical returns.

(PI through Fisheries College, Navsari)

RECOMMENDATIONS FOR SCIENTIFIC COMMUNITY

I NATURAL RESOURCE MANAGEMENT

1. Evaluation of ground water suitability for irrigation in Navsari district

- The Navsari taluka's groundwater was neutral to alkaline. The high salinity could be attributable to a stronger water-rock interaction, such as mineral dissolution and evaporation concentration functions.
- Among cations, strong alkalies predominate over alkaline earth metals, exhibiting a pattern of Na+>Mg++>Ca ++> K +. While anions are dominated by bicarbonates > chlorides > sulphates > nitrate > boron ≈ fluoride > bromide. The groundwater was found to be of the Na-HCO_3 type.
- Prior to the monsoon, the bulk of groundwater was classified as moderately or severely restricted for agricultural purposes. However, following the monsoon, a large amount of groundwater was limited to a low to moderate degree. As a result, seasonal changes have had a major impact on groundwater composition, as irrigation water quality indicators improved during the post-monsoon period (November 2019) compared to the pre-monsoon period (May 2019).

(Research Scientist, Soil Science, NAU, Navsari)

2. Weed management with pre and post emergence herbicides in linseed

Application of pendimethalin 1.0 kg/ha as pre-emergence fb hand weeding at 40 days after sowing for was found effective for weed management and obtaining economical yield of linseed

(Prof. & Head, Dept. of Agronomy, NMCA, NAU, Navsari)

II PLANT PROTECTION

[A] Agricultural Entomology

1. Screening of sapota germplasm against seed borer, *Trymalitis margarias* Meyrick

The sapota varieties/hybrids viz., Kalipatti, Kirthibarthi, DHS-2, CO-2 and Cricket ball were found more susceptible to seed borer, Trymalitis margarias Meyrick; while Chala collection-1, Chala collection-2, Chala collection-3, Zumakhiya, CO-1 and CO-3 were showed less susceptible to seed borer. The fruit infestation was found higher from December to February

(Assistant Research Scientist (Ent.), Fruit Res. Station, NAU, Gandevi)

2. Evaluation of different novel plus formulations against pest complex of okra

Spray of NOVEL PLUS at 1.5 per cent @ 150 ml/10 l, six times from 30 days after germination at every 10 days interval to manage sucking pests (Aphid, Jassid, whitefly and Mite) in okra.

(Asstt. Res. Sci. (Ent.), Soil & Water Management Unit, NAU, Navsari)

3. Evaluation of different novel plus formulations against pest complex of mango crop

Spray NOVEL PLUS 1.5 per cent (150ml /10 lit water) three times at Inflorescence initiation, Pea stage and Marble stage to manage sucking pests (Hoppers, Thrips and Mite) in mango.

(Asstt. Res. Sci. (Ent.), Soil & Water Management Unit, NAU, Navsari)

[B] Plant Pathology

1. Evaluation of different spore harvesting methods of *Trichoderma viride* Pers. Ex.fr

Tween 20 @ 0.01% (v/v) in sterile saline solution (1M) can be used for maximum spore harvest of *Trichoderma viride*

(Prof. & Head, Dept. of Plant Pathology, NMCA, NAU, Navsari)

2. Evaluation of bio-inoculants against anthracnose of banana

The banana fruit dipping in *Bacillus subtilis* (5 ml/lit) 108

cells/ml for 5 minutes found effective to reduce the fruit rot severity in both i.e. pre and post inoculation method.

(Assist. Res. Sci. (Pl. Path.), College of Agriculture, NAU, Bharuch)

3. Screening of rice promising genotypes against blast disease caused by *Pyricularia oryzae*

Rice genotypes *viz*., NVSR-591, NVSR 3065, IR-64 and NVSR 3110 were found highly resistant against leaf blast disease while, Lalkada (LS), HR-12 (NS), NVSR-557, NVSR-592 and GNR-4 genotypes showed highly susceptible reactions under artificial inoculation field conditions.

