RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS

2004
&
2005

DIRECTORATE OF RESEARCH
ANAND AGRICULTURAL UNIVERSITY
ANAND 388 110

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It gives me an immense pleasure to bring out this booklet entitled "Research Accomplishments and Recommendations-2004 and 2005", encompassing technologies developed by the Scientists of Anand Agricultural University for the various Agro-ecological situations.

This booklet is meant for larger circulation amongst the line departments and NGOs committed to the improvement of Agriculture and upliftment of rural people. I am sure; the purpose will amply be served with this publication.

I also take this opportunity to congratulate our scientists for the untiring and dedicated efforts made by them in generating these technologies.

(M. C. VARSHNEYA)
VICE CHANCELLOR
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Foreword

The first publication of this booklet "Research Accomplishments and Recommendations – 2004 and 2005" brought out by Anand Agricultural University is really useful for those engaged in the Agricultural Research, Teaching and Extension Education.

Anand Agricultural University has developed large number of need based technologies for enhancing agriculture productivity and bringing rural prosperity. The high yielding varieties developed by the University alongwith recommendations on precise production and protection technologies will enable farmers to reap higher yield of better quality. Similarly, 6 recommendations on animal production, health and feed and fodder will supplement the income of farmers through increasing the production of milk and milk products. The recommendations made on dairy science and food processing will be of great use to farmers in general and industries in particular. I am highly indebted to Hon'ble Vice Chancellor, Anand Agricultural University, Anand for providing guidance and support for bringing out this publication.

The publication of this nature is difficult to compile without cooperation and helps from the convener of the respective Agresco Sub-Committee and university authorities as well as staff members of this office, for which I thanks all.

[A. R. PATHAK]
DIRECTOR OF RESEARCH & DEAN
FACULTY OF P. G. STUDIES

RESUME

Anand Agricultural University (AAU) was established in the year 2004-05 with the support of the Government of Gujarat, Act No. (Guj 5 of 2004) dated April 29, 2004, carved out of the erstwhile Gujarat Agricultural University (GAU). The AAU was set up to provide support to the farming community in three facets viz., Education, Research and Extension Education in Agriculture, Veterinary Science and Animal Husbandry, Dairy Science, Horticulture, Bio-technology, Agricultural Engineering, Product Processing and Home Science. At present there are three colleges, seventeen research and six Extension Education centers.

AAU's AIMS

- Impart relevant education to the students in agriculture and allied fields.
- Conduct research in order to improve the productivity of rural areas.
- Undertake basic research to make break through in newer areas of knowledge.
- Provide opportunities to observe and understand the life of rural people.
- Enable the students to inculcate the attitude and develop skills for grass-root work.

Besides the main campus, research is being carried out at 16 research stations spread over six districts viz., Ahmedabad, Anand, Dahod, Kheda, Panchmahal and Vadodra of middle Gujarat. The research is focused on major crops like Paddy, Wheat, Maize, Bajra, Pigeonpea, Gram, Castor, Sugarcane, Cotton, Tobacco, Vegetable crops, Horticultural crops and Forage crops. In addition, the research on animal science includes areas like livestock

management, animal breeding, reproductive biology, animal nutrition and poultry. Under Dairy technology the emphasis is given on milk and milk products.

Large scale seed production of improved varieties of major crops is carried out to meet the demand of the farmers. In the areas of plant protection, potential biocontrol agents have been identified for suppression of crop pest, their mass production technologies and integrated pest management packages have been developed for major crops and recommended to the farmers. Protocol for mass multiplication of Date palm has been standardized through Tissue Culture. Weather forecasting to the farmers is a regular feature of the department of Agril. Meteorology. Emphasis on post harvest and processing technology and value addition of agricultural produce is also given.

The AGRESCO sub-committees of various disciplines met to review the progress of research, scrutinize findings of experiments and finalize the formulations of new technical programmes. The recommendations made by different committees for adoption by the farmers in agriculture are listed below.

