RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS

YEAR 2006 & 2007

DIRECTORATE OF RESEARCH
ANAND AGRICULTURAL UNIVERSITY
ANAND 388 110

Citation
Research Accomplishments and Recommendations 2006 and 2007
Anand Agricultural University
Anand 388 110

Published by
Directorate of Research
Anand Agricultural University
Anand 388 110

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Year of Publication
August, 2007

Copies
500

Printed at

ANAND AGRICULTURAL UNIVERSITY
ANAND 388110

MESSAGE

It is my pleasure to bring out "Research Accomplishments and Recommendations of 2006 & 2007 " covering different technologies developed by Scientists of Anand Agricultural University considering Agro ecological conditions for the benefit of farming community. This booklet will serve as source for line departments, NGOs and students working for the betterment of farming community.

I express my heartfelt congratulations to our scientists who dedicated themselves for developing these technologies and Director of Research and his team for compilation of all these technologies and publishing in a book form.

(M. C. VARSHNEYA)
VICE CHANCELLOR

ANAND AGRICULTURAL UNIVERSITY
ANAND 388110

FOREWORD

As Director of Research and Dean PG Studies, I feel immense pleasure to put forward the second "Research Accomplishments and Recommendations of 2006 & 2007" involving technologies developed by Scientists of Anand Agricultural University.

Technologies which are need based for enhancing the Agricultural and related fields productivities for the welfare of farmers and rural communities of Gujarat have been developed by the scientists of this University.

I complement and congratulate all the scientists' workers of Anand Agricultural University for their sincere efforts, dedication and competent service for developing technologies in the field of Agriculture and related areas for the benefit of farming community.

(A. R. PATHAK)
DIRECTOR OF RESEARCH & DEAN
FACULTY OF P.G.STUDIES

PREFACE

Nevertheless, agriculture as a human endeavor dates back to several millennia in past, yet even in this modern era, it is still important source of employment and livelihood for significant proportion of National population.

Gujarat State is one of the most prosperous states as Agriculture growth rate is 11 % at constant price of 1990-2000 against less than 2% of National growth rate in Agriculture. For this spectacular advancement, the role of newer technologies is of great importance.

Sincere, dedicated and hard efforts of our scientists resulted into valuable recommendations for farmers and scientific communities which have been filtered, rectified and decorated by exhaustive meaningful and healthy deliberations in various sub committees.

The total research work conducted during 2005-06 and 2006-07 by the scientists of Anand Agricultural University has been very well churned to bring out useful and fruitful recommendations for farmers and scientific community.

Over all, there have been heartening developments in research of certain areas such as Animal and Agril. Bio-technology, crop improvement, crop protection, fermented dairy products, pesticide residue, animal nutrition, livestock research etc.

It is a high time to intensify and diversify our research to cover maximum areas of research in agricultural, animal science and dairy science, so that solution to most of the burning problems can be given to farmers/animal keepers in time. Our scientists have capability to face new challenges adequately and use them as opportunity to improve the quality and capacity.

Present situation, where New International Trading Regime under the WTO and export opportunities have influenced the paradigm shift in the agriculture from:

- Productivity to profitability
- Subsistence to commercial agriculture
- Green revolution to evergreen revolution
- Commodity oriented to farming system
- Local market to export oriented

- Technology to eco-technology
- Mono-cropping to crop diversity
- Supply driven to demand driven
- Exploitative to sustainable agriculture
- Raw material to value addition

Looking to these shifts, it is now time to have participatory, demand driven, location specific research and extension for promotion of farmer.

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	
	2006	*2007*
Crop Improvement	**01**	**07**
Crop Production	**28**	**14**
Plant Protection	**06**	**08**
Dairy Science, Agri. Engineering & Processing	**06**	**05**
Animal Production	**06**	**09**
Animal Health	**-**	**01**

2006

I CROP IMPROVEMENT

Rice: Ashoka - 200F

The variety was endorsed for cultivation under rainfed drilled (upland) rice growing areas of South and Middle Gujarat. It exhibited 16, 13 and 40 per cent yield advantage over GR-8, IRTP-10800 and Hira, respectively. It matures in 85-90 days with average grain yield of 1500-2000 kg/ha. It possesses long slender grains with 1000 grain weight of 19.5 – 20.5 g. The variety has been evolved through Farmers Participatory Research Programme.

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

II CROP PRODUCTION

[A] CULTURAL PRACTICES

1. Fodder *bajra* – cutting interval

The farmers of Middle Gujarat Agro-climatic Zone- III (AES-II) growing summer forage *bajra* (AFB-1 or AFB-2/GFB-1) are advised to take four cuts at an interval of 40 + 25 + 25 + 25 days and harvest the crop at a cutting (stubble) height of 15 cm above the ground for higher forage production with better quality and net realization.

(Asso. Research Scientist (Agro.), Forage Res. Project, AAU, Anand)

2. Castor – spacing

Farmers of Middle Gujarat Agro-climatic Zone - III (AES - II) growing hybrid castor (GCH – 5) under irrigated condition are advised to adopt 150 x 60 cm or 150 x 75 cm spacing and apply 60 kg N/ha besides basal application of FYM @ 12.5 t/ha and 50 kg P_2O_5/ha for securing maximum production and higher net realization.

(Asso. Research Scientist (Agro.), NARP, Agronomy, AAU, Anand)

3. Chilli-spacing and seed rate for nursery

Farmers of Middle Gujarat Agro-climatic Zone-III(AES-II) growing chilli (cv. S-49) are advised to adopt 5 cm spacing between row with 1.0 kg seed/100 m^2 for raising healthy seedlings in nursery and to get higher green fruit yield and profit.

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

[B] CROPPING SYSTEM RESEARCH

4. Rice – Wheat sequence - N and Zn application to rice

Farmers of Middle Gujarat Agro-climatic Zone-III (AES-II) practicing rice (*Gurjari)* – wheat (GW – 496) sequence are advised to apply 125 kg N/ha along with $ZnSO_4$ @ 12.5 kg/ha in rice and recommended dose of nitrogen (120 kg/ha) to wheat on soils having marginal Zn and high available P_2O_5 status for getting higher yield of rice as well as wheat and profit of the sequence.

(Asso. Research Scientist (Agro.), Main Rice Research Station, Nawagam and Asso. Research Scientist, Micronutrient Project, AAU, Anand)

5. Bajra – cabbage sequence – sewage sludge

The farmers of Middle Gujarat Agro-climatic Zone – III (AES - II) practicing *bajra* (MH –179) – cabbage (Golden acre) sequence using sewage sludge as organic manure are advised to apply 2.5 t/ha treated sewage sludge along with 10 t FYM/ha besides recommended dose of NPK in *bajra* (80-40-0 kg/ha) and cabbage (75-37.5-0 kg/ha) to get higher yield and net return with a minimum risk to soil health.