(Assist. Res. Sci. (Pl. Path.), Regional Rice Res. Station, NAU, Vyara)

4. Evaluation of rice genotypes against sheath blight caused by *Rhizoctonia solani*

Rice Genotypes *viz*., Mandakini Lambayeque and Aditya were found moderately resistant against sheath blight disease in artificial inoculation field conditions.

(Assist. Res. Sci. (Pl. Path.), Regional Rice Res. Station, NAU, Vyara)

5. Effect of biofilms formation in *Trichoderma-Azotobacter* interaction against *Macrophomina phaseolina*

Biofilm formed by *Azotobacter chroococcum* (1x107 CFU) and *Trichoderma viride* (1x106 CFU) leads to production of Extrapolymeric substances (EPS) which at equal proportion can help to extract EPS after 20 days incubation by ethanol precipitation. The extracted EPS @ 2g/Kg seeds of blackgram provide better colonization, increase plant growth and reduce root rot caused by Macrophomina phaseolina over microbial combination.

(Prof. & Head, Dept. of Plant Pathology, NMCA, NAU, Navsari)

III HORTICULTURE

1. An observational trial: Effect of high density planting in cashew (cv.V–4).

The scientists are informed that cashew cv. V-4 can be grown at a spacing of 6.5 m x 6.5 m to get higher plant growth and yield.

(Research Scientist, AES, NAU, Paria)

IV FORESTRY

1. Evaluation of nutritive value of leaves of different bamboo species

Bamboo leaves are rich in nutritive value in terms of dry matter, crude protein, calcium, phosphorus, fat, carbohydrate, crude fibre, nitrogen free extract and total ash content. Therefore, it can be used for further palatability and digestibility experiments. Top five species with respect to nutritive parameters are as under.

Sr. No.	Nutritive Parameters	Range (%)	Bamboo species
1.	Moisture Content (%) and Dry Matter Content (%)	45.51 to 48.09 and 51.91 to 54.49	*Thyrsostachys oliveri, Bambusa multiplex, Ochlandra travancorica, Schizostachyum pergracile and Bambusa pallida.*
2.	Crude Protein (%)	11.71 to 12.55	*Thyrsostachys oliveri, Bambusa multiplex, Ochlandra travancorica, Schizostachyum pergracile and Bambusa pallida.*
3.	Calcium (%)	0.74 to 0.81	*Ochlandra travancorica, Bambusa pallida, Bambusa balcooa, Bambusa vulgaris var. vittata and Dendrocalamus hamiltonii*
4.	Phosphorus (%)	0.32 to 0.42	*Gigantochloa atroviolacea, Bambusa nutans, Thyrsostachys oliveri, Dendrocalamus sikkimensis and Bambusa vulgaris var. vulgaris*
5.	Ether extract or Fat %	3.79 to 4.25	*Bambusa multiplex, Dendrocalamus giganteus, Thyrsostachys oliveri, Bambusa wamin and Bambusa vulgaris var. vittata*
6.	Ether extract or Fat %	76.16 to 77.91	*Bambusa vulgaris var. vulgaris, Dendrocalamus strictus, Schizostachyum pergracile, Dendrocalamus stocksii and Bambusa nutans*

7.	Crude Fibre (%)	21.22 to 22.96	*Bambusa polymorpha, Ochlandra travancorica, Dendrocalamus stocksii, Bambusa vulgaris var. vittata and Bambusa nutans*
8.	Nitrogen Free Extract (%)	52.91 to 54.75	*Bambusa vulgaris var. vulgaris, Dendrocalamus stocksii, Bambusa nutans, Dendrocalamus strictus and Bambusa vulgaris var. vittata*
9.	Total Ash Content (%)	8.00 to 9.91	*Bambusa wamin, Dendrocalamus giganteus, Dendrocalamus strictus, Bambusa vulgaris var. vittata, Gigantochloa atroviolacea and Bambusa vulgaris var. vulgaris.*

(PI & HoD, Silviculture and Agroforestry Dept., CoF, ACHF, NAU, Navsari)

2. Evaluation of various Poplar clones for early growth and establishment under South Gujarat condition

Poplar clone P-5503 is better suited for block plantation under South Gujarat condition.

