Vol. XVI No. 2

April - June 2014

NEWS LETTER

OIL TECHNOLOGISTS' ASSOCIATION OF INDIA
WESTERN ZONE

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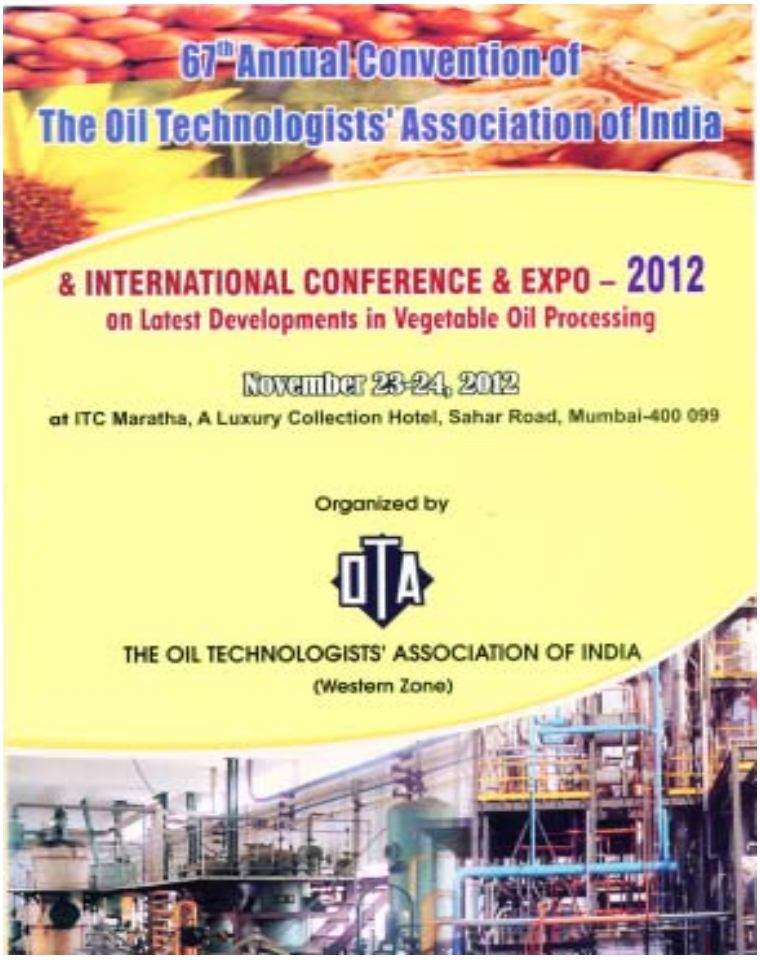

This news letter is for free circulation only to the members of OTAI-WZ

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OIL TECHNOLOGISTS' ASSOCIATION OF INDIA WESTERN ZONE

From the Editors's Desk

The New Govt. is firmly in saddle. But the whiplash of past govt. brings in undesirable consequences. For example, how to carry forward technology of using radiation for all-round growth raises avoidable controversies. And what steps are necessary to improve oil-seed output. When are we hoping to be self-sufficient in edible oils at affordable prices? Plant Engineering also needs new skills, not only to welcome better techniques, but also how to improve methods of maintenance? Using computers? Establish Technology Mission to grapple with problems? Perhaps.

This association must lead.

Trade & Commerce

"USEFUL INFO"

CASTOR CROP SURVEY - EXECUTIVE SUMMARY
CASTOR PROSPECTS- 2013-14

EXECUTIVE SUMMARY

THE Solvent Extractors' Association of India (SEA) is a broad based all India apex body of solvent extraction industry and at present practically all-working solvent extraction units are its members. The association continuously gives feedback to the members about the developments taking place in the country and world.

As one of its activities, SEA conducts Castor crop estimation in Gujarat, Rajasthan and Andhra Pradesh every year. Thus SEA commissioned Nielsen India to conduct a crop estimation study for Castor Seeds in Gujarat, Rajasthan and Andhra Pradesh.

Nielsen India is the largest market research agency in the subcontinent with the requisite experience, expertise and infrastructure to conduct such studies.

Nielsen India is conducting such studies since 2004-05 on behalf of SEA. This year, Nielsen India is conducting the study on behalf of SEA in Gujarat, Rajasthan and Andhra Pradesh during the period October 2013 - May 2014.

The study was carried out in major districts of Gujarat, Rajasthan and Andhra Pradesh in three field survey rounds during October 2013 - February 2014 to assess the crop. Since the Castor crop cycle is long to re-assess the crop estimates two more rounds will be conducted in March & May (in Gujarat & Rajasthan) and crop estimates may be revised if necessary.

District-wise Area, Yield and Production of Castor Seeds in Gujarat (2013-14)

District	Estimated Area Under Crop* (000 ha.)			Estimated Production* (000 tonnes)			Estimated Yield (Kg/ha.)		
	12- 13	12-13	% Change	12-13	13-14	% Change	12-13	13-14	% Change
Banaskantha	123	103	-16%	1659	1776	7%	204	183	-10%
Sabarkantha	72	65	-10%	2014	1974	-2%	145	128	-12%
Mehsana	78	67	-14%	1385	1277	-8%	108	86	-20%
Patan	61	55	-10%	1656	1433	-13%	101	79	-22%
Gandhinagar	36	33	-8%	2167	2088	-4%	78	69	-12%
Kutch	100	90	-10%	720	627	-13%	72	56	-22%
Surendra Nagar	72	52	-28%	972	860	-12%	70	45	-36%
Jamnagar	17	13	-24%	824	1150	40%	14	15	7%
Rajkot	18	13	-28%	1000	1388	39%	18	18	neg
Vadodara	29	25	-14%	1862	1709	-8%	54	43	-20%
Kheda	18	24	33%	1833	1924	5%	33	46	39%
Ahmedabad	25	22	-12%	1760	1892	8%	44	42	-5%
Panchmahal	2	3	50%	2000	1834	-8%	4	6	50%
Others	15	8	-47%	1452	1444	-1%	22	12	-45%
TOTAL	666	573	-14%	1452	1445	-0.5%	967	828	-14%

* Nielsen India estimates

GUJARAT

Total area under Castor crop in Gujarat for the year 2013-14 is 573,000 hectares. It has decreased by 14% as compared to the previous year. The area under Castor crop has decreased across all major Castor seeds growing districts except Kheda and Panchmahal.

Estimated total production of Castor seeds in Gujarat for the year 2013-14 is 828,000 tonnes, which has decreased by 14% as compared to the previous year. Production of Castor seeds has decreased in all major traditionally castor growing districts.

Average yield for the year 2013-14 is 1445 kg/ hectare as against 1452 kg/hectare during the year 2012-13. Negligible de-growth in yield as compared to last year.

Rainfall

This year, Castor producing districts of Gujarat have received 867mm of rainfall which is 40% higher than normal. Though there was excess rainfall in all Castor growing districts, distribution of rainfall was not much favorable for growth of Castor seeds plants. Scanty rainfall from the 4th week of August to 3rd week of September has hampered the growth of Castor seeds plants. Also water logging due to the rainfall during the 1st week of October also damaged the crop in low level area.

RAJASTHAN

• Total area under Castor crop in Rajasthan for the year 2013-14 is 148,000 hectares. It has decreased by 6% as compared to the previous year. Area has decreased in all the major Castor seeds growing districts of Rajasthan this year except Pali.

Estimated total production of Castor Seeds in Rajasthan for the year 2013-14 is 166,000 lakh tonnes. It has decreased by 17% as compared to the previous year.

Average yield for the year 2013-14 is 1122 kg/ hectare, which is 12% lower than the previous year.

District-wise Area, Yield and Production of Castor Seeds in Rajasthan (2012-13)

District	Estimated Area Under Crop* ('000 ha.)			Estimated Production* ('000 tonnes)			Estimated Yield (Kg/ha.)		
	12-13	13-14	% Change	12-13	13-14	% Change	12-13	13-14	% Change
Barmer	12	11	-8%	1333	1182	-11%	16	13	-19%
Jalore	64	63	-2%	1313	1254	-4%	84	79	-6%
Jodhpur	18	17	-6%	722	471	-35%	13	8	-38%
Pali	8	8	0%	1500	1250	-17%	12	10	-17%
Sirohi	40	28	-30%	1400	1143	-18%	56	32	-43%
Others	15	21	40%	1267	1143	-10%	19	24	26%
TOTAL	157	148	-6%	1274	1122	-12%	200	166	-17%

• Nielsen India estimates

Rainfall

This year, Castor seeds cultivating districts of Rajasthan have received 539 mm average rainfall, which is 21% higher than average rainfall in these districts. Like Gujarat, though there was excess rainfall in all Castor growing districts of Rajasthan, distribution of rainfall was not much favorable for Castor seeds plants growth. Scanty rainfall from the 4th week of August to 4th week of September has hampered the growth of Castor seeds plants.

ANDHRA PRADESH

• Total area under Castor crop in Andhra Pradesh for the year 2013-14 is 153,000 hectares. It has decreased by 31% as compared to the previous year.

• Estimated total production of Castor Seeds in Andhra Pradesh for the year 2013-14 Is 102,000 tonnes. It has decreased by 32% as compared to the previous year due to decrease in the cultivated area.

• Average yield for the year 2013-14 is 668 kg/ hectare, against last year 674 kg/ hectare.

Rainfall

This year, all the Castor seeds producing districts of Andhra Pradesh state have received 551 mm average rainfall, which is 8% higher than the average normal rainfall in these districts.

District-wise Area, Yield and Production of Castor Seeds in Andhra Pradesh (2013-14) * Nielsen India estimates

District	Estimated Area Under Crop* ('000 ha.)			Estimated Production* ('000 tonnes)			Estimated Yield (Kg/ha.)		
	11-12	12-13	% Change	11-12	12-13	% Change	11-12	10-11	% Change
Mehaboob Nagar	17	4	-76%	700	655	-6%	12	3	-75%
Kurnool	68	38	-44%	574	543	-5%	39	21	-46%
Anathpur	111	90	-19%	736	725	-1%	82	65	-21%
Nalgonda	8	3	-63%	671	711	6%	5	2	-60%
Ranaareddy	3	2	-33%	519	486	-6%	2	1	-50%
Others	15	15	0%	674	668	-1%	10	10	0%
TOTAL	222	153	-31%	674	668	-1%	150	102	-32%

ALL INDIA

• Total area under Castor crop in India for the year 2013-14 is 916,000 hectares. It has decreased by 16% as compared to the previous year.