(Asso. Research Scientist, Micronutrient Project, AAU, Anand)

6. Potato – summer pearl millet sequence – cow dung slurry

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-II) following potato (Kufri lauker) – summer pearl millet (GHB – 316) cropping sequence are advised to fertilize potato crop with 150 kg N/ha + 7.5 t/ha cow dung bio-gas slurry along with the recommended dose of P_2O_5 (100 kg/ha) and K_2O (200 kg/ha) and recommended dose of NPK (80-40-0 kg/ha) to pearl millet to get higher yield and economic return.

(Asso. Research Scientist RRS, Anand and Asso. Research Scientist, Micronutrient Project, AAU, Anand)

7. Lucerne + *Pandadiu* mix cropping

The farmers of Middle Gujarat Agro-climatic Zone- III (AES-II) growing lucerne (GAUL –1) and *pandadiu* (Wild chicory local) crops are advised to adopt mix cropping of lucerne and *pandadiu* with 5 kg/ha seeds of each crop along with 30 kg N/ha as a basal and 15 kg N/ha after alternate cut to obtain higher green forage, dry matter, crude protein yield and net realization (A common basal application of 10 t FYM/ha + 50 kg P_2O_5/ha should also be given to the crop).

(Asso. Research Scientist (Agro.), Forage Research Project, AAU, Anand)

8. Sorghum + Cowpea

Farmers of Bhal and Coastal Agro-climatic Zone-VIII (AES-II) growing sorghum alone are advised to sow the *kharif* sorghum (SSG-59-3) with cowpea (GFC-3) intercropped in 2:1 row ratio and fertilize it with 40 kg N/ha and 15 kg P_2O_5/ha to secure higher forage yield with good quality and higher returns under rainfed condition.

(Asso. Research Scientist (Agro.), Agriculture Research Station, AAU, Arnej)

[C] NUTRIENT MANAGEMENT

9. Rice – organic manure

The farmers of Middle Gujarat Agro-climatic Zone-III (AES – II) growing rice (GR-11) are advised to use organic fertilizer in conjunction with chemical fertilizer (75% N from Urea + 25% N from castor cake) for obtaining higher grain yield and net profit. The farmers interested in organic farming are advised to use organics *viz.*, green manure (*Sesbania*) or 100 per cent N through castor cake for getting higher yield, better quality and more economic return besides improvement in physical and chemical properties of soil.

(Asso. Research Scientist (Agro.), Main Rice Research Station, AAU, Nawagam)

[D] MICRONUTRIENT

10. Drilled paddy Fe- chlorosis management

Farmers of Middle Gujarat Agro- climatic Zone - III (AES - II) growing drilled paddy (GR – 5) having problem of Fe-chlorosis are advised to give four sprays of $FeSO_4$ @ 1.0 per cent without neutralization starting from 15 to 20 days after sowing at an interval of 8 to 10 days to get higher yield and net return.

(Asso. Research Scientist, AAU, Derol & Asso. Research Scientist Micronutrient Project, AAU, Anand)

11. Groundnut (Summer)- sea weed liquid fertilizer

The farmers of Middle Gujarat Agro-climatic Zone – III (AES- II), growing summer groundnut (GG.2) on soils having marginal status of Zn and Fe are advised to spray 1% of multi micronutrients mixture (Fe 2%, Mn 0.5%, Zn 4.0%, Cu 0.3% and B 0.5% equivalent to Govt. notified general grade-I) or sea weed liquid fertilizer (SLF) @ 1.5% at 15, 30 and 45 days after sowing to get higher groundnut yield and profit.

(Asso. Research Scientist, Micronutrient Project, AAU, Anand and Res. Officer, Fisheries Res. Station, JAU, Okha)

12. Cabbage – micronutrient

The farmers of Middle Gujarat Agro-climatic Zone - III (AES-II) growing cabbage (var. Golden acre) on soils having marginal Fe and Zn status are advised to spray 1% of foliar grade of micronutrients mixture 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 15, 30, 45 and 60 days after transplanting to get higher yield and economic return.

(Asso. Research Scientist, Micronutrient Project, AAU, Anand)

[E] BIOFERTILIZERS

13. Maize (*kharif*)

Farmers of Middle Gujarat Agro-climatic Zone-III (AES-III) growing *kharif* maize (GM-4) are advised to inoculate seeds with *Azospirillum lipoferum* (ASA -1) and *Torulospora globosa(* PBA -22) or *Bacillus coagulans* (PBA -16) having 10^8 CFU/g carrier @ 30 g culture/ kg seed before sowing along with soil application of 40 kg N/ha and 20 kg P_2O_5/ha to save 20 kg each of N and P for higher yield and economic return.

(Asstt. Research Scientist., Maize Research Station, AAU,Godhra and Asso. Research Scientist, Bio-fertilizer Project., AAU, Anand)

14. Pigeonpea

Farmers of Middle Gujarat Agro-climatic Zone -III (AES-II) growing pigeonpea (BDN-2) in *kharif* are advised to use

(i) RDF + *Rhizobium* (RBA-5) + *Azotobacter* (ABA-1) OR

(ii) RDF + *Rhizobium* (RBA-5) + *Azotobacter* (ABA-1) + phosphorus solubilizer (PBA-22) through either seed treatment (30 g/kg seed) or soil application (5 kg/ha) for getting higher yield and net return.

(Asso. Research Scientist (Ag.Chem.), IFFCO chair, Asso. Research Scientist (Agro.), RRS, & Asso. Research Scientist, Bio-fertilizer Project, AAU, Anand)

15. Sugarcane

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-II) growing sugarcane (Co-6304) are advised to fertilize the crop with 150 kg N + 125 kg P_2O_5 + 125 kg K_2O/ha and use sugarcane sets for planting after a

treatment of *Acetobacter diazotrophicus* ACG-2 (containing 10^8 CFU/g carrier) @ 4 kg/ha to save 100 kg N/ha for higher cane yield (14%) and net return.