(PI & HoD, Forest Biology & Tree Imp. Dept., CoF, ACHF, NAU, Navsari)

3. Vegetative propagation of *Salix tetrasperma*

The vegetative propagation of Indian Willow (*Salix tetrasperma*) can be better achieved when softwood cuttings procured in the month of January and dipped in IBA @ 2500 ppm concentration for 30 minutes and grown in net-house under South Gujarat condition

(PI & HoD, Forest Biology & Tree Imp. Dept., CoF, ACHF, NAU, Navsari)

V BASIC SCIENCE

1. In silico characterization of different banana bunchy top virus (BBTV)

Comparing Banana bunchy top virus(BBTV) different genome components, at nucleotide (DNA-R and DNA-U3), and amino acid level (DNA-C and DNA-U3) during in silico analysis of different BBTV showed higher genetic variability in all reported BBTV

strains. Comparing DNA- R (Replicase protein) and DNA-S segments (Coat protein), majority of Indian isolates matched with isolates of the countries in East and Southeastern Africa region and belong to Pacific Indian Oceans (PIO) groups of BBTV isolates classification. BBTV coat protein model showed maximum binding affinity with NBS-LRR class resistance protein. Three mutagenic epitope (GDDLVRLW, IADEFYVERL, SKRFLLVLDD) were predicted from BBTV coat protein region. This will extend the understanding of the processes required for antibody binding and aid the development of epitope based diagnostic tools and for development of disease resistance/management strategy in Banana against BBTV.

(Principal, ASBI, NAU, Surat)

2. Development of mapping population and identification of molecular marker linked to jassid resistance in cotton

The following transgressive RILs were identified as candidate jassid resistant lines that possesses desirable biochemical traits, low jassid count with less jassid injury grade; and higher seed cotton yield than the jassid resistant parent GISV-218. Thus, these potential RILs can used for the further development of cotton varieties with high yield and jassid resistance.

RIL No.	Character
RIL-94, RIL-31, RIL-96, RIL-108	Gossypol
RIL-88, RIL-28, RIL-96, RIL-108, RIL-107, RIL-113	Phenol
RIL-94, RIL-25, RIL-95, RIL-69	Reducing sugar
RIL-94, RIL-31, RIL-6, RIL-24, RIL-25, RIL-69	Jassid count
RIL-94, RIL-88, RIL-31, RIL-28, RIL-24	Jassid injury grade

(Research Scientist, Main Cotton Research Station, NAU, Surat)

3. Evaluation of biochemical parameters of selected cotton genotypes

It is recommended to scientific community to use the below mentioned cotton genotypes in the breeding programme to improve desired characters.

Genotypes	Characters
G.Cot-100, GISV-218 and G.Cot-10	Protein
G.Cot-10, GSHV-01/1338 and G.Cot-100	Gossypol
G.Cot-16, GISV-218 and Suraj	Oil
LRA-5166, GISV-218 and G.Cot-16	Iodine Value
American Nectariles, Surat Dwarf and G.Cot-10	Saponification value
G.Cot-100, G.Cot-10 and G – 67	Unsaturatated Fatty acid
LRA-5166, GISV-218 and G.Cot-16	Poly Unsaturated fatty acid
G.Cot-100, BC-68-2 and G-67 Mono	unsaturated fatty acid

(Research Scientist, MCRS, NAU, Surat)

4. Diazotropic bacterial population and other associated microbes on the phyllosphere of sugarcane

Sugarcane phyllospheric isolates Bacillus amyloliquefaciens S 2.4 and Enterobacter cloacae S 4.1 can be used as plant growth promoting microorganism because of multiple plant growth promoting characters viz., ACC deaminase, siderophore production, nutrient solubilization, antagonistic potential, extracellular hydrolytic enzyme secretion and plant growth hormone production under in vitro conditions.