• Estimated total production of Castor Seeds in India for the year 2013-14 is 1,120,000 tonnes. It has decreased by 17% as compared to the previous year.

• Average yield for the year 2013-14 is 1223 kg/hectare as against 1229 kg/hectare during the year 2012-13. It has decreased by 1% as compared to the previous year.

State-wise Area, Yield and Production of Castor Seeds in India (2013-14)

District	Estimated Area Under Crop* ('000 ha.)			Estimated Production* ('000 tonnes)			Estimated Yield (Kg/ha.)		
	12-13	13-14	% Change	12-13	13-14	% Change	12-13	13-14	% Change
Gujarat	666	573	-14%	1452	1445	-0.5%	967	828	-14%
Rajasthan	157	148	-6%	1274	1122	-12%	200	166	-17%
A P	222	153	-31%	674	668	-1%	150	102	-32%
Other States	51	42	-18%	588	571	-3%	30	24	-20%
Total	1096	916	-16%	1229	1223	-1%	1347	1120	-17%

(Courtesy : SEA NEWS CIRCULAR, FEB., 2014)

"MISSIONARY ZEAL"

Cabinet Committee on Economic Affairs Approves Implementation of The National Mission on Agricultural Extension and Technology

APPROVAL of the National Mission on Agricultural Extension and Technology.

The Cabinet Committee on Economic Affairs has approved the implementation of the National Mission on Agricultural Extension and Technology (NMAET) during the 12th Plan period. The extension of NMAET and its components will be expanded and up-scaled appropriately and implemented in a more coordinated and convergent manner.

The Mission will have a total outlay of Rs. 13073.08 crore, with Government of India's share of Rs. 11390.68 crore and State share of Rs. 1682.40 crore.

NMAET consists of 4 Sub Missions:

(i) Sub Mission on Agricultural Extension (SMAE).

(ii) Sub-Mission on Seed and Planting Material (SMSP)

(iii) Sub Mission on Agricultural Mechanization (SMAM) (iv) Sub Mission on Plant Protection and Plant Quarantine (SMPP).

Agricultural Technology, including the adoption/ promotion of critical inputs, and improved agronomic practices were being disseminated under 17 different schemes of the Department of Agriculture & Cooperation during the 11th Plan. The Modified Extension Reforms Scheme was introduced in 2010 with the objective of strengthening extension machinery and utilizing it for synergizing interventions under these schemes under the umbrella of the Agriculture Technology Management Agency (ATMA).

The NMAET has been envisaged as the next step towards this objective through the amalgamation of these schemes. The Mission Document has been prepared in keeping with the recommendations of the Working Group of the Planning Commission and suggestions and inputs received from extensive consultation with stakeholders, particularly farmers.

The common threads running across all 4 Sub-Missions in NMAET are Extension and Technology. Therefore, while 4 separate Sub-Missions are being proposed for administrative convenience, these are inextricably linked to each other at the field level and most components thereof have to be disseminated among farmers and other stakeholders through a strong extension network.

The aim of the Mission is to restructure and strengthen agricultural extension to enable delivery of appropriate technology and improved agronomic practices to farmers. This is envisaged to be achieved by a judicious mix of extensive physical outreach and interactive methods of information dissemination, use of ICT, popularisation of modern and appropriate technologies, capacity building and institution strengthening to promote mechanisation, availability of quality seeds, plant protection etc. and encourage aggregation of Farmers into Interest Groups (FIGs) to form Farmer Producer Organisations (FPOs).

In order to overcome systemic challenges being faced by the Extension System, there is a need for a focused approach in mission mode to disseminate appropriate technologies and relevant information to larger number of farmer households through inter personal and innovative methods of technology dissemination including ICT.

To alleviate the challenges in the seed sector, there is a need to increase production of certified seeds, upgrade quality of farm saved seeds, coverage of at least 10 percent villages under the Seed Village Programme, production of 100 lakh quintals of seeds/year through the Farmers' Seed System, capacity building of the public and private sectors, upgradation of quality control of seeds, upgradation of seed production infrastructure and implementation of the Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA) Act effectively.

Background:

Agricultural productivity has a positive correlation with level of farm mechanization.

For accelerated growth in farm mechanization in the current decade, there is a need to include the large community of small and marginal farmers into the fold of cost effective and remunerative mechanized farming, to help sustain desired agricultural growth and to enhance agricultural productivity.

Plant Protection plays a significant role in achieving targets of crop production. Strengthening regulatory framework for management of pesticides and plant quarantine are important issues which are required to be taken up during the 12th Plan also. In view of concerns for food safety and impact on India's food and agricultural trade, there is a need to monitor and analyze pesticide residues in agricultural commodities in different agro-ecological regions of the country.

(Courtesy : SEA NEWS CIRCULAR, FEB., 2014)

" GOOD SUGGESTION"

Export of Groundnut Oil & Rice Bran Oil

GOVERNMENT has fixed Minimum Support Price for groundnut in shell at Rs.4,000 per quintal, whereas groundnut in shell is being sold much below at Rs.2,800 to 3,000 since last two months in Gujarat, major producer of groundnut. Although, NAFED has started buying operation in Gujarat and bought about 2.40 lakh tonnes so far, but it has not supported the price and the farmers are forced to sell in distress at very low price and are totally discouraged. We, have strongly represented the Government to support the groundnut farmers, by allowing exports of groundnut oil in bulk without MEP. This will change sentiment in the market and the farmers will get little better price. However, if Government is not able to do away with MEP, then may fix not more than US$ 1200 per tone, a reasonable MEP which will help the exporters to explore the possibility.

Secondly, India produces about 9 lakh tonnes

of rice bran oil against the potential of 15 lakh tonnes. There is demand for Rice Bran Oil in International markets. SEA has once again requested the Government to allow exports of Rice Bran Oil in bulk and if necessary, may fix up the ceiling of 25,000 tonnes per annum, so that this non-traditional oil can penetrate in the International market and would encourage further exploitation of potential of Rice bran oil.

There is no justification or logic to restrict export of edible oils when oilseeds (finished products) and oilmeals are freely exportable and hope that the Government will consider our plea sympathetically.

(Courtesy : SEA NEWS CIRCULAR, FEB., 2014

"EXPERT SPEAKS"

G. CHANDRASHEKHAR'S views on India's National Food Security Act, 2013

G. Chandrashekhar

INDIA'S NFSA (National Food Security Act) approved by the Parliament is one of world's most ambitious welfare programs that seeks to deliver highly subsidised foodgrains to as many as 820 million consumers (12 percent of current world population).

70 percent of the rural population and 50 percent of the urban population is sought to be covered. The Right to Food guarantees at least five kilograms of wheat, rice and coarse cereals per person per month at rates that are just about a tenth of the cost; in other words, as much as 90 percent subsidised.

There are four dimensions associated with this legal right to food :

* Foodgrain production;
• Foodgrain procurement;
* Distribution logistics; and
• Fiscal burden.

Each one deserves a close scrutiny

As world's second largest producer of rice (over 100 million tons) and wheat (over 90 million tons), India's is unlikely to face any serious or persistent production food grains shortage in the next few years, although serious challenges of low yields, worsening soil health, land constraints, water shortage and climate change have to addressed. God forbid, what if India were to face drought that results in sharp production decline? Imports will be inevitable with disastrous consequences for the fisc, forex, markets and prices.

As for procurement, the government, despite criticism of systemic inefficiencies, has a reasonably good track-record of buying and handling 40-50 million tons of grains. Yet, inadequate warehousing facilities, unscientific storage conditions and humungous carrying costs are a worrisome aspect. It is estimated that wnen NFSA is implemented fully, procurement of anything between 62 million and 65 million tons of grains will be inevitable. Storage facilities will have to be created on a war-footing. With that level of procurement, grains available for the open market or private sector will reduce.

The weakest link in the food supply chain for the poor is distribution logistics. Grains will be distributed to the target beneficiaries through the time-tested public distribution systen (PDS). There are about 450,000 such shops across the country Leakages in the supply chain are well known and have to b< plugged. Will the government machinery and the shopkeeper: under PDS be able to reach and service over 800 million people consistently, month after month? Doubts persist.

The estimated cost of the whole exercise is placed at USD 2(1 Billion (about Rs 120,000 crore). This translates to an incremental cost of $ 6-7 Billion (about Rs 40,000 crore) from the current fooJ subsidy burden. The fiscal deficit, already at an alarming level! risks worsening.

Importantly, NFSA does not address the serious national crisis oil pervasive malnutrition and under-nutrition. Protein deficient and calorie deficiency across the country, especially in rural areas, is palpable. We need policies that advance nutrition! security in addition to food security. NFSA is silent on this.

At present, pulses are not included in the basket of grains undeil NFSA.

I firmly believe they ought to be and there is a strong case for it.lnl my capacity as journalist and public speaker, I have on several! occasions argued in public seminars, on television programs anil in private meetings with ministers and officials at the highest! levels in the government in favour of including pulses under NFSAl /PDS to address the worsening nutrition status of the poor. I ami not really aware of any systematic initiative by organised trade orl industry groups to lobby for inclusion of pulses in FSB/PDS.

Impact on pulses : I firmly believe, NFSA will have a positive! impact on pulses consumption. Primarily, demand for pulses isl not stand-alone; but supplementary in nature. With the potential increase in consumption of rice and wheat under NFSA, demand! for pulses is sure to expand as pulses are necessary and integral! part of staple Indian diet which is dal-chawal (pulse and rice) orl dal-roti (pulse and wheat bread).