(Asstt. Research Scientist (Agro.), ARS, AAU, Thasra and Asso. Research Scientist, Biofertilizer Scheme, AAU, Anand)

[F] WATER MANAGEMENT

16. Okra – drip irrigation

The farmers of Middle Gujarat Agro-climatic Zone–III (AES – II) growing okra (cv. GOH-1) during summer are advised to adopt drip irrigation to save 60 per cent irrigation water without affecting yield. They are also advised to fertilize the crop with 100 kg N/ha and 25 kg K_2O/ha by water soluble fertilizers in six equal splits starting from 21 days after sowing at six days interval.

The crop should be sown in triple row group at 30 cm distance and 60 cm between two groups keeping plant to plant distance at 15 cm. The system should be laid out at 16 mm lateral size at 1.2 m and 2 drippers (4 LPH) at 45 cm distance. This system should be operated at every two days interval at 1 hr and 50 minutes duration through out the crop season.

(Asstt. Prof., Department of Horticulture, BACA, AAU, Anand)

17. Cotton (deshi / hybrid)

Farmers of the Bhal and Coastal Area Agro-climatic Zone-VIII (AES–II) are advised to give two irrigations each of 60 mm at 20 and 40 days after withdrawal of monsoon to deshi (G.Cot.13, G. Cot.21) and hybrid (Hy.-6, Hy.-8 and Hy.-10) cotton for securing higher seed cotton yield.

(Asso. Research Scientist (Agro.), Agriculture Research Station, AAU, Arnej)

18. Mustard

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-III) cultivating mustard (GM-2) in Narmada command are advised to irrigate the crop at sowing, node elongation, flowering and pod development stages with 5 cm depth to get higher net return. Use of black plastic mulch gave higher yield, but not economical.

(Asstt. Research Scientist, Paddy Research Station, AAU, Dabhoi and Research Scientist, SWMP, NAU, Navsari)

19. Gram

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-III) cultivating gram (var. GG-2) in Narmada command are advised to irrigate the crop with canal irrigation at branching stage to get higher yield as well as higher profit.

(Asstt. Research Scientist, Paddy Research Station, AAU, Dabhoi and Research Scientist, SWMP, NAU, Navsari)

20. Wheat - canal irrigation

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-III) cultivating wheat (var. GW-496) in Narmada command are advised to irrigate

the crop with canal irrigation of 60 mm depth at critical growth stages of CRI, milking, dough and grain filling stages besides one irrigation at sowing to achieve higher yield and net profit. In order to save the water, four irrigations at sowing, CRI, flowering and dough stages are also advised.

(Asstt. Research Scientist, Paddy Research Station, AAU, Dabhoi and Research Scientist, SWMP, NAU, Navsari)

21. Tomato - IW/CPE ratio and mulch

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-II) in Narmada command growing tomato (Namdhari-2535) are advised to give total 11 irrigations each of 60 mm depth @ 1.0 IW/CPE ratio at an interval of 15 days during December and January and 11 days during February upto last picking for getting higher yield (27% more) and net return. They are also advised to mulch the crop either with paddy straw @ 5 t/ha or black plastic for getting higher net return.

(Asstt. Research Scientist, Agricultural Research Station, AAU, Thasra and Research Scientist, SWMP, NAU, Navsari)

22. Castor

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-II) in Narmada command area growing castor (GCH-5) (late *kharif*) are advised to give total five irrigations each of 50 mm in all furrow at an interval of 25 to 30 days to get higher yield (17.4%) and net profit (29.8%). Use of black plastic mulch is beneficial which gave higher yield, but found uneconomical.

(Asstt. Research Scientist, Agricultural Research Station, AAU, Thasra and Research Scientist, SWMP, NAU, Navsari)

23. Maize (*rabi*)- sprinkler

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-II) growing *rabi* maize (GM-3) in Narmada command area are advised to give 7(1+6) irrigations through sprinkler to get higher yield (27.0%) and net return (38.0%). The first irrigation should be given at the time of sowing and remaining six irrigations should be given at an interval of 17 days. However, to save 26% water, 5 (1 + 4) irrigations should be given through sprinkler to get 15 % higher yield and net return (16%). First irrigation should be given at the time of sowing and remaining four irrigations should be given at an interval of 25 days. The sprinkler system should be laid at 12 × 12 m spacing and should be operated at 2.75 kg/cm^2 pressure to achieve 1.67cm/hr application rate. The system should be operated for a period of three hours.

(Asstt. Research Scientist, Agricultural Research Station, AAU, Thasra and Research Scientist, SWMP, NAU, Navsari)

24. Cabbage (*rabi*) – okra (summer) ; drip irrigation

The farmers of Middle Gujarat Agro-climatic Zone-III (AES-II) in Narmada command area are advised to adopt drip system in cabbage (*rabi*)- okra (summer) crop

sequence. In cabbage, irrigation should be applied at 0.8 PEF (drip) to get higher yield (29.5%), net return (31.2%) and water saving (14.5%). Okra should be irrigated at 0.6 PEF (drip) to get higher yield (28%), net return (29.7%) and water saving (59%). The drip system should be laid out at a lateral distance of 0.90 m (in alternate row) and dripper (4.0 LPH) spacing at 0.60 m.

Cabbage (cv. Golden acre) should be planted across the lateral line and system should be operated at 1.2 kg/cm^2 pressure for 50 minutes on alternate day.

Summer Okra (cv. Parbhanikranti) should be sown along the lateral line and system should be operated at 1.2 kg/cm^2 pressure for 75 minutes on alternate day.

(Asstt. Research Scientist, Agricultural Research Station, AAU, Thasra and Research Scientist, SWMP, NAU, Navsari)

[G] HORTICULTURAL CROPS

25 Banana

Banana (cv. Basrai) growers of Middle Gujarat Agro-climatic Zone -III (AES–II) are advised to apply 50 g $FeSO_4$ + 40 g $ZnSO_4$ per plant as basal on soils having marginal status of Zn and Fe along with the recommended dose of 200 + 100 + 200 g NPK + 10 kg FYM per plant to obtain higher yield of quality fruit with higher net return.

(Professor & Head, Department of Horticulture, BACA, and Asso. Research Scientist (Micronutrient), AAU, Anand)

26. Spider lily

The spider lily growers of Middle Gujarat Agro-climatic Zone – III (AES-II) are advised to apply 25 t/ha farm yard manure with 150 kg N/ha in form of castor cake as a basal dose in month of July. After 60 days, 150 kg N/ha should be applied through urea for getting higher flower production and net profit.

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

27. Safed musli

Farmers of Middle Gujarat Agro-climatic Zone-III (AES-II) who wish to cultivate *safed musli (Chlorophytum borivillianum)* are advised to plant single fasciculated root at 10 cm x 10 cm spacing to get higher production of fasciculated roots with higher net profit.