(HoD, Dept. of Agril. Microbiology, NMCA, NAU, Navsari)

5. Nutritional profiling of different Tannia (*Xanthosoma sagittifolium*) genotypes

Among Tannia genotypes; NT-5 (lower oxalate content 0.05 %), NT-9 (lower tannin content 16.24 mg/100 g) and NT-7 (higher ash content 1.98 %) are recommended for leafy vegetable purpose. Whereas, NT-5 (lower oxalate content 0.43 %), NT-3 (lower tannin 87.04 mg/100 g) and NT-1(lower phytate 123.63

mg/100 g) are recommended for corm purpose. Further NT-5 is recommended to the breeders due to lower antinutritional factor for further breeding programme

(HoD, Dept. of Soil Science and Agril. Chemistry, NMCA, NAU, Navsari)

VI SOCIAL SCIENCE

1. Development and standardization of scale to measure the attitude of employees towards ICTs apparatus for exploring agricultural information

Methodology:

Among the available scaling techniques, an 'Equal Appearing Interval Scale

Technique' developed by Thurstone's (1928) was used for selection of items and ascertaining the responses.

1. **Item collection:** 100 statements were finalized after content analysis.
2. **Item analysis:** To judge the degree of most unfavourableness to most favourableness of each statement on the 11-point continuum, the schedule was sent to148 judges and among them 96 had responded. However as 36 had carelessly responded; only 60 schedules were kept for the study.
3. **Determination of Scale 'S' & 'Q' values:** Based on judgment, the Median Value (S) of the distribution and Inter Quartile value (Q) for 100 statements were calculated.
4. **Selection of Statements:** In all, 28 statements (17 positive and 11 negative statements) were selected whose 'S' values were greater than 'Q' values. However, when a few items had the same scale values, and for those the lowest 'Q' values were considered.

Reliability: Split Half Technique was used and reliability was 0.8907 for the year 2017, 0.9038 in the year 2018, 0.9013 in the year 2019 and 0.9068 in the year 2020. Thus, scale is recommended for Scientific Community.

Sr.	Statements	F	N	UF
1.	ICTs apparatus plays a pivotal role in exploring agricultural information. (+)			
2.	ICTs apparatus are not resolving the conflicts among the users. (-)			
3.	ICTs apparatus induces one for acquiring more information. (+)			
4.	ICTs apparatus is an effective medium to impart training. (+)			
5.	ICTs apparatus resolves the crisis of ToT staff. (+)			
6.	ICTs apparatus are unable to meet the increasing demands of farmers. (-)			
7.	Teacherless classroom can be conceptualized through ICTs apparatus. (+)			
8.	Television helps to explore new technology among the farmers. (+)			
9.	Radio converts an individual from awareness to interest stages of adoption. (+)			
10.	Farm Radio enhances the interactive communication between scientists and farmers. (+)			
11.	Computer helps to present offline agriculture content. (+)			
12.	Computer enables the extension workers to take quick decisions while ToT. (+)			
13.	In the present time crop based CD/DVD becomes ready reckoner for the farmers. (+)			
14.	Internet strengthens the linkage between different stakeholders. (+)			
15.	Accuracy of information available on the agricultural website is questionable. (-)			
16.	Web portals are useful to farmers for accurate and timely information. (+)			
17.	Mobile phone is not a potential tool to reach the unreached. (-)			
18.	Mobile phones facilitate teleconferencing within the group. (+)			
19.	Kiosk is complex ICT apparatus and therefore, it does not reach rural areas.(-)			
20.	Field functionaries have very poor acquaintance with a kiosk. (-)			
21.	Extension personnel are not considering KCC as a credible source for information. (-)			
22.	Video conferencing reduces the time and cost of extension functionaries. (+)			
23.	Practicability of video conferencing is less. (-)			
24.	Extension personnel cannot analyse the intensity of field problem by video conferencing. (-)			
25.	WhatsApp and Facebook generate the peer to peer discussion. (+)			
26.	Social Media is for entertainment only. (-)			
27.	'Kisan Mitra' app developed by NAU, Navsari is widely appreciated by the farming community. (+)			
28.	'Kisan Mitra' app is not a good source to avail offline agricultural information. (-)			

(HoD, Agril. Extension & Communication, NMCA, NAU, Navsari)

2. Development and Standardization of Scale to measure knowledge of rural women about the agro-based enterprises Methodology:

Guilford method and Rulon formula (1965) was used to measure the knowledge about the agro-based enterprises.