Increase in grain consumption will drive pulses demand. From a price perspective, supply of grains at highly subsidised rates will leave or release some cash in people's pockets, a part of which most likely will be spent on pulses and edible oils. However, it would be na'i've to take this for granted. A systematic campaign is necessary to educate consumers about inclusion of pulses (for protein) and edible oil (for calories) in the daily diet.

Sometime in 2012,1 wrote a 'white paper'for the Government of India on 'mainstreaming coarse cereals through publicly funded welfare programs'. The paper was released through a minister of the union government and is currently under examination by various ministries. A similar initiative is necessary for pulses. I will be happy to associate with any initiative CICILS or any interested organisation proposes.

(Courtesy : GRAINS ASIA, FEBRUARY 2014).

PM urges people to drop prejudice against GM crops

The Indian Prime Minister (PM) says that Genetically Modified (GM) crops have great potential to improve yields and while safety is important people should not succumb to unscientific prejudices against GM crops. The PM said the Department of Biotechnology has started private public partnerships in research and development (R&D) in biotechnology and appealed to the private sector to work with the government.

He asked agricultural scientists to launch an ever-green revolution to ensure food security and to improve land and water productivity. Currently, India does not allow cultivation of GM food crops, including GM rice, but government representatives are largely in favor of introduction of GM rice and other GM foods. Last year, the Genetic Engineering Appraisal Committee (GEAC) approved experimental field trials of some GM plants, but the government postponed it because the matter is pending approval in the Supreme Court. Activists remain opposed to GM crops in India. They say that not enough tests have been done on GM crops and add that allowing GM crops will hurt the country's exports due to fear of contamination among rice importing countries.

"NOT YET"

Are adequate steps being taken to become self-sufficient in edible oils?

The dependence on imported edible oil is rising day by day, thereby putting the domestic edible oil manufacturers in jeopardy. Prasenjit Chakraborty speaks to industry experts on government measures required to address the issues of these manufacturers.

K Ravichandran
Senior Vice President &
Co-head, Corporate Ratings,
ICRA Ltd.

THE dependence on imported edible oil is expected to increase in the future due to anticipated domestic supply constraints, increasing urbanisation, moderate growth in population as well as disposable incomes and the high cost-competitiveness of imported oils. Further, initiatives undertaken by the government - one of them being supply of palm oil at subsidised rates under Public Distribution System (PDS) - have facilitated lower oil price to consumers, which in turn has pushed demand leading to higher oil imports. Even while the imports of refined edible oils are on the rise, the Indian government has recently imposed 2.5 per cent customs duty on crude edible oil (0 per cent earlier) while maintaining the status quo on refined edible oil (no change at 7.5 per cent), which has negatively impacted the already underutilised installed domestic edible oil capacity.

Raj Sharma
Co-founder & President
(Global),
Majestic MRSS

THE edible oil industry demanded the government to take measures to help the domestic farmers and refiners to withstand competition in the market from foreign players. The Finance Minister in the 2013-14 Budget speech said that the food inflation is worrying and that oilseed, pulses supply-demand mismatch can further fuel the inflation. Therefore, there was no increase in import duty on edible oil. This enables the farmers to switch to other crops, which can further make India more dependent on imports. However, the Wholesale Price Index (WPI) of edible oil was 150.5 in 2012 as compared to all other essential commodities. This suggests that there is room for the government to intervene. Industry body Solvent Extractors Association of India has demanded a hike in import duty of refined oils to curb imports and protect domestic refineries.

Dinesh Shahra
Founder & Managing Director,
Ruchi Soya
Industries Ltd.

THE anomaly in the government policy has hit us hard in the past six months. Import of refined palm oil - RBD - is reported to be 3,73,837 tonne in May 2013, highest in any single month since edible oil allowed under Open General Licence (OGL) in 1994, compared to 2,53,489 tonne in March 2013, thanks to reduction in duty difference between crude and refined palmolein and inverted duty structure by palm oil exporting countries. Current fluctuations in the Rupee-Dollar exchange rates have added to the problems faced by the Indian refiners. This is affecting their ability to make further investments. The government should impose an import duty of 10 per cent on Crude Palm Oil (CPO) and 20 per cent on RED, which will give sufficient protection to the Indian farmers and vegetable oil refining industry.

(Courtesy : Modern Food Processing, July 2013).

Technology

USE OF RADIATION TECHNOLOGY FOR IMPROVING PRODUCTIVITY OF OILSEEDS

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ABSTRACT

Nuclear science and technology at the Department of Atomic Energy has been contributing towards enhancing the production of agricultural commodities and their preservation. Bhabha Atomic Research Centre (BARC), Mumbai has a broad based research programme in food and agriculture involving genetic improvement of crops through mutation breeding and biotechnological approaches, food irradiation, isotope aided soil studies, understanding the fate and persistence of pesticides and integrated pest management. Radiation induced genetic variability in crop plants is a valuable resource for various desired characteristics to produce better crop varieties. Crop improvement programmes involving radiation induced mutagenesis along with recombination breeding at BARC have evolved 41 varieties in oilseeds (groundnut, mustard, soybean and sunflower), pulses (urdbean, mungbean, pigeonpea, cowpea), rice and jute. These have been released and Gazette notified by the Ministry of Agriculture, for commercial cultivation across the country. Some of the desirable traits in these crops include higher yield, improved quality traits, early maturity and resistance to biotic and abiotic stresses. Several of these varieties especially in oilseeds and pulses have high patronage from the farming community and are extensively grown in the country.

INTRODUCTION

Oilseeds constitute an important component of Indian food scenario by occupying an average area of 21 .6% with a total production of 12.2% in the last five years. Globally, India is the fifth largest oilseed producer. Among the oilseeds, soybean, groundnut and rapeseed-mustard are the major ones, which together cover around 80% of total area in oilseeds with a production of 88%. Soybean ranks first in both area and production (35.8%; 38.6%) followed groundnut (21 .7%; 25.5%) and rapeseed-mustard (22.8%; 23.9%) based on an average of last five years. Large proportion of Indian population relies on oilseeds as a source of edible oils. National productivity levels of oilseeds compare poorly with rest of the world. In 201 1 , total oil availability was around 1 8 million tonnes, of which 9.7 million tonnes was produced domestically and rest of the quantity was imported. Annual oil consumption is expected to increase further with increased urbanization, higher incomes and growing population, necessitating more imports. Many of the issues attributed to lower productivity were narrow genetic base, lack of tolerance to biotic and abiotic stresses, lack of quality seeds of improved varieties and restriction of these oilseed crops on marginal areas with poor inputs. There is a need to develop suitable varieties in oilseeds, which are high yielding with improved oil content and quality and resistance to biotic and abiotic stresses.

The Department of Atomic Energy through its research, development and deployment activities in nuclear science and technology, has been contributing towards enhancing the production of agricultural commodities and their preservation. Radiations and radioisotopes are used in agricultural research to induce genetic variability in crop plants to develop improved varieties, to manage insect pests, to monitor fate and persistence of pesticides, to study fertilizer use efficiency and plant micronutrient uptake and also to preserve agricultural produce. Use of radioisotopes in agriculture is one of the important fields of peaceful applications of atomic energy for societal benefit and the BARC has contributed significantly in this area.

Radiation technology for the development of new variety

Traditionally, selection and hybridization have been employed in the improvement of crop varieties for enhancing agricultural productivity. Genetic variability in crop plants is a valuable resource from which the plant breeder can select and combine different desired characteristics to produce better crop varieties. Natural variability is generated by spontaneous mutations, which occur at extremely low frequency (one in million). This can be enhanced to several fold (one in thousand) using chemical or physical mutagens. Mutations, spontaneous or induced, are an important source for inducing genetic variability. Improvement in either single or few economic and quality characters can be achieved with the help of induced mutations. Use of induced mutations has widely been accepted as a supplementary approach in the crop improvement programme. It has been successfully employed to enhance the production and productivity of crop plants. Globally, more than 3200 improved varieties have been developed by employing mutation breeding.

Mutations can be induced using a variety of radiations including gamma- rays, X-rays, beta particles, neutrons, ion and electron beams. Among these, gamma-rays have been extensively used, due to convenience of handling and better penetrating power. Gamma radiations bring genetic changes (mutations) by inducing chromosomal aberrations and causing single or double strand breaks in DNA (genetic material). Desirable mutations are selected from a large number of random mutations and incorporated to develop superior breeding lines.

Development of oilseed varieties at BARC

Crop improvement programmes at BARC employ radiation based induced mutagenesis along with recombination breeding in cereals (rice and wheat), oilseeds (groundnut, mustard, soybean and sunflower), pulses (urdbean, mungbean, pigeonpea and cowpea) and vegetatively propagated crops (banana and sugarcane). Sustained induced mutagenesis has resulted in wide spectrum of mutants affecting various traits and over 200 mutants in oilseeds are maintained as a mutant repository at BARC (Table 1; Fig. 1 and 2). Based on certain novel traits, several Trombay mutants in groundnut, sesame and sunflower have been registered with National Bureau of Plant Genetic Resources (NBPGR), New Delhi (Table 2).(Refer Page 14).

The desirable traits which have been bred through induced mutations include higher yield, improved quality traits, early maturity, disease and pest resistance, improved plant type, increased harvest index, semi-dwarf habit and abiotic stress resistance. Crop improvement programme makes use of induced variability either by using the desirable mutants directly or by using them in cross-breeding to combine the desirable traits.