(Research Scientist, Medicinal and Aromatic Plants Project, AAU, Anand)

28. Shankhpushpi

Farmers of middle Gujarat Agro-climatic Zone-III (AES-II) who wish to cultivate *Shankhpushpi (Convolvulus microphyllus)* are advised to sow *Shankhpushpi* in the first week of July and commence the harvest in the month of October with subsequent two harvests at ground level keeping 90 days interval i.e. in January and April to get higher yield as well as good quality with higher net profit (Sowing of 400 g seed/ha during onset of monsoon at a spacing of 45 cm is necessary).

(Research Scientist, Medicinal and Aromatic Plants Project, AAU, Anand)

III PLANT PROTECTION

[A] PLANT PATHOLOGY

1. Potato early blight

The farmers of middle Gujarat growing potato are advised to manage the early blight disease by spraying propineb @ 0.2 per cent (ICBR 1: 6.58) thrice i.e. first spray at the initiation of the disease and subsequent two sprays at 15 days interval.

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

2. Root rot management in forage cowpea

The farmers of middle Gujarat are advised to give seed treatment of carbendazim @ 2.0 g/kg seed (ICBR 1:128.66) for the management of root rot in forage cowpea.

(Asstt. Research Scientist (Plant Patho), Forage Research Station, AAU, Anand)

[B] AGRICULTURAL ENTOMOLOGY

3. Mango hopper

The mango growers of middle Gujarat who want to use neem based formulations are advised to spray azadiractin based EC formulation at 0.0018 per cent or neem seed kernel extract at 5 per cent or neem oil at 0.5 per cent for the management of mango hopper.

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

4. Lucerne pest

For the effective and economic control of *Spodoptera litura*, *Helicoverpa armigera* and rust disease in lucerne, following module is recommended:

i. Raising of marigold (0.5 m apart) on border and bunds in the field.
ii. Raising the castor plants (3.0 m apart) on border and bunds in the field.
iii. Application of NSE 5 per cent and mancozeb 0.2 per cent at the time of flowering.
iv. Application of HaNPV and SlNPV @ 250 LE/ha at the time of appearance of 2 larvae/m^2 followed by application of mancozeb 0.2 % (ICBR 1:3.87).

(Asso. Research Scientist (Ento) Forage Research Project, AAU, Anand)

5. Chilli thrips

For effective and economical management of chilli thrips, alternate spray of triazophos @ 0.04 %, imidacloprid @ 0.005 % and acephate @ 0.075 % following ETL (1 thrips/leaf) is recommended to the farmers of Middle Gujarat (ICBR 1 : 8.51).

(Asstt. Research Scientist (Ento), Vegetable Research Station, AAU, Anand)

6. Okra mites

For effective and economic management of mites in okra, two sprays of fenazaquin 0.01 % (ICBR 1:3.67) or difenthiuron 0.05 % (ICBR 1:3.98), first spray at appearance of mites and second after 10 days of the first spray are

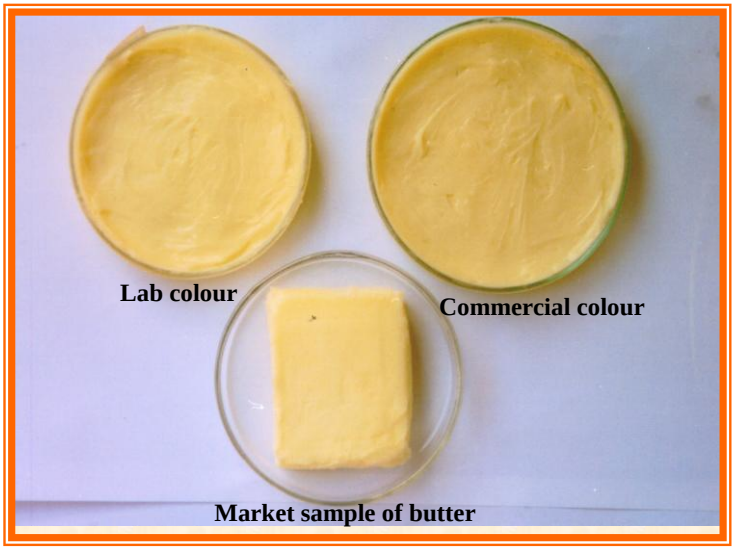
recommended in addition to previously recommended acaricides i.e. wettable sulphur 0.125% (ICBR 1:16.11) and dicofol 0.03% (ICBR 1:7.79).

(Asstt. Research Scientist (Ento), Vegetable Research Station, AAU, Anand)

IV DAIRY SCIENCE, AGRIL. ENGINEERING AND PROCESSING

[A] DAIRY SCIENCE:

1. Peanut spread



Protein enriched peanut spread can be prepared employing the traditional method by partially replacing roasted groundnut seeds with Defatted Groundnut Flour (DFGF) and Whey Protein Concentrate (WPC) along with sugar and salt without compromising on sensoric characteristics as compared to the control. The product has a better nutritional value (higher protein content, lower fat and improved essential amino acid content) and better stability.

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

[B] AGRICULTURAL ENGINEERING

2. Fruit grader

The precision weight base grader for selected fruits is recommended to the farmers and concerned entrepreneurs for grading of fruits. The developed machine has high capacity as

compared to manual grading. It is also efficient and economical in grading of the fruits especially irregular shape fruits such as mango.

(Professor & Head, APPE, AAU, Anand)

3. Banana

Growers and suppliers of banana cv. Robusta are advised to pre-cool (7 ^{O}C) the bunches for extension of its self life. The pre-cooled banana can be stored up to 24 days under cold storage (13.5 $\pm$ 0.5 ^{O}C and 85 to 90 % RH) or up to 19 days under evaporative cooled storage conditions. However, pre-cooling is not suggested for banana to be stored under ambient storage condition.