1. **Item collection:** 76 statements were finalized after content analysis
2. **Item analysis:** To judge the items collected from different sources and schedule of items were sent to 178 judges and among them 82 had responded. However as 22 had carelessly responded; only 60 schedules were kept for the study.
3. **Determination:** Calculation of "Index of item difficulty", "Index of item discrimination" and "Biserial correlation" for all the collected items.
4. **Selection of the statements: Based on** significant values of the biserial 'r_{bis}', difficulty index and discrimination values, the items were selected for the final test battery of knowledge about agro-based enterprises.
5. **Reliability:** Split half technique was used and reliability was **0.9306 for the year 2018**, **0.9028 in the year 2019** and **0.9665 in the year 2020**. Thus, scale is recommended for scientific community.
6. Further, it is to be noted that the right answer on the statement with dichotomous choices was given 1 score for 'YES' and 0 for 'NO' answer. Whereas for the statements with four choices, a score of 0.25 were allotted to each correct answer and the statements with three choices were allotted 0.33 score for each correct answer.

Actual format of the test to measure knowledge of rural women about agro-based enterprise as presented in following table:

Sr.	Questions
	Dairying
1	Do you know that the colostrum should be fed to the newborn calf within an hour after birth? **Yes/No**
2	Do you know about balanced feeding for healthy dairy animals? Yes/No
3	Do you know about treatment for improving the quality of roughages? Yes/No
4	Do you know how much mineral mixture to feed a dairy animal? **Yes/No**
5	Do you know that chaffing fodder is fed to dairy animals? **Yes/No**
6	Do you know about the importance of pre and post milking teat dip? Yes/No
7	Do you know why the orientation of cattle should be in the east-west direction? **Yes/No**
8	Do you know that cross ventilation is essential in cattle sheds? **Yes/No**
9	Do you know that concrete floor is better than kachcha floor in cattle shed? **Yes/No**
10	Do you know why dairy animals are vaccinated? (a) Preventing or reducing disease (b) Higher milk production (c) Other reasons
11	Do you know why deworming among dairy animals? Yes/No
12	Is raw milk safe to be consumed as such? Yes/No
13	Do you know which agency set the price of milk in Gujarat? (a) Amul (b) National Dairy Development Board (c)Gujarat Cooperative Milk Marketing Federation
14	Selling milk directly to consumers is more economically beneficial? **Yes/No**
15	Do you know that drinking fresh and cold water throughout the day is essential for animals? Yes/No
Vermicomposting	
1	Do you know the species of earthworms that are utilized for vermicomposting in South Gujarat? (a) Red wigglers[Eisenia fetida] (b)European night crawlers[Eisenia hortensis] (c) Red worms [Lumbricusrubellus]
2	Do you know the worms during the natural climate for compost? **Yes/No**