Mutants or recombinants initially developed at BARC are evaluated in collaboration with the Indian Council of Agricultural Research (ICAR) or State Agricultural Universities in multi-location trials for various agro-climatic zones and the promising ones are released for commercial cultivation by the Ministry of Agriculture, Government of India (MoA, GOI). With an effective blend of mutation and recombination breeding, 41 crop varieties developed at BARC have been released and Gazette notified by the MoA, GOI for commercial cultivation. These include 21 in oilseeds (15 in groundnut, 3 in mustard, 2 in soybean, 1 in sunflower; Fig. 3), 18 in pulses (8 in mungbean, 5 in urdbean, 4 in pigeonpea, 1 in cowpea) and one each in rice and jute (Table 3). After the notification, varieties enter into the seed chain of nucleus seeds, breeder seeds, foundation seeds and certified seeds. Certified seeds are supplied to the

Table 1. Spectrum of mutants in oilseeds maintained at BARC, Mumbai

Crop	No of mutants	Mutagen used	Traits mutated
Groundnut	167	X rays, gamma rays, EMS, Electron beam, Sodium azide	Plant height, leaf, pod, seed, disease resistance, oil content and quality
Soybean	55	Gamma rays phytic acid, trypsir	Plant height, leaf, flower colour, protein, fatty acid, inhibitor
Mustard	12	Beta rays, gamma rays	Earliness, seed colour, low erucic acid high oil, leaf type and colour, appressed pods, powdery mildew tolerance
Sunflower	10	Gamma rays	Plant height, leaf colour, seed colour male sterility, high oil, less ray florets small ray florets

farmers for cultivation.

Trombay varieties were developed by incorporating desirable agronomic features in groundnut, soybean, mustard and sunflower. One of the notable contribution of BARC has been in the development of early maturing confectionery grade large seed (100-seed weight >60g) groundnut varieties suitable for export and table purpose. Existing large seed varieties were with long duration, longer seed dormancy and low productivity. However, the recently released large seed varieties like TBG (TDG) 39, TPG 41, TLG 45, TG 47 (Bheema) benefited many farmers, traders and exporters. Semi dwarf habit, high harvest index and better partitioning in TAG 24 and TG 26 help to increase plant population per unit area, prevent lodging and permit pegs to enter the soil early. Fresh seed dormancy in TKG 19A, TG 22, TG 26 and TPG 41 prevents in situ seed germination due to end season rains when the crop is ready for harvest. This trait is very useful under current changing climatic conditions wherein unpredictable rains are often experienced. Early maturity in TAG 24 and TG 51 is helpful to escape end-season drought and to fit into different cropping systems. Drought tolerance in TAG 24 and TG 37A and high oleic acid (60%) in TBG (TDG) 39 and TPG 41 are also desired traits.

In general, seeds of Brassica species are brown/black in colour. Yellow seeded rapeseed-mustard are more desirable than brown/black seed because it has thinner seed coat, higher oil content, high protein and lower fibre content than brown seeded varieties. It has improved nutritive value of the meal after oil extraction. Yellow seeded genotypes are available in B. rapa, B. juncea, and B. carinata. Till late 1960s all B. juncea genotypes available in the germplasm collection had brown seed coat. At BARC, yellow seed mutant (Fig. 2) was isolated from the variety Rai-5 using 32P radioisotope and named as Trombay Mustard 1 (TM 1). In 2011, a dwarf, early and yellow seed coat mutant was isolated from most popular variety 'Varuna' using gamma rays. Characterization of this mutant is being carried out.

Further in soybean, early maturity and resistance

Table 2: Trombay oilseed crops registered with National Bureau of Plant Genetic Resources (NBPGR), New Delhi

Crop	Genotype	INGR No.	Year	Trait
Groundnut	TG-18AM	4039	2004	Disease lesion mimic leaf
	TGE 1	4040	2004	Foliaceous stipule, high shelling out turn
	Small leaf mutant	4041	2004	Dwarf with small leaf
	Imparipinnate leaf mutant	4097	2004	Dwarf with imparipinnate leaf
	Suppressed branch mutant	4098	2004	Suppressed branches
	TG-18A	7032	2007	Large pod and seed
	TGM 112	11058	2012	White to light orange flower
	TGM 38	12011	2013	Suborbicular leaflet
	TGM 51	12012	2013	Funnel leaflet
	TGM 167	13011	2013	Gibberellin insensitive dominan dwarf
Sunflower	Fasciation mutant	4100	2005	Fasciation leaves
Sesame	NM58	5018	2005	Stiff Stem mutant
	N-29	7030	2007	Polypetalous corolla
	N-129	7029	2007	Tall seedling

to bacterial pustule in TAMS 38 and resistance to pod shattering, bacterial pustules, myrothecium leaf spot, soybean mosaic virus and moderately resistance to rust and other leaf spot diseases in TAMS 98-21 have benefitted farmers to increase soybean productivity. In sunflower, using gamma rays black seed coat mutant variety TAS 82 was isolated from zebra stripped seed coat variety 'Surya' whose yield potential is equivalent to hybrids. Besides isolating black seed coat mutation, a large numbers of morphological mutations have also been isolated. Most prominent among them are extreme dwarf mutation and fasciation mutation.

Socio-economic impact of Trombay varieties in oilseeds

Cultivation of Trombay oilseed varieties has made a significant impact on our national agriculture scenario by benefiting the farmers considerably. Trombay groundnut varieties are very popu-

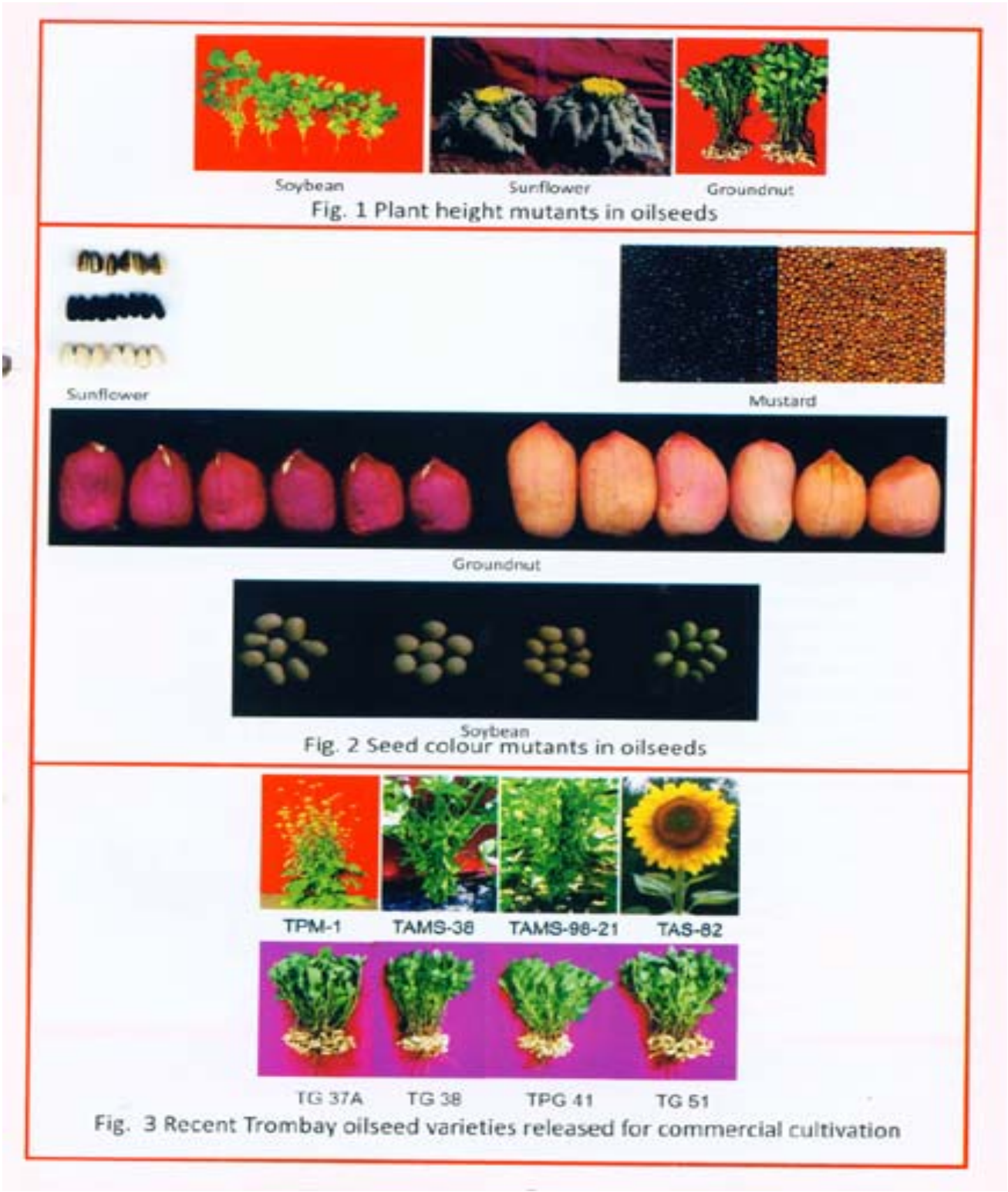

Fig. 1 Plant height mutants in oilseeds

Fig. 2 Seed colour mutants in oilseeds

Fig. 3 Recent Trombay oilseed varieties released for commercial cultivation

lar among the farming community and are cultivated throughout the nation in view of their various desirable traits. Among the released TG varieties, TAG-24, TG-26, TG 37A, TG 38, TG 51 in normal seed class and TKG 19A, Somnath, TBG 39 (TDG 39), TPG 41, TLG 45 in large seed class are popular among the farmers of major groundnut growing states such as Gujarat, Andhra Pradesh, Maharashtra, Karnataka, Orissa and Rajashtan and are also becoming popular in West Bengal, Punjab and Tamil Nadu, Madhya Pradesh, Uttar Pradesh and Goa. TAG-24 is the most popular TG

Table 3: Trombay oilseed varieties released and notified for commercial cultivation in India