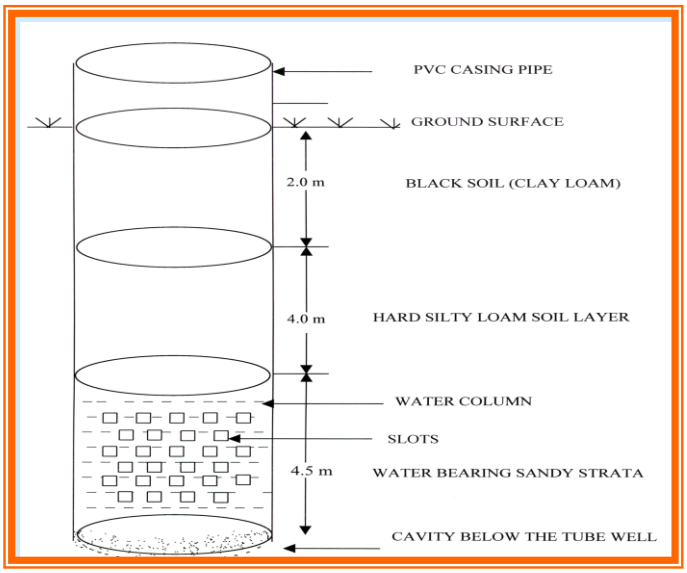
(Professor & Head, APPE, AAU, Anand)

4. Biogas

The standard KVIC design biogas plant has been modified with replacing the masonry work of the digester by a 3000 µ HDPE film lining. The modified version developed is cheaper by about 36 % as compared to the standard KVIC biogas plant of the same size and also requires 22 per cent less time for its installation.

(Professor & Head, APPE, AAU, Anand)

5. Groundwater recharging system



The farmers of Bhal region are advised to use groundwater recharging system using tube well with sand stone filter made of five layers, each of 30 cm thickness of various sized stones, aggregates and coarse sand for filtering the runoff water available during rainy season from 5 hectares of land to recharge and improve the quality of groundwater. The farmers can obtain about 45 – 50 per cent additional yield and income by utilizing the recharge water.

(Asso. Research Scientist, Agriculture Research Station, AAU, Arnej)

6. Deep tillage with MB plough

The farmers of Bhal region are advised to perform deep tillage up to 30 cm with mould board plough at conducive field condition for tillage after considerable rainfall in the month of June in order to conserve more soil moisture in black soil of Bhal region and subsequently 26 per cent higher grain yield of wheat as compared to that under conventional tillage.

(Asso. Research Scientist, Agriculture Research Station, AAU, Arnej)

V ANIMAL PRODUCTION

1. Buffalo feed

A. The lactating buffaloes of Satlasana, Becharaji and Kadi talukas yielding above five liters of milk per day were underfed for energy and that of Becharaji and Kadi for both, protein and energy. Hence, the farmers of Satlasana are advised to feed additional 1.25 kg grain or grain by product and that of Kadi and Becharaji to feed 1.25 kg grain or grain by product with 0.5 kg oil cake.

(Research Scientist, Animal Nutrition Research Station, AAU, Anand)

B. During summer, the protein intake of dry buffaloes was found short of the requirement in Satlasana, Kadi and Becharaji talukas of Mehsana district. The farmers are advised to feed additional 1.0 kg compound concentrate mixture to bridge this gap.

(Research Scientist, Animal Nutrition Research Station, AAU, Anand)

2. Buffalo & cow feed

The farmers of Dediyapada taluka of Narmada district are advised to feed additional 1.0 kg compound concentrate mixture to the lactating buffaloes. The cow heifers and dry cows of Dang and buffalo heifers of Narmada district should be fed additional 250 g oil cake or 500 g compound concentrate mixture. The farmers of Halvad taluka of Surendranagar district are advised to feed 2 kg compound concentrate mixture or 1 kg oil cakes to their lactating buffaloes giving more than 5 kg of milk and compound concentrate mixture 1.5 kg to buffalo heifers and 1 kg to cow heifers.

(Research Scientist, Animal Nutrition Research Station, AAU, Anand)

3. Zinc supplement to Animals

To ensure adequate supply of zinc, the farmers of Dang, Valsad, Narmada and Surendranagar districts are advised to supplement mineral mixture as per BIS specifications i.e. daily @ 40 g to their lactating cows, buffaloes and pregnant animals and 30 g to heifers and bullocks.

(Research Scientist, Animal Nutrition Research Station, AAU, Anand)

4. Purchasing of concentrate mixtures

The farmers of Mehsana district are advised to be cautious while purchasing some private compound concentrate mixtures as these are low in protein and high in crude fiber and silica content. Similarly, Maize bharda sold in local market is also found adulterated and poor in nutritive value.

(Research Scientist, Animal Nutrition Research Station, AAU, Anand)

5. Hormonal application in Goat

In non-breeding seasons hormonal applications (Progesterones and Pregnant Mare Serum Gonadotropin combinations) can induce estrus up to 75 per cent in goats with kidding rate of 35-38 per cent.

(Research Scientist, Reproductive Biology Research Unit, AAU, Anand)

2007

I CROP IMPROVEMENT

1. RICE: DDR-97 (ADR-1)

The culture DDR-97(ADR-1) showed 21.7 % and 26.5 % yield superiority over check varieties GR-5 and GR-9, respectively in middle Gujarat (Zone-III). Similarly, in south Gujarat (Zone II) it displayed 10.2 % yield increment over the popular check GR-5. Besides, it is early maturing, drought tolerance, with good grain quality is recommended for rainfed / drilled rice growing areas of Middle and South Gujarat.

(Research Scientist (Rice), AAU, Nawagam)

2. COWPEA: CYACP65 (AVCP-1)

The culture CYACP65 (AVCP-1) has given 73.70 q/ha green pod yield under middle Gujarat condition which was 99.14 and 161.73 per cent higher over check varieties, Pusa Falguni and

GC 4, respectively. The genotype was found resistant to viral diseases, moderately resistant to root knot nematodes with better pod quality. It is recommended for its release in Middle Gujarat agroclimatic zone.

(Research Scientist (Vegetable), AAU, Anand)

3. CHILLI: ACS-01-4 (AVC (NP)-131)

The variety AVC(NP)-131 (7039 Kg/ha) gave 43.2 and 51.7 per cent higher green fruit yield over the checks SG 5 and KTPL 19, respectively. It is recommended for its cultivation in Middle Gujarat. It is having zero pungency of green fruits, higher fruit yield and better quality.

(Research Scientist (Vegetable), AAU, Anand)

4. PIGEONPEA: ANDT-3 (AVT-1)

The variety ANDT-3 (8272 Kg/ha) registered 32.6, 36.2 and 18.1 per cent higher yield over GT 100 (6652 Kg/ha), GT 101 (6929 Kg/ha) and GT1 (7154 Kg/ha), respectively. The entry ANDT-3 (AVT-1) has been recommended due to ideal plant type for the vegetable purpose, high yield, tolerance to pod damaging pest complex (pod borer, pod fly and pod bug) and quality of the pods, for its release in Middle Gujarat.