Name of the Sub-committee	**No. of recommendations finalized for farmers**	
	2004	***2005***
Crop Improvement	08	04
Crop Production	14	12
Plant Protection	03	08
Dairy Science, Agri. Engineering & Processing	07	07
Animal Production	03	05
Animal Health	-	01
Social Science	-	01

CROP IMPROVEMENT

The following varieties were recommended for farmers during 2004

Sr. No.	Crop	Name of Variety	Average Yield kg/ha	Justification for release	Distinguishing characters	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Rice	Guj.Rice-12 (GR-12)	5327	Higher yield over checks, multiple diseases resistant, fine grain quality, early maturity	Long fine grain, curved kernel beak, long compact well exerted panicle, tipped awns	Due to fine long grain fetch better price. Recommended for Middle Gujarat
2	Chilli	Guj. Veg. Chilli-101 (GVC-101)	14489	High green fruit yield, fruit appearance similar to S-49 with high chlorophyll and ascorbic acid content. More shelf-life. Low incidence of major pests than S-49.	Large green shinning fruits. Purple pigementation at node, larger green leaves	Due to green shinning, fruits will fetch more market price. Recommended for Middle, North Gujarat. Also identified at National level, Proposed name is Anand Jyoti-49
3	Chilli	Guj. Veg. Chilli-121 (GVC-121)	12853	High yield over G-4, Fruits larger in length and girth, with high ascorbic acid content and less capsaicin than G-4. More shelflife.	Semi-determinate plant type. Larger green shinning fruits, intermediate calyx margin, adherence of calyx to fruit is semihard as compared to G-4.	Good fruit quality in respect to fruit length and fruit size. Recommended for Middle and South Gujarat.
4	Brinjal	Gujarat Oblong Brinjal-1 (GOB-1)	48690	Higher yield over checks, fruits attractive in colour shape and size. Low incidence of sucking pests.	Newly emerged leaves have light purple colour, short size of calyx and pedicel.	Attractive black colour with oblong shape, less seeds, Recommended for Middle Gujarat and Saurashtra.
5	Tomato	Guj. Tomato-2 (GT-2)	34045	High yield over Junagadh Ruby and Pusa Ruby. Determinate plant type, fruits medium in size with good TSS and pulp to juice ratio, attractive red colour. long shelflife. Tolerant to leaf miner and fruit borer.	Determinate plant type at full foliage stage, fruits dark red in colour with heart shaped and medium in size.	Due to dark red colour and heart shaped medium size fruit, it will fetch good market price. Recommended for Middle Gujarat and Saurashtra.

6	Cucumber	Guj. Cucumber-1 (GC-1)	25074	High yield over checks, long, tender fruits with attractive light green strips, soft skin. Long shelflife. Less infestation of major pests.	Long, tender fruits, soft with, light greenish strips, blended at neck side, Nonhairy fruits.	Recommended for Gujarat except Saurashtra in summer season.
7	Muskmelon	Guj. Muskmelon-3 (GM-3)	12705	Higher yield over checks, fruits medium size, brown spotted with attractive green colour pulp, sweet in taste.	Fruits skin is brown spotted, attractive green flash colour	Recommended for summer cultivation in Middle Gujarat.
8	Pearl millet (Forage)	Guj. Fodder Bajra-1 (GFB-1)	116300 (Green) 26340 (Dry)	High green and dry fodder yield under multicut management. Good regeneration capacity under multicut.	Tall plant, thin green colour stem.	Recommended for summer cultivation in North and Middle Gujarat.

The following varieties were recommended for farmers during 2005

Sr. No.	Crop	Name of Variety	Average Yield	Justification for release	Distinguishing characters	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	Lucerne	Anand Agril. Uni. Lucerne-3 (AAUL-3)	1103 q/ha	Perennial type of variety. Yielding 31.6 and 44.0 % higher over RL-88 and Anand-2, respectively.	Solid and erect stem with dark green foliage	Recommended for middle Gujarat.
2	Tobacco	MR GTH-1	3793 kg/ha	Resistant to mosaic (TMV) Tolerant to root knot disease	Matures 8 – 10 days earlier than GTH-1	Recommended for bidi tobacco growing areas of Gujarat
3	Bottle gourd	Anand Bottlegourd-1 (ABG-1)	223.97 q/ha	Yielding 100.52 & 47.33 percent higher over Pusa Navin and PSPL, respectively. Low incidence of leaf miner.	Fruits are tender, attractive and light green in colour.	Recommended for Middle Gujarat Agro-climatic Zone in Kharif season.

PLANT PHYSIOLOGY

Chilli

For seed production of chilli, the farmers are advised to harvest chilli fruits as and when they ripe. The red ripe fruits produce higher seed yield and germination percentage in comparison to mature wrinkled or dried fruits.