Variety	Year of release	States	Special features
Groundnut			
TG 1	1973	All India	High yield, large seed, more branches, 50 days seed dormancy
TG 17	1985	Maharashtra	No secondary branches, 30 days seed dormancy
TG3	1987	Kerala	High Yield
Somnath (TGS 1)	1991	Gujarat	Large seed (70-80 g/100 seeds), Semi-runner type
TAG 24	1992	Maharashtra, Orissa, Kamataka, West Bengal, Rajasthan	Semi-dwarf, Small dark green thick leaves, Earliness (95-100 days), high harvest index, high partitioning %, wider adaptability
TG 22	1994	Bihar	Medium large seed (55-60g/100 seeds), 50 days seed dormancy
TKG 19A	1996	Maharashtra	Large seed (70-75g/100 seeds), 30 days seed dormancy
TG 26	1996	Gujarat, North Maharashtra, Madhya Pradesh	Earliness (95-100 days), high harvest index, 20 days seed dormancy, Smooth pods, Salinity tolerance.
TG 37A	2004	Haryana, Rajasthan, Punjab, Uttar Pradesh, Gujarat, Orissa, West Bengal, Bihar, North Eastern states	High yield, smooth pods, collar rot and drought, tolerance, wider adaptability
TPG 41	2004	All India	Large seed (75-80g/100 seeds), Medium maturity (120 days), 20 days seed dormancy, High oleic acid (60%).
TG 38	2006	Orissa, West Bengal, Bihar, North Eastern states	High shelling % (78%), more 3-seeded pods, more round seeds
TLG 45	2007	Maharashtra	Large seed (75-80g/100 seeds), Medium maturity (115-120 days)

Variety	Year of release	States	Special features
TG 39 (Trombay Bikaner)	2008	Rajasthan	Large seed (75-80g/100 seeds), Medium maturity (115-120 days), high oleic acid (59%) more number of branches
TGLPS 3 (TDG 39)	2009	Karnataka	
TG 51	2008	Orissa, West Bengal, Bihar, North Eastern states	Early maturity (90 days), medium large seed (50-55g/100 seeds), high shelling% (78%), more 3-seeded pods.
TG 47 (Bheema, RARS-T-1)	2011	Andhra Pradesh	Large seed (65-70g/100 seeds), Maturity of 110-115 days
Mustard			
TPM 1	2007	Maharashtra	Yellow seed, Tolerant to powdery mildew
TM2	1987	Assam	Appressed pod
TM4	1987	Assam	Yellow seed
Soybean			
TAMS 38	2005	Maharashtra	Early maturing, resistant to bacterial pustule, Myrothecium leaf spot
TAMS 98-21	2007	Maharashtra	Resistant to bacterial pustules, Myrothecium leaf spot, soybean mosaic virus diseases
Sunflower			
TAS82	2007	Maharashtra	Black seed coat, tolerance to necrosis disease

variety grown throughout the country and is also used as a National Check variety in post-rainy trials in the All India Coordinated Research Project on Groundnut. In addition, TKG 19A, TG 26, TG 37A, TG 38, TPG 41, TG 51 and Somnath are also used as check varieties in the respective zonal and state varietal trials. Currently, many of these varieties and mutants are being utilized as parents in the national and state groundnut breeding programmes and as the source material for understanding the genetic and molecular basis of different traits. Using Trombay groundnut varieties as parental material, state agricultural universities have developed seven improved groundnut varieties in their states (Dh 40, R 9251, GPBD 5 in Karnataka; GG 21 in Gujarat; JCG 88, TPT 25 in Andhra Pradesh; JL 501 in Maharashtra). Collaborative studies with Directorate of Groundnut Research and ICAR Complex for North-Eastern states resulted in identifying TKG-19A as one of the tolerant varieties to aluminium toxicity, which is often associated with acidic soils. TG varieties also facilitated farmers to develop newer cropping systems like intercropping groundnut with sweet

corn, sugarcane, onion, cotton and use of polythene mulch technology for intensive groundnut cultivation.

As a first step to transfer the benefits of these varieties to the farmers, nucleus or basic seed having 100% genetic purity was multiplied at BARC followed by large-scale breeder seed production programmes were undertaken by involving several national institutes, state agricultural universities and progressive farmers. TG varieties account for about 17% of the total breeder seed production in the country. BARC has alone distributed more than 430 tonnes of breeder seed of TG varieties in the last decade to national institutes, agricultural universities, seed corporations, Krishi Vigyan Kendras, seed companies, NGOs and farmers. In Karnataka, under the "Seed Village Concept", a large quantity of breeder seed of TAG 24 and TPG 41 was produced with farmers' participation and distributed to several seed agencies. Ministry of Agriculture under ISOPOM scheme drawn an annual plan for TG seed production to the extent of 15,000 tonnes accounting 30% of the total groundnut seed production by the National Seed Corporation and State Farms Corporation of India for 2012-13. Further, several millions worth trading of groundnut varieties has been taking place in most of the groundnut markets. Farmers have been realizing the high yielding ability of groundnut varieties by harvesting record groundnut yields in many parts of the country. Several farmers have harvested significant improved productivity even upto 7,000 kg/ha as compared to national average of 1500 kg. Recently a progressive farmer from Kadapa district in Andhra Pradesh had harvested 7,500 kg/ha pods of newly released groundnut variety TG 51 by growing under suitable agro-ecology, balanced nutrition and optimum irrigation. In Gujarat, majority of TG varieties are grown in larger areas particularly in Saurashtra and Kutch-Bhuj regions and farmers have obtained promising yields compared to local varieties. A drought tolerant and early maturing variety TG 37A and an early maturing large seed variety TBG 39 have brought back cultivation of groundnuts in large desert areas in Rajasthan state. Based on the feedback and with our own estimates, TG varieties cover around 15-20 per cent of the grourjdnut area in the country.

Utilization of induced mutations in crop improvement programme has resulted into the development of 31 varieties in rapeseed-mustard all over the world. Among them, 12 are from B. juncea, 14 from B. napus, 2 from B. rapa, and 3 from white mustard. Fifteen varieties have been developed using gamma rays and four by X-rays. Remaining varieties were developed using chemical mutagen and mutants used in hybridization. Work on mutation breeding at BARC has resulted into the development of three high yielding varieties namely, TM 2, TM 4 and TPM1. Among them TM 2 and TPM 1 are direct mutants, whereas TM 4 is derived from cross between Varuna and TM 1. TM 4 and TPM 1 are yellow seed coat varieties. TPM 1 is relatively powdery mildew resistant variety. This is the first variety released for state of Maharashtra which has been identified as non- traditional area of mustard cultivation. TM 2 and TM 4 are released for the North-Eastern Hilly state of Assam.

In soybean, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola popularizing extensively varieties TAMS 38 and TAMS 98-21 by undertaking large scale seed production and distributing to the farmers in Vidarbha region of Maharashtra. In sunflower, selection and evaluation of the black seed coat mutant has resulted in the development of high yielding variety TAS 82. It has green leaf and dark black seed coat with high oil content upto 39%. Its yield potential is relatively better under low rainfall conditions. It has tolerance to sunflower necrosis disease.

Mutation breeding programme is also complemented with biotechnological approaches. Molecular markers are useful in crop improvement programmes for varietal identification, marker assisted selection, estimating genetic distances, linkage studies, phylogenetic analysis and tagging and cloning of desirable genes. Genomic assisted breeding and gene pyramiding for disease resistance and other economically important traits will help in hastening the mutation breeding programme. Mutated genes have also become a valuable resource to plant breeders and molecular biologists for understanding not only the function but also in isolating and shuffling the genes between varieties. At BARC, molecular markers have been used to tag agronomically important traits such rust and late leaf spot resistance in groundnut; yellow mosaic virus and bruchid resistance in urdbean; rust resistance in wheat and flowering time in Sesbania rostrata.

Conclusions: Experiences at BARC has shown that using radiations for crop improvement has come to stay as an efficient plant breeding method complementing the conventional methods. Nuclear technologies have benefited the farmers, traders and end-users and will continue to play a significant role in addressing food and nutritional security. In the context of emergence of genomic era, induced mutants would be an ideal genetic material for future functional genomic studies.

Acknowledgements: The contribution rendered by S.H. Patil, Chandramouli, V. Abraham, S.E. Pawar, D.M. Kale and G.S.S. Murty for varietal development is duly acknowledged. Cooperation received from Indian Council of Agricultural Research, State Agriculture Universities, State Agricultural Departments, National and State Seed Corporations, NGOs and progressive farmers is acknowledged.

(Courtesy : SEA NEWS CIRCULAR, Jan, 2014)

"BAD OMEN"

El Nifio raises chances of deficient rains this year

THE chances of India's southwest monsoon, the lifeline of millions of farmers, being 'below normal' have risen due to the emergence of the El Nifio weather phenomenon, according to a private weather forecasting agency.

In its first indication of the monsoon pattern this year, Skymet Weather Services said this year, the southwest monsoon would probably not experience the La Nina (which translates into excess rainfall), reducing the chances of excess rains.

Skymet sounded caution on the forecast, as outlooks have changed often when the summer sets in. The India Meteorological Department classifies monsoon rains at 96-104 per cent of the long-period average (LPA) as normal; 105-110 per cent of the LPA is considered 'above normal' and rains exceeding 110 per cent of the LPA are termed 'excess'. Rainfall of 90-94 per cent of the LPA is considered 'below normal' and rains below 90 per cent of the LPA result in a drought. LPA is the average rainfall received in the last 50 years.

IMD will announce its first official monsoon forecast for this year in April.

In the last decade, 2002, 2004 and 2009 were drought years, owing to the emergence of the El Nifio during these years. In 2002, the southwest monsoon was 22 per cent below normal; in 2004; it was 17 per cent below normal. In 2009, when India faced one of the worst droughts in recent years, rains were 27 percent below normal. In 2012, an El Nifio year, rains were seven per cent below normal.

The El Nifio phenomenon emerges once every three-seven years. Meanwhile, Bloomberg news agency quoting a statement from the Australia's Bureau of Meteorology said that most climate models suggest the tropical Pacific will warm through the southern autumn and winter. An El Nino trend is likely to develop this year, Gavin Schmidt, deputy director of NASA's Goddard Institute for Space Studies in New York, said this month.

(Courtesy : SEA NEWS CIRCULAR, Feb., 2014)

"CAN WE EMULATE?"

Castor bean oil slated as biodiesel feedstock

EVOGENE (Rehovot, Israel), a plant genomics company specializing in enhancing crop productivity for the food, feed, and biofuel industries, announced at the end of the third quarter that its subsidiary, Evofuel Ltd., had complete three years of successful field trials in Brazil for the development of castor bean as an alternative feedstock for production of biodiesel and other renewable chemicals.