(Research Scientist (Vegetables), AAU, Anand)

5. KALMEGH: (Anand Kalmegh-1)

The proposal of Anand Kalmegh-1 was recommended for its release in Middle Gujarat due to its yield and quality. The variety AKC 3 (3599 Kg/ha) recorded 14.8 per cent higher yield over check variety ND 1 (3136 Kg/ha).

(Research Scientist (M&AP), AAU, Anand)

6. SAFED MUSLI: AMVI-II (ASM-1)

The strain AMVI-II (ASM-1) was recommended for its release in Middle Gujarat due to its superiority for yield and quality. The variety ASM 1 is first of its kind for the farmers and recorded the highest (3564 Kg/ha) fasciculated roots yield in comparison to rest of the tested germplasm.

(Research Scientist (M&AP), AAU, Anand)

7. NAGLI: WN-228 (Gujarat Nagli-4)

(Research Scientist (Sorghum), NAU, Surat)

The variety Gujarat Nagli 4 (1406 Kg/ha) recorded 14.2 percent higher seed yield over Gujarat Nagli 3 (1231 Kg/ha). The variety was recommended for Middle Gujarat due to its nutritive value and its higher yield over Gujarat Nagli-3.

II CROP PRODUCTION

[A] CULTURAL PRACTICES

1. Time of Harvest and N in marvel grass

The farmers of North Gujarat agro-climatic zone-IV (AES- IX and XII) having naturally grown grass (marvel grass) are advised to harvest natural grass once at the time of maturity and apply 60 kg N/ha at onset of monsoon to obtain higher dry fodder yield as well as higher net realization (CBR- 1: 4.32).

(Associate Research Scientist, N.C. Farm, AAU, Chharodi)

[B] CROPPING SYSTEMS

2. INM in pearlmillet-wheat sequence

The farmers of middle Gujarat Agro-climatic zone - III (AES-I & II) are advised to apply 100 % NPK as per soil test through inorganic fertilizers to both pearlmillet (GHB-316, 518) in *kharif* and wheat (GW-496) in *rabi* grown in a sequence under irrigated conditions for getting higher production and net realization (CBR pearlmillet 1:3.30, wheat 1:4.31).

(Professor, Dept. of Agronomy, Dept. of Agril. Chem. & Soil Science and Dept. of Bio-Chemistry, BACA; Assoc. Research Scientist, Bio-fertilizer Project, AAU, Anand)

3. Nitrogen application in forage crops in sequence

The farmers of Middle Gujarat, Agro-climatic Zone-III (AES-II) are advised to grow sorghum (S-1049) (single cut) in *kharif*, sunflower (EC-68414) in semi *rabi* and Lucerne(GAUL-1) in *rabi* season with application of 100% RDF to each crop along with 30 t FYM/ha to *kharif* crop to obtain higher forage production, quality as well as higher net realization (CBR- 1: 1.65) under irrigated conditions.

(Asstt. Research Scientist, Forage Research Project, AAU, Anand)

4. Forage cropping system with inter crops

The farmers of middle Gujarat agro-climatic zone- III (AES-II) are advised to adopt cropping system of hybrid Napier (APBN-1) with cowpea (EC-4216) as inter crop in *kharif* and Lucerne (GAUL-1) in *rabi* for obtaining higher net return (CBR-1: 2.05). It gives higher forage production round the year for two to three years cycle under irrigated condition.

(Asstt. Research Scientist, Forage Research Project, AAU, Anand)

[C] NUTRIENT MANAGEMENT

5. Applications of nitrogen with and without irrigation to dillseed in Bhal area

Farmers of Bhal and Coastal Zone VIII (AES 1A & 1B) are advised to sow dillseed (GD-2) fertilized with 20 kg N ha^{-1} and 20 kg P_2O_5 ha^{-1} as basal application. The crop should be given one irrigation of 50 mm at 30 DAS and top dressing of 20 kg N ha^{-1} after the irrigation to secure higher yield and net return (CBR-1:5.7). While, under conserved moisture condition, farmers should apply only 40 kg N ha^{-1} as basal application at the time of sowing.

(Associate Research Scientist, ARS, AAU, Arnej)

[D] MICRONUTRIENT

6. Micronutrients application in tomato

The farmers of middle Gujarat agro-climatic zone-III (AES-II), growing tomato (Junagadh rubi) on soils marginal in available Zn and Fe status are advised to spray neutralized solution of 0.5 % FeSO4 at 30, 50 and 70 days after transplanting of tomato to get higher yield and net return (BCR 1:5.04).

(Research Scientist, Micronutrient Research Project and Associate Research Scientist, MVRS, AAU, Anand)

7. Micronutrients application in chilli

The farmers of middle Gujarat agro-climatic zone-III (AES-II), growing chilli (S-49) on soils having marginal status of available Zn and Fe are advised to apply micronutrients mixture (Fe-2%, Mn-0.5%, Zn-5%, Cu-0.2%, B-0.5%) equivalent to Government notified soil application Grade-V @ 20 kg/ha to get higher yield and more net return (CBR 1: 2.6)

(Research Scientist, Micronutrient Research Project and Associate Research Scientist, MVRS, AAU, Anand)

[E] BIOFERTILIZER

8. Seed treatment with biofertilizer and N application in *rabi* maize

The farmers of middle Gujarat Agro-climatic zone -III (AES-I & II) growing maize cv. GM-3 in *rabi* season are advised to treat the seeds with *Azospirillum lipoferum* culture having 10^8 C.F.U. per ml at sowing and apply 120 kg N/ha splitting 25 per cent N at basal (30 kg/ha), 50 per cent N at knee high stage (60 kg/ha) and 25 per cent N at tasseling stage (30 kg/ha) for

securing higher grain yield and net realization. Whereas, marginal farmers are advised to apply 60 kg N/ha to the maize.

(Professor, Dept. of Agronomy, BACA, AAU, Anand)

[F] SOIL AMENDMENTS

9. Amendments use in *herbaceum* cotton

The farmers of the *Bhal* and coastal Agroclimatic Zone VIII (AES 1A & 1B) growing *herbaceum* cotton in salt affected soil are advised to apply Gypsum and FYM @ 3t/ha each for securing higher seed cotton yield and net return (CBR- 1:2.88) in kharif season.

(Asstt. Research Scientist, ARS, AAU, Dhandhuka)

[G] WATER MANAGEMENT

10. Irrigation scheduling in *rabi* maize

The maize growing farmers of Middle Gujarat Agro-climatic zone-III (AES-II) are advised to give total 7 irrigations of 60 mm depth in *rabi* season for securing higher yield and net return. The first, second and third irrigation should be given at the time of sowing, at 6 DAS and at 30 DAS, respectively. The remaining four irrigations should be applied each at an interval of 15 days to get higher yield and net return (CBR- 1: 2.15). Withholding of irrigation at silking stage is detrimental.