CROP PRODUCTION

CULTURAL PRACTICES

Year – 2004

Groundnut and Wheat

Farmers following groundnut – wheat sequence in middle Gujarat (AES-II) are advised to adopt the following practices of micronutrient supplementation in soil having marginal to deficient status of Zn/Mn/Mo.

Zinc :

(a) Groundnut : A basal soil application of $ZnSO_4$ $7H_2O$ (21% Zn) @ 25 kg/ha is recommended for getting higher yield and more income.

(b) Wheat : The seeds should be treated with zinc oxide (ZnO).
(Seed treatment method : Mix 10 ml of ZnO (30% Zn) solution with 1 kg seed of wheat before sowing).

Manganese :

(a) Groundnut : Seed treatment of MnO_2 (Seed treatment method; Mix 12 ml. of MnO_2 (25% Mn) solution with 1 kg seed of groundnut before sowing)

(b) Wheat : The seed treatment of $MnCl_2$
(Seed treatment method: Mix 10 ml. of $MnCl_2$ (25% Mn) solution with 1 kg seed of wheat before sowing).

Molybdenum:

Groundnut and Wheat: Seed treatment of Ammonium Molybdate solution (seed treatment method ; Mix 6 ml. of Ammonium Molybdate solution (12.5 % Mo) with 1 kg groundnut/wheat seeds before sowing.)

Sugarcane

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-II) growing sugarcane C.V. Co.No. -91132 are advised to plant sugarcane crop at 45-90-45 cm pair row method and intercrop it with cabbage for getting higher cane yield (133.58 t/ha) and net realization 1,11,531 Rs/ha with C.B.R. (1:4.48) for more profitable sugarcane cultivation.

Pandadiu (Chicorium intybus L.)

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-II) growing pandadiu are advised to use seed rate of 10 kg/ha and fertilize the crop with 45 kg N/ha after each cut to obtain higher green forage, dry matter and crude protein yields and for getting higher net realization. (A common basal dose of 30 kg N/ha + 30 kg P_2O_5/ha should also be applied to the crop.

Rustica Tobacco

The farmers of North Gujarat Agro-climatic Zone-IV (AES-5,1) are advised to grow GC-1 at a spacing of 60 x 45 cm and fertilized with 200 kg N/ha, of which 90 kg N as basal and remaining N should be top dressed @ 20, 30, 30 and 30 kg N/ha at 15, 30, 50 and 70 DAT for getting maximum cured leaf yield and net return, respectively.

Year – 2005

Tobacco

The farmers of Middle Gujarat Zone III (AES II) growing Bidi Tobacco GTH-1 are advised to do two times tractor cultivation in summer and eight times interculturing at eight days interval or deep ploughing in summer with six times interculturing at 12 days interval beginning 20 days after transplanting for getting higher yield and economic return.

Paddy

The farmers of Middle Gujarat Agro-climatic Zone-III comprising of Agro Eco-situation II & IV (Thasra and Nawagam) growing rice varieties GR-7, GR-11 and Narmada are advised to transplant the crop during 20th June to 10th July for lower spikelet sterility percentage and thereby obtaining higher grain yield.

Safed Musali

Farmers of Middle Gujarat Agro-climatic Zone III (AES II) are recommended to cultivate Safed musli using the planting material of approximately 5 g bunches (2-3 tubers) per hill, with a spacing of 30 x 15 cm, applying 5 ton poultry manure or 10 ton FYM/ha to obtain the highest fasciculate root yield and net profit.

NUTRIENT MANAGEMENT

Year - 2004

Sorghum

The farmers of Bhal and Coastal Agro-climatic Zone, who are growing fodder sorghum 'Solapuri' under conserved moisture condition during rabi season are advised to apply 30 kg N + 15 kg P_2O_5/ha for getting higher yield and economics.

Pigeonpea

The farmers of middle Gujarat agro climatic zone-III (AES-IX) growing Kharif Pigeonpea (BDN-2) on black cotton soil having marginal Fe and Zn status are advised to spray 1% foliar grade of multi-micronutrient having Fe 4%, Mn 1%, Zn 6%, Cu 0.3% and B 0.5% equivalent to Govt. notified grade IV (For Fe & Zn deficiency) at 60, 90 and 120 DAS to get higher yield and net return.

Aonla

The farmers of Middle Gujarat (AES-VI) growing aonla are advised to apply 100 g CuSO4 (24% Cu) or 200 gm boric acid (17% B) in soil at the onset of monsoon followed by three sprays of 0.2% $CuSO_4$ and 0.4% boric acid in first week of July, third week of July and first week of August for getting higher yield as well as more healthy fruits.