The field trials, conducted in cooperation with the agricultural producer SLC Agricola S.A. (Porto Alegre, Rio Grande do Sul), demonstrated strong yield performance of Evofuel's proprietary castor seed varieties under rain-fed conditions in northeast Brazil.

Evofuel envisions castor seed being a competitive feed-stock for biodiesel as well as for traditional industries currently using castor oil, such as

the lubricant and biopolymer industries.

Based on these field tests, advanced product development and pre-commercial trials are targeted to begin in 2014. Evofuel estimates its castor seeds will reach the commercialization stage in 2016.

The collaboration with SLC is aimed at developing castor as a rotation crop with soybeans.

(Courtesy : SEA NEWS CIRCULAR, Feb., 2014)

"RICE SPIKE GENE"

Research aims at boosting Global Food Security : IRRI Scientist

SPIKE gene can boost rice yields in Asia and Southeast Asia significantly and contribute to global food security in coming years, according to Dr. Tsutomu Ishimaru, Plant Breeder of International Rice Research Institute (IRRI)-Japan Collaborative Research Project. The SPIKE gene is derived from Indonesian landrace, and helps improve yield of rice plants significantly. Dr. Tsutomu Ishimaru says he has achieved yield improvement of around 13-36% compared to IR64 and IRRI146. The SPIKE gene version of IR64 is being tested in several Asian countries including Laos, Indonesia (Java island), India (Tamil Nadu) and Japan. Tests are going on to improve yield in popular rice varieties in South Asia and Southeast Asia usingthe SPIKE gene.

Dr. Tsutomu Ishimaru says, "The SPIKE breeding is still in the process for BR11 (popular variety in Bangladesh), Swarna (popular variety in Eastern India), TDK1 (popular variety in Laos), Ciherang (popular variety in Indonesia) and PSBRclS (popular variety in the Philippines). It will take a few years to finish the transfer of SPIKE to these five varieties." Though it hasn't been tested yet, the taste, milling quality and cooking properties of traditional rice varieties (such as basmati fragrant rice) are likely to remain same with the introduction of the SPIKE gene through conventional breeding. Increase in yield would also translate into more profit for rice farmers and help in the improvement of the economy of South Asia and Southeast Asia.

Rice is a staple food for almost half of the global population which is growing in Southeast Asia and South Asia. Rice consumption is also increasing in Africa. It is estimated that by 2035, a 26% increase in rice production will be essential to feed the growing population, and according to the International Grains Council (IGC), global rice consumption will surpass rice production in just three years. Dr. Tsutomu Ishimaru hopes SPIKE research will spread to several rice growing countries in future and contribute to global food security. The IRRI-Japan Collaborative Research Project is supported by the Ministry of Foreign Affairs and the Ministry of Agriculture, Forestry and Fisheries of Japan. The Japan International Research Centerfor Agricultural Sciences (JIRCAS) is a key partner of the Global Rice Science Partnership (the CGIAR Research Program on Rice), says IRRI.

IRRI developing 3-in-l climate-resilient rice variety

The Philippines-based International Rice Research Institute (IRRI) is developing a new variety of rice, "3-in-T'climate tolerant rice, which can tolerate flooding, a prolonged dry season, and saltiness near coastal areas, accordingto local sources.

According to the IRRI, the new variety will be a climate-resilient variety and help mitigate climate change and sustain agricultural productivity in rice-producing countries. The IRRI first developed the "2-in-l" variety, which could tolerate flooding and drought situations.

Flood resistant variety "IR 64 Subl" was derived from an Indian rice variety. Scientists isolated the SUB 1A gene and identified the genetic code that controls submergence tolerance. The SUB 1A gene activates when the plant is submerged, making it dormant and conserving energy until the floodwater recedes. The "IR 64 Subl" can tolerate flooding for 14 days and still can produce an average yield of 6.4 tons per hectare.

The drought-tolerant variety "Sahod ulan" was derived from the Indian variety "Sahbhagi Dhan" and the Nepal variety "Sookha Dhan". The IRRI scientists identified quantitative trait loci (QTLs) genes which give the drought-tolerance and improve yield. These are activated in popular variet-

ies like IR64 to produce better yieldseven in drought conditions.

Now the IRRI is in its last stage of developing the "3-in-l" variety. It is developing seeds that have genes that can sustain climatic changes and yet provide good yields. IRRI's Deputy Director General says IRRI is working closely with the Philippines Department of Agriculture and the Philippine Rice Research Institute (Philrice) to help the government attain its rice self-sufficiency target. The IRRI promises technology support to Philippines to accelerate high-yielding varieties, he adds.

(Courtesy : GRAINS ASIA, Feb., 2014)

"DO IT NOW"

Reducing Power Consumption for a bright future

India is the largest producer of milk and the second-largest producer of fruits and vegetables in the world. And owing to the fast-paced growth of the food industry. India's logistics infrastructure, particularly cold chain network, has come into the limelight. However, the cold chain sector needs to adhere to energy-efficient practices for donning a responsible image.

WITH increasing purchasing power among the growing middle class in India, individuals with higher socio-economic status and more economic means are likely to consume fresh vegetables and fruits, not only in higher quantities but also in greater variety. Further, fresh and read-to-eat convenience food products are gaining traction in urban India. However, products such as pre-cut fruits & vegetables and ready-to-cook meals require an effective cold chain network that enables to keep food fresh for extended periods and eliminate doubts over the quality of the food products.

The cold chain market is estimated at ? 800 crore, and growing at a rate of 20-22 per cent. However, this industry is plagued with the challenge of rising energy costs. In spite of this, the cold chain sector is looking at ways to ensure energy-efficient practices to cope with global warming and imminent fossil fuel shortages.

Understanding the cold chain

Cold chain logistics systems may be defined as a series of inter-related facilities for maintaining ideal storage conditions for perishables from the point of origin to the point of consumption in the food supply chain. The first stage of a cold chain is the receiving cold room. This is inclusive of a pre-cooling facility, subsequent compartmented short-term storages and ancillary equipment. Cooling fresh fruits and vegetables before processing removes the field heat from the freshly harvested products to inhibit decay and helps in maintaining moisture content, sugars, vitamins, and starches. The quick freezing of processed fresh fruits and vegetables helps retain the quality, nutritional value and physical properties for extended periods. The final stage is the consumer, and they are linked to the farmer through cold chain links, which are essentially thermally-controlled transport units, warehouse cold storages, direct access cold storages or a pull-based direct supply system, minimising effects of last supply chain, for just-in-time consumption.

A core component of the success of an ideal cold chain is the type of container used and the refrigeration method. Reefers, a generic name for a temperature-controlled container, can be a van, small truck, a semi or a standard ISO container. These containers, which are insulated, are specially designed to allow temperature-controlled air circulation maintained by an attached and independent refrigeration plant. However, the way these reefers operate in the country is often debated. Vikas Mirtal, Managing Director, McCain Foods India Pvt Ltd, says, "Food products, especially frozen, in any country are fully dependent on the support from cold supply chain facilities. It is an efficient cold chain that transports frozen products in stipulated timeframe while maintaining the required temperature. In India, the cold chain segment is largely dominated by fly-by-night suppliers and small businesses with poor networks. As the services are not integrated, it leads to high energy consumption, wastage and damage to food due to frequent handling and transfer."

Energy consumption pattern

The energy consumption patterns in India differ significantly as the cargo is typically not pre-cooled before being put into the cold chain. There are several areas where power supply is intermittent or not available, so diesel generators are used, which increases operating costs. Transport systems are designed for maintaining precise temperature control of the cargo; however since most produce is loaded at higher temperatures, the refrigeration units have to operate longer, and beyond rated consumption, to reach the desired set point.

The refrigeration systems, especially in case of fruit processors, usually operate at their heaviest load during the summer daytime hours when electrical costs and outdoor temperatures are the highest. Also, the initial processes of cooling, processing and cold storage of fresh, perishable produce - fruits and vegetables - are among the most energy-intensive segments of the food industry. Significant level of refrigeration is needed to slowdown imminent spoilage. Also, care has to be taken to maintain the pre-harvest freshness and flavour of ripe fruits 8c vegetables.

Cost-saving measures

Keeping the above scenario in mind, opportunities to cut energy costs in the cold chain lie in developing and using correct systems for various types of cargo. While some cargo typically requires tighter temperature compliance, and therefore, systems are designed with complex controls, other cargo such as fruits and vegetables require low-cost, simpler systems.

Studies have shown that for small processing industries, there is significant potential for energy cost savings in both the installation of high-efficiency refrigeration equipment and in the optimisation and control of the existing refrigeration systems. The older compressors and controls in the ammonia refrigeration systems at such plants make them ideal for energy savings in these two areas. Substantial cost savings can also be achieved by focussing on the proper installation of motor drives and controls as well as time-of-use shifting strategies for the cold storage refrigeration systems. Time-of-use shifts promote a conscientious attitude as steps are taken to shift some of the energy use to mid-peak or off-peak times in order to reduce the electricity costs while helping to improve the environment.

Alternative sources of energy

The Indian F8cB industry is evolving and acceptance of the cold chain has increased manifold in the last few years. Use of alternative/renewable energy in the cold chain logistics becomes viable for larger capacity systems, such as trailers. New solutions like multi-temp container, which is a system that maintains different temperatures in the same container, are being developed. These units ensure low energy consumption, enhanced environmental performance and maximum cold chain protection along with reduced downtime and maintenance needs. This is just one example out of the many for reducing energy consumption in a cold chain network.

The cold chain industry is expected to grow at double-digits owing to organised retail and growth in processed food sector. Thus, if appropriate steps are taken to reduce energy consumption in a cold chain network, the food processing industry can reach new heights in the times to come.