(Asstt. Research Scientist, Main Maize Research Station, AAU, Godhara)

[H] WEED MANAGEMENT

11. Weed management in *Kharif* maize

The farmers of middle Gujarat zone-III (AES-II) growing maize (GM-4) are advised to apply mixture of

pendimethalin @ 0.25 kg / ha + atrazine @ 0.50 kg / ha as pre-emergence for effective weed control measures to get higher net return. (Twice inter culturing and hand weeding (20 and 40 DAS) is also equally effective for weed management in *Kharif* Maize).

(Agronomist, AICRP on Weed Control, AAU, Anand)

[I] HORTICULTURE CROPS

12. Micronutrients application in *kagazilime*

The farmers of middle Gujarat agro-climatic zone-III (AES-II), growing *kagzilime* on soils having marginal status of Zn and Fe are advised to spray neutralized $ZnSO_4$ at 0.3% OR $FeSO_4$ at 0.5% starting from first year during February-March and October- November besides application of recommended dose of NPK + FYM to get higher fruit yield and net return (CBR-$ZnSO_4$ 1: 7.04; $FeSO_4$ 1: 6.94). The NPK (900:750:500 g/plant) and FYM (50 kg/plant) application schedule is as under.

NPK in two equal splits in July and November while FYM once in a year at onset of monsoon (July).

(Professor, Dept. of Horticulture, BACA and Research Scientist, Micronutrient Research Project, AAU, Anand)

13. Use of poultry manure in banana

Banana cv. 'Robusta', growers of middle Gujarat (AES-2) are advised to replace 25% of recommended dose of N in banana in the form of poultry manure and apply at the time of planting which gives higher net return (CBR- 1 : 3.53) and improves quality of banana fruits and soil health.

(Professor, Dept. of Horticulture, BACA, AAU, Anand)

14. Use of nitrogen in aonla

The farmers of Middle Gujarat Agro-climatic Zone –III (AES-II) growing ten years old aonla cv. Gujarat Aonla-1 are advised to apply 1 kg N in addition to 100 kg FYM per tree (age 10 years and above) at the onset of monsoon (June- July) to get higher net realization (CBR-1: 3.14).

(Professor, Dept. of Horticulture, BACA, AAU, Anand)

III PLANT PROTECTION

[A] PLANT PATHOLOGY

1. Management of powdery mildew disease in mustard

For effective and economical management of powdery mildew disease in mustard crop, farmers of Middle Gujarat are advised to spray hexaconazole @ 0.005 % (ICBR 1: 5.77) or penconazole @ 0.005 % (ICBR 1:4.40) thrice i.e. first at the initiation of disease and two sprays at 10 days intervals.

(Professor, Dept. of Plant Pathology, BACA, AAU, Anand)

2. Management of root-knot nematodes in brinjal

For effective and economical management of root-knot nematodes in brinjal, the farmers of middle Gujarat Agro-climate Zone-III are advised to apply *Paecilomyces lilacinus* @ 25 kg spore dust (10^9 conidia/g) with carrier / ha at the time of transplanting + Poultry manure @10 tons/ ha a week prior to transplanting (ICBR 1: 18.58) **OR** mustard cake @ 2 tons/ha a week prior to transplanting (ICBR 1: 6.71) **OR** *P. lilacinus* @ 25 kg spore dust (10^9 conidia/g) with carrier / ha at the time of transplanting + neem cake @ 2 tons/ha a week prior to transplanting (ICBR 1: 5.80).

(Professor, Dept. of Nematology, BACA, AAU, Anand)

[B] AGRICULTURAL ENTOMOLOGY

3. IPM for fruit and shoot borer in brinjal

In order to reduce load of pesticides in the environment and to conserve natural enemy *Trathela flavo-orbotalis* following eco-friendly IPM strategy has been recommended to the farmers of middle Gujarat and south Saurashtra

region for the management of fruit and shoot borer *Leucinodes orbonalis* in brinjal crop:

(i) Removal of previous year brinjal crop residue from farm before planting

(ii) Prompt cutting and disposal of damaged shoots.

(iii) Installation of pheromone-baited traps @ 40 / ha throughout the field once at flowering starts. The trap should be installed in such a way that the lure remains 1 ft above canopy level. The lure should be changed at least at monthly interval.

(Professor, Dept. of Entomology, BACA, AAU, Anand)

4. Control of mango leaf weber

One spray application of dichlorvos @ 0.05 % or chloropyriphos @ 0.04 % is recommended to the farmers of middle Gujarat for the control of mango leaf weber. The spray application covering the whole canopy of the tree should be made at the initiation of tent formation usually in the month of August – September. The costs of application for one spray of above insecticides are Rs. 4 and 11 per tree, respectively.

(Professor,* Dept. of *Entomology, BACA, AAU, Anand)

5. Management of mite in brinjal

For the effective and economical management of mite (*Tetranychus urticae)* in brinjal, two sprays of fenazaquin @ 0.01 % (ICBR 1: 16.17), first at the appearance of the mite and second after 15 days of first spray are recommended for the farmers of middle Gujarat.

6. Management of little leaf, fruit and shoot borer in brinjal

To minimize the occurrence of little leaf disease, fruit and shoot borer and to get the higher fruit yield the farmers of middle Gujarat are advised to transplant brinjal crop in the first week of September.

7. Management of thrips in chilli

For the effective and economical management of thrips, *Scirtothrips dorsalis* in chilli crop farmers of middle Gujarat are advised to spray ready mix formulation of ethion 40 % + cypermethrin 5 % @ 0.045 % (ICBR 1: 22.10) or difenthiuron @ 0.05 % (ICBR 1: 15.60) in addition to earlier recommended insecticides *viz*., imidacloprid @ 0.005 % (ICBR 1: 17.20) and triazophos 0.04 % (ICBR 1: 26.60) following ETL of 1 thrips per leaf.

8. Management of leaf miner and fruit fly in Cucumber

For effective and economical management of leaf miner and fruit fly in Cucumber (Kakadi.) following IPM module is recommended to the farmers of Middle Gujarat (ICBR 1: 41.4 0)

(i) Installation of yellow sticky trap @ 1 / 10 hills after germination.

(ii) Clipping of infested leaves in the initial stage of the crop.

(iii) Application of neem soap @ 10g / litre of water at two leaf (cotyledonary) stage.