Okra

The farmers of Middle Gujarat Agro-climatic Zone (AES-II) growing okra (Prabhani Kranti) on soil having marginal Fe and Zn status are advised to apply soil application on multi micronutrient mixture having Fe 2%, Mn 0.5%, Zn 0.5%, Cu 0.2% and B 0.5% equivalent to Government notified grade V at the time of sowing along with recommended NPK dose to get higher yield and net return. Alternatively, the farmers are advised to spray 1% of foliar grade of multi-micronutrient having Fe 4%, Mn 1%, Zn 6%, Cu 0.3% and B 0.5% equivalent to Government notified grade-IV (For Fe and Zn deficiency) at 15, 30, 45 and 60 DAS to get higher yield and more economic return.

Year – 2005

Bajra and Wheat

Farmers of Middle Gujarat Zone III (AES-II) following bajra-wheat sequence are advised to apply Zn @ 2.5 kg ha^{-1} in the form of enriched FYM along with recommended dose of NPK application to both the crops in a sequence to obtain higher crop yields in soils having marginal Zn availability. [200 kg FYM composted with 2.5 kg of Zn or 12 kg $ZnSO_4$ and mixing with Biogas slurry @ 1% (2 kg) for 40-45 days is to applied in one hectare land.]

Banana

The Banana growers of Middle Gujarat (AES-II) are advised to give recommended dose of fertilizers (200-100-200 NPK + FYM 10t/ha) which is applied in three equal splits on 3^{rd}, 4^{th} and 5^{th} month of planting. Application of extra N and K each @ 50 g/plant as adopted by some farmers at post shooting was not found better.

BIOFERTILIZER

Gram

The farmers of Middle Gujarat Agro-climatic Zone-III cultivating gram crop (GG-2) are advised to add an application of 75 per cent recommended phosphorus fertilizer @ 30 kg/ha and phosphobacterin culture with adequate organic manure as a basal treatment in conjunction with irrigation in two stages (i.e. branching and pod formation) for getting higher yield as well as higher net profit.

Mungbean

Recommended dose of fertilizers (20-40 N-P kg/ha) may be applied to mungbean for getting higher yield and net return (CBR 3.46). The biofertilizers (*Rhizobium and PSB*) were not better than the chemical fertilizer but gave significantly higher yield than the control.

WATER MANAGEMENT

Year – 2004

Wheat

Farmers of Middle Gujarat Agro-climatic Zone-III, (AES-IX) are advised to irrigate wheat (Var. GW-496) crop (at 50% management allowed deficit) with 4 irrigation

each of 60 mm depth with the schedule of following interval should be applied to get higher yield and net return (CBR 1:2.26).

(a) 1st irrigation just after dry sowing.

(b) 2nd irrigation after 25-30 days followed by 1st irrigation.

(c) Remaining two irrigation at an interval of 30-35 days.

Gram

Farmers of Middle Gujarat Agro-climatic Zone-III (AES-IX) are advised to irrigate Gram (Var. ICCC-4) crop (at 50% management allowed deficit) with 4 irrigation each of 60 mm depth with the schedule of following interval should be applied to get higher yield and net return (CBR 1:3.03).

(a) 1st irrigation just after dry sowing.

(b) 2nd irrigation after 40-45 days followed by 1st irrigation.

(c) 3rd irrigation after 30-35 days followed by 2nd irrigation.

Potato

The farmers growing potato in sandy loan soils (AES : P_{1-2}) of Middle Gujarat Agro-climatic Zone are advised to adopt drip irrigation system for getting 29 per cent higher tuber yield with a saving of 43.3 per cent water. The crop should be fertilized @ 60 per cent of recommended dose (180 kg N/ha) of nitrogen. They should apply 25 per cent of the total nitrogen as basal and remaining 75 per cent through fertigation in 4 equal splits at 10 days interval. The fertigation should be started after 40 days of planting.

The system should be laid out at a spacing of 90 cm (middle of two crop rows) with 4 LPH discharge dripper placed at a distance of 45 cm (six plants per dripper) and operated at 1.2 kg/cm^2 pressure for about 50 minutes on alternate days.