(Courtesy : MODERN FOOD PROCESSING JULY., 2014)

"BE SURE"

TOP TIPS
TO EXTEND EQUIPMENT LIFE

Maintenance is no longer a cost centre but an inevitable action point to be considered. It can be converted into a profit centre as enhancement of equipment life will eventually lead to higher productivity and increased bottom lines. Hence, every company is required to adopt new technologies and effective maintenance techniques.

IDENTIFY THE REQUIREMENTS

The first step towards extending equipment life is primarily assessing the preventive maintenance plan, critical process points and specific machinery that need to be identified and covered under more frequent maintenance programmes.

CRITICALITY FACTOR

Determine the 'criticality' level (low, medium, high) of each piece of equipment on the food processing shop floor. Base the criticality assessment upon a combination of the following points: ease of availability of alternative equipment; availability of alternative technique to derive the same or similar processing standards; and the impact of the unavailability of the item to one's processes and productivity.

RISK OF FAILURE

Also, determine the risk of failure (low, medium, high) of equipment. Risk, in this context, is primarily about the age of item, the maintenance history of the item, and the presence of components that would be expensive to replace if a failure occurred.

CONCENTRATE ON SMALLER PARTS

Pay most attention towards smaller parts, such as gaskets, valves, clamps or connections, etc as even they are most likely to lead to major problems and breakdowns.

POST SALES MAINTENANCE SUPPORT

Zero in on a highly efficient after-sales support particularly when it comes to maintenance.

SKILLED AND TRAINED MANPOWER

Misuse and abuse are among the leading causes of equipment malfunction, and most warranties will not cover repairs resulting from such misuse. Educate your employees on how to properly use, clean and maintain the food processing equipment to keep everything up and running and eliminate the amount of money that may have to be spent on non-warranty issues. Alternatively, one can consider inducting all production and maintenance supervisors on a compulsory asset management course.

RECORD MANGEMENT

Keep records for each machine to make sure these maintenance procedures are being performed at the right time. These records will also help you predict parts inventory needs. If you keep a stock of required maintenance parts, such as filters, bed knives, belts and seals, you would not be caught in a situation where important maintenance activities were not performed on schedule because of lack of parts.

COMPUTERISED MAINTENANCE SYSTEM

Utilise a Computerised Maintenance Management System (CMMS) to keep track of your assets, warranty periods, designated service provider, service level agreements, service history, preventive maintenance schedule, etc.

BASIC CONDITION - MONITORING REGIME

Regularly orient the service operators to give priority to vibration/oil analysis/ thermography/ see-touch-hear inspections.

ALIGN OPERATIONS AND MAINTENANCE

Using this strategy, if a thorough production plan and schedule covers both manufacturing of product and equipment maintenance, the bottom line can be enhanced to a large extent. This requires higher amount of co-ordination among various departments of the company.

(Courtesy : Modern Food Processing, July 2013)

India's first food packaging lab inaugurated at Delhi IIP

INDIA'S first laboratory dedicated to testing food packaging was inaugurated by commerce and industry minister E M Sudarsana Natchiappan at the Indian Institute of Packaging (IIP), New Delhi recently. The facility would deal with the shelf life and other aspects of food packaging, and provide inputs to the packaging industry, primarily in the northern part of the country.

The minister said the Centre had a target to increase the growth of the processed food sector from seven per cent to 20 per cent by 2020, and added that since the packaging and food processing sectors were complementary to each other, it was high time the government provided such facilities for value addition.

"The lab would support the testing of the material used for food packaging and the processing sector. It would be at par with the global needs and standards," he said, adding that member nations of the World Trade Organisation (WTO) could ask for the standards followed by exporting countries. He said the commerce ministry did not want the return of any Indian good on any ground.

Natchiappan added that the commerce ministry was in consultation with other departments and agencies like the Agricultural and Processed Food Products Export Development Authority (APEDA) for the certification of export consignments at various export facilities.

One such facility was set up at Tuticorin Port for the export of spices. The minister pointed out that wherever there was demand, the ministry would facilitate the same, so that the goods to be exported could be certified.

TanweerAlam, HP's regional head for the capital, elaborated that for processed foods, packaging was a vital instrument for survival, and this laboratory would analyse the food packaging requirements and improvements needed in food packaging in the country. "After processing, packaging takes care of food. It protects food from microbial attacks, transport hazards and other things that spoil it, and increases its shelf life. So the facility would determine what is the appropriate packaging for processed foods. This would further help in reducing their wastage," he said.

Alam pointed out that the functional properties, barrier properties in terms of moisture, oxygen, transport worthiness, etc. required by the food packaging would be determined at the facility. It is pertinent to mention here that there was no exclusive laboratory for such purpose and therefore, during the 12th Five-year Plan, IIP expanded the existing infrastructure and created this facility.

The institute was also in talks with the Vaishno Devi Shrine Board and Mumbai's Siddhi Vinayak Temple for the purpose of packaging prasadam, and this laboratory would help in reviving these projects.

On the issue of non-bio-degradable packaging material, N C Saha, director, IIP, said, "Technically, there is no alternate to plastic packaging. There are companies in India that claim to manufacture bio-degradable and oxo-bio-degradbale plastic material. But, there is a need for barrier properties for moisture and oxygen for that. Right now, such materials are being used garbage bins, but not as packaging materials."

Consume Plenty of Milk to Prevent Osteoporosis

By
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MILK is a bio fluid replete with high quality lactose, fat, proteins, minerals (major and minor) and micro nutrients like vitamins, enzymes and hormones regulating metabolic functions during one's entire life cycle. The water in milk acts as a carrier of nutrients found in the soluble, colloidal and emulsified forms. Although the Green Revolution has provided self-sufficiency in grain production in quantitative terms, the quality of food has not been addressed even in the much-hyped food security programme. Inequalities and diversities in incomes among various groups of population are well known economic problems facing INdia and many developing countries. The challenge of managing the optimum daily needs of protein, energy minerals and vitamins for children, pregnant and lactating mothers and economically distressed population remains a distant dream. Underprivileged groups suffer from severe malnutrition and deficiency syndromes. These problems are most acute amongst rural masses. A common man cannot afford to buy even the minimum listed quantity of quality foods like pulses, fruits, vegetables, milk and milk products. High commodity prices coupled with high incidence of unemployment has not been addressed even in the much-hyped food j and limited disposable incomes have put quality foods security programme. Inequalities and diversities in incomes among various groups of population are well known economic problems facing India and many developing countries. The challenge of managing the optimum daily needs of protein, energy, minerals beyond common man's reach. Every third child born in India is underweight and more than 50% of school going children suffer from physical deformities and under-nutrition. Notwithstanding the food value of lactose, fat, proteins and vitamins in milk, much of the significance has to be given to the presence of minerals in milk found essential for tissue and bone growth. Calcium and phosphorous are two essential minerals which play an important role

Table 1: Compositional differences in Milk of different species

Constituent	Human	Cow	Buffalo
Protein, g	12	3.3	4.2
Fat.g	3.6	4.1	7.0
Lactose, g	7.0	4.5	5.1
Total ash, g	0.21	0.72	0.82
Calcium, mg	28.0	120.0	210.0
Magnesium, mg	4.0	10	16
Sodium, mg	17.0	50.6	40.0
Potassium, mg	55.0	145.0	110.0
Phosphorous, mg	14.0	82.0	128.0
Ascorbic acid, mg	3.6	2.56	2.97
Vitamin A (ug/g fat)	13.8	9.2	9.8
Thiamine (jig/ml)	0.20	0.45	0.50
Riboflavin (ug/ml)	0.26	1.49	1.07
Vitamin E (ug/g fat)	3.5	1.84	1.97
Fat globule size, um	1.0	3.85	5.0

in bone structure and functions during all spans of human life cycle.

COMPOSITION OF MILK

The proximate composition of milk from mammalian species, viz. human, cow and buffalo, is mentioned in two types in having less protein, low fat, lower mineral and higher lactose contents. Animals known for very fast growth rate have high protein content in milk e.g. a rabbit needs only 6 days to double the body weight after birth. Rabbit milk contains highest level of proteins (10.38%).

IMPORTANCE OF MILK PROTEINS

Milk proteins have high nutritive value because of a favourable balance of essential amino acids, which cannot be synthesized by human beings. Cow milk contains at least 18 amino acids, particularly 8 essential ones, in greater amounts than in many other common foods. Milk proteins can be fractionated into 2 types — casein, constituting about 83% of the total milk proteins, and serum proteins comprising of lactalbumin and lactoglobulin. The well proportioned amino acids of milk make it a valuable supplement in a mixed diet, especially for the under-nourished and as a preventive and curative source in protein deficiency diseases, like kwashiorkor and stunted growth. Dairy products like cheese, paneer, khoa, chhana, milk based sweets, dahi and srikhand serve as good supplement to cereal foods deficient in lysine. Addition of skim milk powder to bakery products improves their nutritional quality to a level almost equal to that found in cheese, paneer and chhana.

Human milk derives its special biological effect from the fact that it is highly digestible and leads to the excretion of only small amounts of urea. The high digestibility of human milk is influenced by the coagulation properties of its proteins, because casein micelles are smaller and precipitate in a more finely dispersed form. It may be remembered that excess of dietary nitrogen puts strain on the kidneys. Therefore, in an adapted baby milk food, the protein content is lowered to a value that is only a little above that of human milk. Cow milk is generally considered more favourable for infant foods than buffalo milk. The beta-casein is the main casein fraction in human milk and its structure is similar to that of beta-casein in cow milk. Alpha-lactalbumin constitutes 10-25% and immunoglobulin 10% of the total protein of human milk. In cow milk, casein constitutes 80% and whey proteins 20%. Whey proteins contain a total of 50.8g of essential amino acids per lOOg of protein, mainly threonine, lysine, isoleucine and tryptophan, whereas casein contains only 45.1g/100g of these amino acids. The protein intake recommended for the infants of 6 months age is 2.2-2.5g/Kg body weight/day and for those of 6 months to 1 year age 2.5-3.5g/Kg body weight. Milk serves as the main source of protein in the infants.