(iv) Application of deltamethrin @ 0.0014 % + 20 g jaggery per litre of water at initiation of flowering.

(Asstt. Research Scientist (Ento.) Vegetable Research Station, AAU, Anand)

IV DAIRY SCIENCE, AGRIL. ENGINEERING & PROCESSING

[A] DAIRY SCIENCE:

1. Spouted inert bed drying chamber

Plate I: Spouted Inert Bed Dryer

It is recommended to use the spouted inert bed drying chamber along with the complete set of air blower, air heater, cyclone separator and feeding system for drying of milk at small scale level using polypropylene bids as the inert particle. The flow rate of milk is recommended as 0.5 to 0.7 kg/h.

(Principal, SMC College of Dairy Science, AAU, Anand)

2. Synbiotic dahi

Synbiotic dahi in three different forms can be prepared using cow milk with nutritional and therapeutic advantages containing probiotic culture *L. acidophilus* LBKV$_3$ (@ 2.0 % v/v) and prebiotic inulin (@ 2.0 % w/v) ;

M - Acidophilus dahi

A - Synbiotic dahi (Plain)
B - Synbiotic dahi with non-nutritive sweetener (Sucralose)
C - Synbiotic dahi with sugar (Sucrose)

(i) Plain synbiotic dahi (blend A) is suitable for all age groups.

(ii) Blend-A along with addition of non-nutritive sweetener sucralose @19.5 mg / 100 ml (blend B) for calorie conscious and diabetic persons.

(iii) Blend-A along with addition of nutritive sweetener sucrose @ 9.0 w/v (blend C) for normal and healthy consumers of all age groups.

(Principal, SMC College of Dairy Science, AAU, Anand)

3. Ready-to-serve (RTS) soup

An acceptable quality of ready-to-serve (RTS) soup can be prepared from soup powder mix consisting of *tofu* powder, whey powder, garlic, ginger, onion powder, chilli, monosodium glutamate, sodium alginate and common salt. One serving size (30 g/ 175 ml) of RTS soup provides 5.9 g of protein, 16.7 g of carbohydrates, 1.1 g of fat and 2.6 g of minerals and is recommended to the consumers particularly the vulnerable groups to meet their protein requirements.

(Principal, SMC College of Dairy Science, AAU, Anand)

4. Dietetic frozen dessert

A good quality dietetic, sugar-free, enriched with protein, poly unsaturated fatty acids and calcium, low fat (2.5 X lower than average ice cream) frozen dessert can be made utilizing ingredients like sunflower oil, coconut oil and milk fat as fat source, milk SNF and Whey Protein Concentrate as MSNF sources along with sucralose, sorbitol, polydextrose, maltodextrin, stabilizer and emulsifier. The dietetic frozen dessert is 20 %

cheaper than a regular full-fat ice cream and has 40% lower calorific value. The dietetic frozen dessert is recommended for commercial and industrial exploitation.

(Principal, SMC College of Dairy Science, AAU, Anand)

[B] AGRIL. ENGINEERING & PROCESSING

5. Technology for Production of Dehydrated Coriander Leaves

The food processing entrepreneurs interested in dehydration of vegetables are recommended to use the technology developed by Anand Agricultural University for the production of dehydrated coriander leaves. The technology is simple and economically viable and the product obtained is well acceptable to the consumers and it is superior to the sun dried product.

(Head, PHET, AAU, Anand)

V ANIMAL PRODUCTION

1. Mixed ration

The total mixed ration comprising of 50% bajra straw can support daily gain over 500 g when fed to 6-9 months old crossbred calves and was superior to total mixed ration ither with 40 or 60% bajra straw.

2. Additional compound concentrate mixture

A. The farmers of **Surat** district are advised to feed additional compound concentrate mixture 1-1.5 kg to cows and buffaloes producing 5-8 kg milk and 2.5-3.0 kg to animals producing up to 15 kg milk per day during summer and during monsoon 1.0 kg to cows and buffaloes producing 5-8 kg and 1.5-2.0 kg to cows and buffaloes producing 8-12 kg milk" on account of green fodder unavailability.

B. The farmers of **Navsari** district are advised to feed additional compound

concentrate mixture 1.0 kg to cows producing 8-10 kg milk and 0.5 kg to cattle and buffalo heifers, respectively. They are also advised to supplement all categories of dairy animals 30 g of mineral mixture (without salt) as per BIS specifications.

C. The farmers of **Bharuch** district are advised to feed extra compound concentrate mixture 1.0 kg to the lactating buffaloes producing 5.5-9 kg milk and to feed 45g mineral mixture as per BIS specifications to lactating cows producing 6-15kg and buffaloes 5.5-9 kg milk and to pregnant, dry and, buffalo heifers and bullocks.

D. The farmers of **Vadodara** district are advised to feed extra compound concentrate mixture 1 kg to the lactating buffaloes and to the other buffaloes producing 9-12 kg milk. They are also advised to feed 50 g mineral mixture as per BIS specifications to all categories of dairy animals.

E. The farmers of **Anand** district are advised to feed extra compound concentrate mixture 1.5 kg to buffaloes producing 12-15 kg milk. They are also advised to feed 30 g mineral mixture as per BIS specifications to pregnant cows, buffaloes and bullocks.

F. The farmers of **Jamnagar** district are advised to feed extra compound concentrate mixture 0.5 kg to cows producing 14-16 kg and 2kg to buffaloes producing 11-13.5 kg to bridge the gap of protein supply. They are also advised to feed 100 g mineral mixture as per BIS specifications to lactating and pregnant cows and buffaloes.

3. Mineral mixture

A. The farmers of Mahuva and Gadhada taluka of **Bhavnagar** district are advised to feed 75 g mineral mixture as per BIS specifications to the lactating cows and buffaloes and 50 g to other categories of cattle and buffaloes.

B. The farmers of **Porbandar** district are advised to feed mineral mixture as per BIS specifications 150g to lactating and pregnant cows and buffaloes and 50g to dry buffaloes and heifers.

(Animal Nutrition Research Department, Vety. Sci. College, AAU, Anand)

VI ANIMAL HEALTH

Recommendation for field veterinarians and poultry farmers

Diclofenac sodium proved highly nephrotoxic to broilers leading to gout with high mortality. Field veterinarians and poultry farmers are advised not to use diclofenac sodium in any form of treatment to broilers.

(Professor, Department of Pathology, Vety. Sci. College, AAU, Anand)

RESEARCH ACCOMPLISHMENTS AND RECOMMENDATIONS

2006 & 2007

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