Year – 2005

Mustard

The farmers of Agro-climatic Zone-III (AES-II) of Middle Gujarat growing mustard in Narmada command areas are advised to irrigate crop at node elongation, flowering and pod development stages with 6 cm depth to get more net return

(17031 Rs/ha). Mulching with black plastic was not found better in improving the yield or economics.

Gram

The farmers of Agro-climatic Zone-III (AES-II) of Middle Gujarat growing gram in Narmada command areas are advised to give single irrigation to crop at branching stage with 6 cm depth. When the soil is medium in available phosphorus, the crop may be fertilized with 37.5 kg of P_2O_5 per ha and adequately manured at the time of sowing to get more net return (32181 Rs/ha).

Brinjal

Brinjal (GBH-1) growers of Middle Gujarat Agro-climatic Zone-III (AES-II) are advised to use drip irrigation to irrigate the crop at alternate day for 35 minutes in October and for 25 minutes in November to January (with 60% water saving) and apply liquid fertilizer @ 50 kg N and 25 kg P_2O_5/ha. (with a saving of 50% fertilizer) in 10 equal splits at 6 days interval after 21 days of TP (with 20 t/ha FYM). This practice gave 31.13% higher yield with higher CBR (1:2.06) as compared to flood irrigation system. If liquid fertilizer is not available in the market, urea can be added to the fertilizer tank and SSP can be given as soil application.

The drip may be laid out at lateral pipe at 90 cm and two dripper having 4 lit/hr capacity at 60 cm with a crop spacing of 90 x 60 cm. and operated at 1.25 kg/cm^2.

Banana

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-II), growing banana (cv. Basrai) are advised to apply 40% of recommended fertilizer (liquid fertilizers) in three equal splits during 3rd, 4th and 5th month after planting of banana at 32 days interval through drip. This will result in 20% more yield and 20% saving in water over surface method of irrigation. If liquid fertilizer is not available in the market, urea can be added to the fertilizer tank and SSP can be given as soil application.

The drip system should be operated at 1.25 kg/cm^2 pressure for 2.5 hrs during Oct. to Feb. and 5 hrs during March to on-set of monsoon at alternate

days. The lateral should be placed at 180 cm distance with 2 drippers of 4 lit/hr. The dripper should be placed 30 cm away on either side of the plant.

WEED MANAGEMENT

Year - 2004

Maize and Pigeonpea

The farmers of Middle Gujarat Zone (AES-II) practicing maize-pigeonpea intercropping system are advised to perform three hand weeding at 30, 45 and 60 DAS or inter culturing and hand weeding at 30 and 60 DAS. Under paucity of labours, pre-emergence application of alachlor @ 0.5 kg/ha or oxadiazon @ 0.25 kg/ha is recommended for efficient weed management and better return.

Clusterbean

The farmers of middle Gujarat zone (AES-II) growing clusterbean for seed purpose are advised to do two inter culturing and two hand weeding at 30 and 45 DAS for effective weed control. Under paucity of labours, pre-emergence application of pendimethalin or fluchloralin or trifluralin or butachlor @ 0.5 kg/ha with interculturing at 30 DAS is recommended for efficient weed management.

Year – 2005

Wheat

Farmers of Bhal zone are advised to spray Glyphosate @ 0.4% + 1.5% Ammonium Sulphate for the effective control of 'camel thorn' (*Alhagi camelorum, Fisch*) locally called Jawasia. As this herbicide is nonselective in nature, it should be sprayed on the weed after harvest of the wheat crop.

SOIL AMENDMENT

Year - 2004

Pigeonpea

Farmers of middle Gujarat agro-climatic Zone-III (AES-IX) growing *Kharif* Pigeonpea (BDN-2) in deep black soil are advised to apply 15 t pressmud to improve soil physico-chemical properties (OC, Infiltration, WHC) and maximum grain yield and net realization.

PLANT PROTECTION

AGRICULTURAL ENTOMOLOGY

Year - 2004

Cotton

For the management of pest complex and to conserve entomophage diversity in cotton Hybrid-10, following IPM package is recommended to the farmers of Middle Gujarat Zone (ICBR 1:1.67).

(i) Hand picking of different stages of pests and putting them in 60 mesh wire screen cage twice during peak incidence.

(ii) Interspersing of 10% maize with cotton crop, sowing of cotton and maize should be done simultaneously.

(iii) One release of *Chrysoperla carnea* @ 14,000 larvae (2-3 days old) synchronizing with the appearance of the pests.