3	Do you utilize a mixture of decomposing vegetable or food waste, bedding materials for preparing vermicompost? **Yes/No**
4	Do you know that the site of vermicomposting attracts flies and mosquitoes? **Yes/No**
5	Do you know that earthworms are safe to handle with hands? **Yes/No**
6	Do you know about the recommended size of vermibed? **Yes/No**
7	How many earthworms are required for 15m×4m size vermibed? (a) 1-2kg (b)2-3 kg (c) 4-5kg (d) 10kg
8	Do you know the price of 1 kg earthworms used for vermicomposting? Yes/No
9	Do you know the sources from where one can buy earthworms? (a) Private agency (b) Agro-business Center (c) Agricultural University (d) others
10	Do you know the estimated cost for preparing vermicompost from 15m × 4m size vermibed? (a) Rs.1000 to Rs.1500(b) Rs.1500 to Rs.2000 (c) Rs.2000 to Rs.2500 (d) Above Rs.2500
11	Do you know the average selling price of 50kg vermicompost? (a) Rs.100 to Rs.200 (b) Rs.250 to Rs. 300 (c) Rs.350 to 400
Food Processing	
1	How many products of mango fruits are prepared by processing? (a) 1 to 2 products (b) 2-3 products (c) 3-5 products (d) More than 5 products
2	Do you know the packaging of food is economically beneficial? **Yes/No**
3	Do you know about products that are prepared from pulses by food processing? (a) Papad and Vadi, (b) Soybean balls (c) protein-rich flour
4	Do you know about marketing facilities available for different food processing products in South Gujarat? (a) Hat Bazaars (b) Grocery stores (c) Commercial Online Websites (d) Craft Markets
5	Do you know that value addition gives more benefits? Yes/No
6	Do you know various sources from where one can buy fresh fruits, vegetables, chemicals and packaging materials for food processing? (a) Hat Bazaars (b) Grocery stores (c) e-Commerce websites (d) Craft Markets
7	Which fruits are uses for making pickles? (a) Mango (b) Lemon (c) Aonla (d) Koronda

Beekeeping	
1	Do you know that the *Apis melifera* species of honeybee, which has been domesticated in South Gujarat? **Yes/No**
2	Honeybee activities are higher in winter as compared to summer, is it true or false?
3	Do all honeybees make honey? **Yes/No**
4	Do you know the honey ever goes "bad" or "spoil"? **Yes/No**
5	Do you know the reason for honey solidification? **Yes/No**
6	Do You know the places where one can buy hives for beekeeping? (a)Private agencies (b)NGOs (c) Progressive beekeepers (d) Navsari Agricultural University
7	How many beehives require for one hector cucumber farm? (a) 2-3 beehives/ha (b) 3-5 beehives/ha (c) 5-7 beehives/ha (d) Above 7/ha
8	Do you know the four frames beehive and ten frames beehive are available for beekeeping? **Yes/No**
9	How much honey is produced by one four frames beehive? (a) 0.5 kg to 1 kg (b) 1 kg to 2 kg (c) 3 kg to 5 kg (d) More than 5 kg
10	Which safety measures for harvesting the honey from beehives? (a) Do the inspection during nice weather (b) Wear protected Gear (c) Keep the hive tidy
11	How can we know the purity of honey? (a) Thumb test (b) Water test (c)Flame test (d) Use vinegar (e) Heat test

(Senior Scientist & Head, KVK, NAU, Vyara, Tapi)

3. Group Dynamics of FIGs / CIGs working under ATMA in South Gujarat

Extension officers of ATMA project are advised to emphasize on the three dimensions of group dynamics *viz*. interpersonal trust, group leadership and group atmosphere in order to empower group functioning through the members. Moreover, economic orientation, extension contacts and market orientation factors/aspects of groups should also be prioritized.

(DEE, NAU, Navsari)

4. Seasonal variations and Forecasting in Wholesale Prices of Okra in Surat Market

Seasonal ARIMA model to develop dependable monthly wholesale price forecasts for okra in Surat market is found to be more effective as compared to various non-seasonal models (*viz*. Simple Non-Seasonal, Holts Linear Trend, Brown's Linear Trend, Damped Trend) as well as various seasonal models (*viz.* Simple Seasonal, Winter Additive, Winter Multiplicative) on the basis of different model selection criteria like minimum Mean Absolute Percentage Error (MAPE) and minimum Bayesian Information Criterion (BIC).