(iv) Release of *Trichogramma chilonis* @ 1,50,000 per hectare per week (5 releases), first release should be synchronized with the appearance of the bollworms.

Year – 2005

Chickpea

From the view point of safety to environment and natural enemies, following eco-friendly IPM module is recommended for the control of pod borer (Heliothis*)*, (*Helicoverpa armigera* (Hubner)). Hand pick in chickpea (var. ICCC 4) cultivated in Middle Gujarat, it is found comparatively safer to natural enemies and also found cost effective (ICBR 1:13.03).

1. Installation of T-shaped perches @ 100/ha to attract the predatory birds at two weeks after germination.
2. Spray of neem based formulation 1% EC (Azadirechtin 10,000 ppm) @ 5 ml in 10 liter water (Azadirechtin 0.0005%) on appearance of first instar larvae.
3. Spray of endosulfan @ 0.07% (20 ml endosulfan 35 EC in 10 liter water) at the time of pod on 50% plants.

Brinjal

For effective and economical management of pest complex in brinjal sprays of NSKE 4% at 45, 60, 75, 90 and 105 DATP (ICBR 1:8.11) or application of Neem cake @ 250 kg/ha at 30 DATP + Shoot clipping at weekly intervals + NSKE (4%) sprays at 60, 75, 90 and 105 DATP is recommended for farmers of Middle Gujarat growing brinjal.

Rice

For the management of leaf folder and for conservation of predatory spiders in rice the following IPM package is recommended for farmers of Middle Gujarat Agro-climatic Zone-III (ICBR 1:1.14).

1. Grow tolerant variety Gurjari with recommended dose of chemical fertilizers.
2. Transplant the crop during first fortnight of July.
3. Broadcast wheat/Lucerne straw (80 kg/ha) at 15-20 DAT in paddy field to encourage spiders population.
4. Spray endosulfan @ 0.07% as and when required.

Tobacco

Considering the effectiveness and net return of different insecticidal treatments, two applications (20 and 30 days after germination) of any one of the following insecticides is recommended for the control of *Spodoptera litura* in tobacco nursery under Middle Gujarat conditions.

1. Chlorpyriphos 50%, Cypermethrin 5% (Nurelle D 55% EC) @ 0.11%
2. Alphamethrin 0.015%
3. Quinalphos 0.05%
4. Deltamethrin 0.8% + Endosulfan 32% (Civet 32.8% EC) @ 0.07%

PLANT PATHOLOGY

Year - 2004

Fennel

The farmers of Middle Gujarat are advised to give seed treatment with metalaxyl MZ @ 6 g/kg seeds followed by soil drenching of metalaxyl MZ 0.02%

@ 1 litre/m^2 at seed germination and two more soil drenchings at 10 days interval (ICBR 1:4.49) for the effective management of damping off of fennel in nursery.

Turmeric

For effective management of root-knot nematodes in turmeric, the farmers of Middle Gujarat Agro-climatic Zone are advised to follow soil solarization with 25 µ LLDPE clear plastic film for 15 days in summer (ICBR 1:6.21) or rabbing with bajra husk @ 7 kg/m^2 (ICBR 1:5.18).

Year – 2005

Mungbean

The farmers of Middle Gujarat are advised to spray carbendazim @ 0.05% at 40, 55 and 70 days after sowing (ICBR 1: 8.95) for the management of Macrophomina blight and Cercospora leaf spot diseases of mungbean.

NEMATOLOGY

Ginger

For effective management of root-knot nematodes in ginger, the farmers of Middle Gujarat are advised to follow soil solarization for 15 days in summer with 25 µ LLDPE clear plastic (ICBR 1 : 5.17) or rabbing with bajra husk @ 7 kg/m^2 (ICBR 1 : 3.38).

Tobacco

For effective and economic management of root-knot disease and nematodes in bidi tobacco nursery and thereby increase number of healthy transplants, farmers of Middle Gujarat are advised to drench the nursery with carbosulfan @ 2.5 l/ha 1 DPS + 25 DAS using nematicidal solution @ 2 lit/sq.m. (ICBR 1 : 5.50; Net realization Rs.2,07,728/ha.).

Infection of reniform nematode delayed the growth and development of bidi tobacco seedlings by 38 days causing 22.1% avoidable loss at I^{st} pulling (38 days) and overall loss to the tune of 5.51% in production of transplants.

Maize

Farmers of Middle Gujarat growing *rabi* maize are advised to treat the seeds with *Trichoderma harzianum* @ 4 g/kg seeds having 2 x 10^8 CFU/g carrier (ICBR 1:6.30) OR with benomyl @ 2.5 g/kg seeds before sowing and apply castor and

neem cake each @ 250 kg/ha in open furrows 15 days prior to seeding (ICBR 1:4.84) for effective and economic management of stalk rot and nematodes (stunt and lesion) and to achieve highest grain and fodder yield.

DAIRY SCIENCE, AGRICULTURAL ENGINEERING & PROCESSING

AGRICULTURAL ENGINEERING & PROCESSING

Year - 2004

The tractor operated multi elevator platform attachment is recommended for the use by farmers and orchard owners for efficient harvesting of fruits, the attachment being a versatile and reliable worker positioning system may also be used for many alternate uses such as tree pruning, spraying, cleaning etc.

The food processing entrepreneurs interested in dehydration of vegetables are recommended to use the technology for the production of dehydrated fenugreek. The product obtained is acceptable to the consumers and it is superior to the sun dried product. The technology is simple and economically viable.

The food processing entrepreneurs interested in dehydration of aonla are recommended to use the technology for the production of dehydrated aonla. The product obtained is acceptable to the consumers and it is superior to the sun dried product. The technology is simple and economically viable.

Year – 2005

The farmers and entrepreneurs desiring to install and use a greenhouse in hot and dry climatic conditions of Middle Gujarat are recommended to use following design parameters to obtain higher efficiency of environmental control.

1. Greenhouse should have at least 15% of floor area as rooftop ventilation with a provision to close it during the night.

2. Greenhouse should be covered with only 50% shade net at least during March to June between 10.00-16.00 hrs. The shade net should be fixed 0.5 m above the roof.
3. Evaporative cooling pad should be fixed on the West side of the greenhouse along with matching exhaust fan giving 1-1.5 air change per minute to be fixed on the East side of the greenhouse and should be used in the month of March, April & May.

The Jetropha seed dehuller developed at A.P.P.E. Unit, Anand is recommended for the use of farmers and concerned entrepreneurs for dehulling of Jatropha seeds. The developed machine has higher capacity as compared to manual dehulling and is efficient and economical in dehulling the Jatropha seeds.

The entrepreneurs interested in production of Jatropha seed oil are recommended to use the oil expression technology developed by A.P.P.E., Anand for the maximum recovery of oil from Jatropha seed.

The farmers of the Bhal region are advised to use the ridge former attachment developed for the field drilling of cotton seeds on the ridges in order to save the seedlings from stagnation of rain water in the field for getting requisite plant population and higher cotton yield.

DAIRY SCIENCE

Year - 2004

To produce uniform and good quality Chhash (from skim milk) with improved shelf life, it is recommended to employ *Streptococcus thermophilus (HST)* and *Lactobacillus delbrueckii* subsp. bulgaricus (LBW) starter culture in proportion of 1:1 @ 2.0% (v/v) of skim milk. The desirable level of total solids in Chhash is 7.0% and preferred acidity 0.6% L.A. To prevent / retard the whey separation,

either sodium alginate or guar gum can be employed at the rate of 0.05% (w/v) of Chhash. For improving the shelf life of Chhash, it can be homogenized (at 60^{o}C and 100 kg/cm^{2} pressure) and heat-treated at 75^{o}C / 5 min in Batch method or 75^{o}C/16 sec in HTST method. In order to improve the taste of the product, cumin in the form of powder (< 250 µm) and common salt can be employed at the rate of 0.4 and 0.5% (w/v) of Chhash, respectively. Fresh whey can be used up to the rate of 20% (v/v) of dahi in making Chhash.

It is recommended to replace 25% of gram flour with equal proportion of the papain modified soya flour and whey protein concentrate (WPC) in preparing Sev (noodles) with improved nutritive value. Microwave heating (450 W for 3 min and with dual cooking setting) is a better alternative to deep fat frying and hence is recommended.

Low cost vaccum bottle filler, a simple machine for filling any general fluid in bottle, has been fabricated and is recommended for small scale industry.

The batch type SSHE fabricated for kneading cum cooking of Chhana-sugar mixture is recommended for mechanized production of Sandesh.