(Principal, AABMI, NAU, Navsari)

5. Population growth study of sheath mites in different rice cultivars using statistical models

The maximum temperature and minimum relative humidity were both positively and significantly associated with the sheath mite population indicating that the weather characteristics are primarily responsible for vulnerability of the rice crop, particularly in the 42nd and 43rd SMW. Accordingly, the scientists are advised to suggest farmers take preventative steps prior to the 42nd and 43rd SMW. The Sinusoidal model accurately describes the growth pattern in almost all years. As a result, it is recommended that the Sinusoidal nonlinear model can be used to forecast Sheath mite population growth dynamics in Navsari, Gujarat.

(Asso. Prof. & Head (I/c), Dept. of Agril. Statistics, NMCA, NAU, Navsari)

VII ANIMAL SCIENCE

1. *In-vitro* screening of indigenous medicinal plants for their acaricidal activity against the bovine ticks

Freeze dried methanolic extract (paste) of air dried leaf powder of 100% concentration in 5% Tween-20 of *Azadirachta indica* (Neem) / *Eucalyptus alba* (Nilgiri) stand a promising acaricidal agent on the cellulose filter paper against the adult stage of *Rhipicephalus (Boophilus) microplus* with the mortality of

98.75±1.25%/ 96.25±1.83% and inhibition of oviposition of 44.47±0.87%/ 42.39±0.48% at 72 hours of treatment over the extracts of *Ashoka indica* (Ashok)/ *Murraya koenigii* (Curry) and 1:1 ratio of *Azadirachta indica* (Neem): *Eucalyptus alba* (Nilgiri)/ *Azadirachta indica* (Neem): *Ashoka indica* (Ashok) / *Azadirachta indica* (Neem): *Murraya koenigii* (Curry)/ *Ashoka indica* (Ashok): *Eucalyptus alba* (Nilgiri) / *Eucalyptus alba* (Nilgiri): *Murraya koenigii* (Curry).

(PI through Head, Department of Parasitology, Vet. college, KU, Navsari)

2. *In-vitro* evaluation of lemon grass (*Cymbopogon flexuosus*) extract for pharmacological properties

Methanolic and aqueous extracts of lemon grass (*Cymbopogon flexuosus*) possess antioxidant, antiproteinase and antibacterial properties with following details:

Properties	Methanol Extract	Aqueous Extract
Antioxidant (IC50)		
DPPH	0.52 mg/ml	0.65 mg/ml
ABTS	0.38 mg/ml	0.45 mg/ml
Antiproteinase (IC50)	1.53 mg/ml	4.38 mg/ml
Antibacterial (MIC)		
Staphylococcus aureus	20.48 mg/ml	-
Escherichia coli	20.48 mg/ml	20.48 mg/ml
Salmonella Typhimurium	20.48 mg/ml	-
Bacillus subtillis	1.28 mg/ml	10.24 mg/ml
Streptococcus pyogenes	0.32 mg/ml	20.48 mg/ml
Proteus mirabilis	-	5.12 mg/ml

(PI/ Head, Dept. of Pharmacology and Toxicol., Vet. College, KU, Navsari)

3. Comparative study of anaesthetic regimens of butorphanol or buprenorphine with dexmedetomidine as preanaesthetic and propofol as induction & maintenance anaesthesia in dogs.

The balanced anaesthetic protocol for performing various surgical interventions in dogs is as follows:

Butorphanol (0.2 mg/kg) or
buprenorphine (0.02 mg/kg) IM
↓ After 15 minutes
dexmedetomidine (5µg/kg) IV
↓ After 15 minutes
1% propofol IV (till effect)
(Induction Anaesthesia)
↓
Propofol @ 0.2 mg/kg/min
(Maintenance Anaesthesia)

(PI/Head, Dept. of Vet. Surgery and Radiology, Vet. College, KU, Navsari)

4. Clinico-diagnostic and therapeutic study of otitis externa in dogs.

Cleaning of ear canal with normal saline followed by 0.1% salicylic acid ear cleanser twice daily along with topical and systemic antibiotic (Enrofloxacin 5mg/kg BW BID) and NSAIDs for 7–15 days can be used for management of chronic otitis externa in dogs.