Year – 2005

The ultra filter deproteinized and lactose hydrolyzed Cheddar Cheese Whey (unsalted) permeate-based beverage with acceptable quality can be prepared using mango pulp (15%), sugar (5%), stabilizer (guar gum 0.1%) and sodium benzoate (0.03%) and the pH maintained at 4.0 using citric acid solution. The pasteurized (72^{o}C / 15 sec) product, packaged in pre-formed polyethylene pouches can be stored safely upto 35 days at 7±2^{o}C.

Packaging of khoa in multiplayer co-extruded film (PET 12 µm: white/opaque polyethylene, 45 µm adhesive GSM 2.5) pouches without any treatment but

storing at 5±2^{o}C give shelf life of 14 days. Packaging the same khoa under vacuum (730 mm) or incorporation of 0.1% potassium sorbate (if permitted) increases the shelf-life upto 21 days at 5 ± 2^{o}C.

By vacuum packaging in PET:PE pouches, paneer can be stored for 4 weeks at refrigeration temperature (7 ± 2^{o}C). The shelf-life can be further extended to 6 weeks by dipping in 20% brine for 10 minutes and vaccum (730 mm) packaging.

Chhash can be made from double toned milk supplemented with 20% mozzarella cheese whey and by fermentation using combination of Str. thermophilus MD2 :Str. thermophilus D16 : Lb. acidophilus V3 (0.80: 0.80: 0.40). Heat treatment of chhash at 60^{o}C for 5 min extends the shelf-life of chhash upto 25 days at refrigerated storage 5±2^{o}C.

VETERINARY SCIENCE

ANIMAL PRODUCTION

Year - 2004

Four percent urea treatment of roughage left over with supplementation of molasses/salt can meet energy needs of non-producing large ruminants. However, it is advisable to feed 0.5 kg protein and phosphorus rich feed (e.g. groundnut cake) to each animal per day to meet their protein and phosphorus requirements.

Complete feed with 42 % threshed wheat straw, 25 % de oiled groundnut cake, 10 % Prosopis juliflora pods, 8 % rich polish, 12 % molasses, 2 % mineral mixture and 1 % salt can be used as ration for calves without any adverse effect on growth, rumen fermentation and digestibility. It reduces feed cost per kg gain by 33 % over conventional system of feeding.

Guttan panic grass hay provided 1.64% DCP and 60.43% TDN on dry matter basis.

Year – 2005

Incorporation of Mango seed kernel @ 10% in broiler starter feed improves feed efficiency by 11.52% with 25.68% more return over feed cost.

The broiler birds can be reared economically on rice husk litter material by feeding 2879 (BS)-2941 (BF) ME energy and 22.12% (BS) – 19.87% (BF) protein ration to harvest 207% return over feed cost.

The average Animal Housing Index on 28 point scale in middle and south Gujarat was 14.38 i.e. nearly 50% comfort. At present more than 75% farmers provide roof of animal houses at less height (5 – 6 feet) with no manger and uneven earthen floor. To improve the micro-climate of rural animal houses, the height of the roof should be 8 – 10 feet, provision of manger and slope even earthen / brick on edge floor.

The body condition score (BCS) of high milk producer cows and buffaloes ranged from 2.0 to 4.5 cm on 5 point scale. While the desirable BCS is 3.0 to 3.5. More than 85% of the farmers were not feeding mineral mixture and their animals showed energy deficit to high producers. Thus, balanced mineral mixtures daily @ 35 to 50 grams per cow / buffalo and one kilogram grain bharda or cake should be fed to improve both milk production and reproductive efficiency.

During the year, the availability of green sugarcane tops is for 5 months i.e. November to March. It contains 34.24% moisture, 5.97% CP, 1.55% EE, 34.49% CF, 52.29% N FE and 5.7% Ash. While dry sugarcane tops contains moisture 5.5%, CP 5.42%,; EE 1.5; CF 35.5; NFE 51.56 and Ash 6 %. The sugarcane tops can be fed safely 15 – 20 kg daily to medium to high producers for 5 months without any adverse effect on milk yield, BCS, Hemoglobin and Blood sugar.

ANIMAL HEALTH

Year – 2005

Dairy farmers are advised to breed the bovines by 7^{th} weeks postpartum to optimize the intercalving period. Animals not observed in oestrus, by this time are required to be examined gynaeco-clinically by veterinarians for inducing estrus and the subsequent breeding.

SOCIAL SCIENCE

Year – 2005

Effort should be made by cold storage owners to minimize the spoilage of potato during cold storage. The concerned scientist should carry out the research with an objective to minimize the spoilage of potato kept in cold storage.