(PI/Head, Dept. of Vet. Surgery and Radiology, Vet. College, KU, Navsari)

5. Comparative efficacy of different concentrations of egg yolk for cryopreservation of Surti Buck semen

Egg yolk @10% in Tris egg yolk citrate dilutor gives better post thaw motility, live count, morphology and plasma membrane functional integrity of spermatozoa for cryopreservation of Surti buck semen.

(*PI/Head, Dept. of Vet. Gynaecology & Obstetrics, Vet. College, KU, Navsari)*

6. Effect of mango (*Mangifera indica*) plant leaves extract supplementation in Tris Egg Yolk Citrate Extender on Surti buck semen quality preserved at refrigerated temperature.

The aqueous extract of Mango (*Mangifera indica*) plant leaves @1% in tris egg yolk citrate extender gives better result over 2% as well as 3% to maintain motility above 50% till 48 hours at refrigerated temperature with normal sperm membrane integrity and morphology.

Aqueous extract from Mango (*Mangifera indica*) plant leaves has good antioxidant property with inhibition percentage of 90.21 and 82.07 at concentration of 10mg/ml in ABTS and DPPH assay, respectively.

(*PI/Head, Dept. of Vet. Gynaecology & Obstetrics, Vet. College, KU, Navsari)*

7. Placental morphometry *vis-a-vis* neonatal behaviour in Surti buffaloes

Placental morphometry in Surti buffaloes revealed that the multiparous buffaloes tend to have significantly ($P<0.05$) higher breadth, radius and surface area of medium size cotyledon, weight of small cotyledon as well as higher birth weight and ponderal index of calves. Moreover, dams of male calves tend to have significantly higher radius of medium size cotyledon. Further, birth weight of calves was significantly ($p<0.01$) positively correlated with length of placenta (0.507**), weight of placenta (0.483**), no. of large size cotyledon (0.511**), surface area of large size cotyledon (0.516**). Therefore, while selecting the animals for added birth weight of calf length of placenta, weight of placenta, no. of large size cotyledon, surface area of large size cotyledon may be considered.

(PI/Head, Department of LPM, Vet. college, KU, Navsari)

8. Comparison of film forming solution on wound healing in rats.

The wound healing characterized by collagen deposition, vascularisation and epithelialisation of the below mentioned film-forming solution is better as compared to the 10% Povidone-iodine solution and normal saline in aseptic punched wounds of rats.

Composition of Film Forming Solution:

No.	Items/ chemicals	Quantity
1.	Chitosan	1.00 g
2.	Lemon Juice (Filtered)	100 ml
3.	Tween 20	7.0 ml
4.	Ethanol	36.0 ml
5.	Propylene Glycol	9.0 ml
6.	NaCl (Sodium chloride)	100 mg
7.	Turmeric Extract :40 mg/ml (Curcuminoids 95%)	1 ml
8.	Thymol	19.0 ml
9.	Demineralised water	To make up the volume 355 ml

(PI through Research Scientist, LRS, NAU, Navsari)

9. Studies on effect of different ecbolic agents on post-partum reproductive performance in Surti buffaloes.

Inj. Dinoprost tromethamine ($PGF_2\alpha$ analogue) @ 25 mg, I/M, immediately after parturition improves the post-partum reproductive performance in Surti buffaloes.

(PI/Research Scientist, LRS, NAU, Navsari)

10. Tissue depletion and withdrawal period estimation of Florfenicol in feed administration to *Cirrhinusmrigala* advance fingerlings

No withdrawal period is required after use of florfenicol at 10mg/kg of fish biomass as feed additive for a period of 10 days to the advanced fingerlings of Mrigal.

(PI through Head, Fisheries College, KU, Navsari)

GR-23

GR-24 (NVSR-2801)

GNJ-1 (SR-2917)

CFMV-3 (WN-591)

NCK-15-09

NSUN-59

BAMBOO RESOURCES CENTRE





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