All normal human beings register a steady bone development during early growth, but start to lose bone as they grow older. When this loss is accelerated, it leads to increased incidences of fractures. Osteoporosis may occur in individuals of all ages as a result of physiological abnormalities in the metabolism of calcium, phosphorous, vitamin D and certain hormones. Increased intake of calcium from natural sources like milk and moderate exercise usually help in preventing or slowing down the progression of osteoporosis.

IMPORTANCE OF FAT

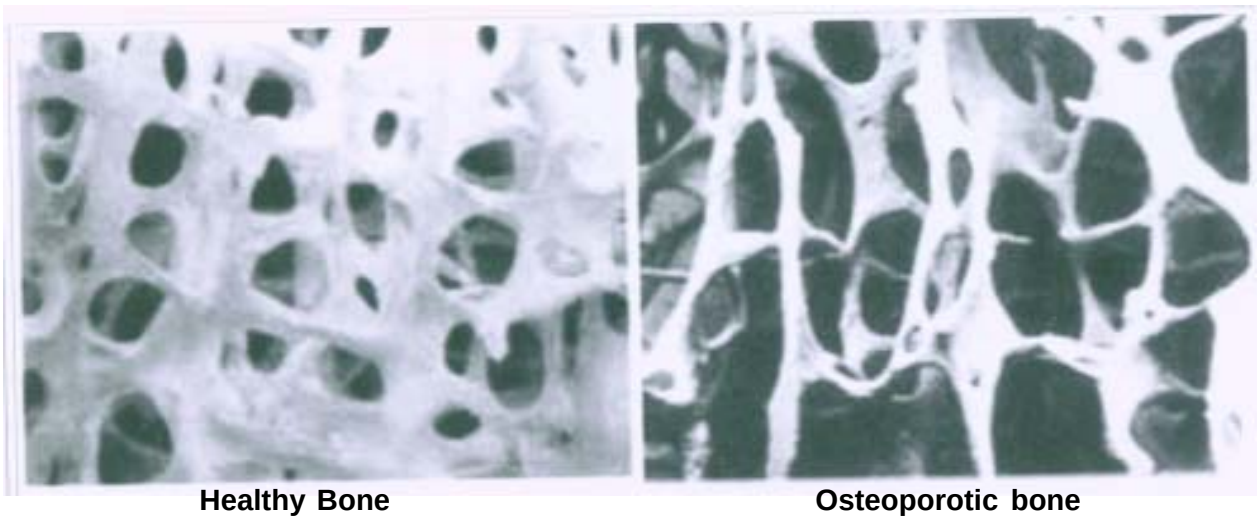
The milk fat, cream, butter, ghee and butter oil are the rich sources of calories and supply many essential fatty acids not found in any other food and fat-soluble vitamins (A, D, E and K). Cow ghee improves eye vision, cures night blindness, improves resistance to infections and rejuvenates health and memory. The absence of fat and vitamin A in skimmed milk makes it an unsuitable food for babies. All the other constituents more or less remain unchanged in skimmed milk, and at the expense of missing fat they are proportionally increased. Cholesterol usually required for vitamin D synthesis is often implicated as a cause of heart ailments. Although convincing medical proof on this aspect is not available, the anti dairy lobbies are making a great noise against the use of milk fat. It is heartening to know that buffalo milk fat carries the lowest amount of cholesterol. It is found that the cholesterol content in goat, cow and buffalo milk (mg/100 g of fat) is 420, 319 and 214 respectively. Ghee produced by indigenous method in India is reported to contain anticarcinogenic compounds (CLA) and carries the lowest amount of cholesterol due to its fractionation in ghee residue.

IMPORTANCE OF LACTOSE

Lactose, yet another energy-yielding constituent, is made up of glucose and galactose — an essential constituent for the growth of nervous tissue. It is important for the myelin synthesis as an element for cerebrosides formation. Lactose also plays a significant role in calcium utilization in the body. Lactose malabsorption and lactose intolerance in human beings is caused by a reduced Beta-galactosidase enzyme activity in the mucosa of the small intestine. This enzyme hydrolyses lactose into glucose and galactose. In the absence of this enzyme, lactose concentration inside the intestine produces symptoms of abdominal pressure, colic, flatulence and diarrhoea. Lactose intolerance can be found in the elderly in certain populations throughout the world. It is now possible to reduce the lactose content in dairy products by more than 80% with the help of ultra filtration process. In fermented milks like dahi, misti dahi, yoghurt, srikhand and cheese products, bacterial fermentation breaks down part of lactose into lactic acid and in the coagulated, pressed and drained products like paneer and chhana much of the lactose goes out with whey.

CALCIUM AND BONE MASS

Calcium comprises of 1.5 to 2.0% weight of the adult human body. Over 99 weight percent of calcium is present in bones and teeth. The normal calcium content of blood is 9-11 mg/100 ml. About 48% of serum calcium is ionic, 46% is bound to blood proteins and the rest is present as diffusible complexes e.g. of citrate. Bone structure comprises a strong organic matrix combined with an inorganic phase which is primarily hydroxy apatite [3Ca3(PO4)2.Ca(OH)2]. A high initial bone mass would ensure that the mass of residual bone remains above the fracture threshold in later life. Hypocalcaemia increases excitability of neuromuscular tissue and symptoms of tetany would ap-



Healthy Bone **Osteoporotic bone**

pear like muscular spasm, tremor and convulsions. Calcium stimulates release of blood clotting factors from platelets. Adult women have lesser bone mass than adult men.

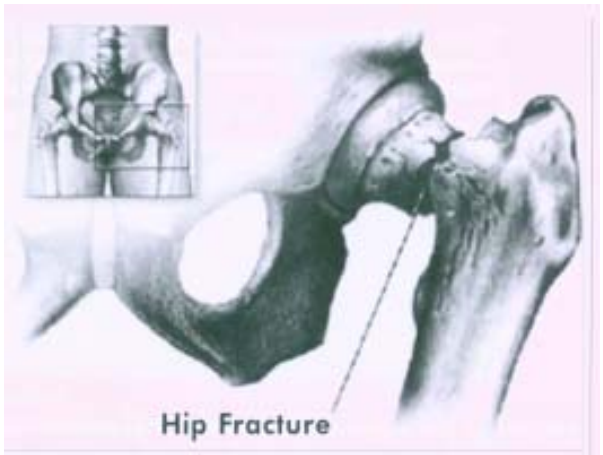
Deficiency of calcium and vitamin D in mothers is passed on to newborns, causing an increase in incidence of heart failures. According to paediatric specialists, a child needs 9-11 mg/dl calcium for a healthy heart.

OSTEOPOROSIS

All normal human beings register a steady bone development during early growth, but start to lose bone as they grow older. When this loss is accelerated, it leads to increased incidences of fractures in arms, vertical bodies and hips. Fractures of the hip in elderly individuals are associated with a mortality rate of 12-20% and half of those who survive require prolonged and expensive medical care. There is a general agreement that the mass of bone accumulated during growth and early adulthood determines the severity of risk of an osteoporotic bone fracture in later life. Increased intake of calcium from natural sources like milk and moderate exercise usually help in preventing or slowing down the progression of osteoporosis. This problem also occurs in patients with excess glucocorticoid secretion (Cushing's syndrome). Insulin treatment in diabetics increases the bone formation, but there is a significant bone loss in untreated diabetic patients. About 85% of the patients with Cushing's syndrome are hypertensive due to increased secretion of both deoxycorticosterone and angiotensinogen or a direct glucocorticoid effect on blood vessels which cause bone dissolution and osteoporosis.

All mammalian species undergo a gradual decrease in bone mass and bone loss or ageing osteopenia. Immediately after menopause, women suffer rapid bone loss making them susceptible to osteoporotic bone fractures. Such fractures are

consequence of a degenerative process that has been ongoing for several years, just as heart attacks are the result of an analogous chronic process affecting the cardiovascular system. It may, however, be stated that osteoporosis may occur in individuals of all ages as a result of physiological abnormalities in the metabolism of calcium, phosphorous, vitamin D and certain hormones.



Holes in the bone decrease the mass of the bone tissue relative to its volume leading to a reduced weight or shock bearing capacity of bones. Incomplete mineralization of osteoblasts (new bone cells) takes place when there is an inadequate concentration of calcium and phosphate ions at the ! including contraction of skeletal, cardiac functions, sites of bone formation to cause crystallization of blood clotting, transmission of nerve impulses and Hip Fracture salts on the collagenous matrix. The spine, hip and neck of the femur are the major sites of osteoporotic bone fractures. However, fractures also occur at other sites such as the wrist.

CALCIUM REQUIREMENTS

The main nutrients that are implicated in the aetiology of osteoporosis are calcium, phosphorous, protein and vitamin D. The calcium requirements of adults range from 300 to 1500 mg per day, depending on its availability and supply from varied diets. In cereal based foods, the daily requirements are 400 to 500 mg per day, whereas in countries strong in dairy industry, the intake should be 600 to 800 mg per day. It may be possible that the calcium requirement of adults consuming high protein, high phosphorous and acid producing diet may be greater than those consuming a low protein, neutral to alkaline, cereal based diet.

Extracellular calcium ion concentration is determined by the interplay of calcium absorption from intestine, renal excretion of calcium and bone uptake and release of calcium, each of which are regulated by parathyroid. Calcium plays a key role in many physiological processes, formation of smooth muscles. Neurons are sensitive to

changes in calcium ion concentration. Hypocalcaemia causes the nervous system to become more exited and elicit titanic muscle contraction and causes progressive depression of nervous system.

Tetany ordinarily occurs when the blood concentration of calcium falls from its normal level of 9.4 mg/dl to about 6 gm/dl and it is usually lethal at about 4 mg/dl. In laboratory animals extreme hypocalcaemia was found to cause marked dilatation of the heart, changes in cellular enzyme activities, increased membrane permeability in some cells and impaired blood clotting.

The average daily intake of both calcium and phosphorous in human beings separately is about 1000 mg which is equivalent to amounts found in 1 litre of milk. Being divalent, calcium ions are poorly absorbed from the intestines. Vitamin D promotes calcium absorption and about 35 percent of the ingested calcium is usually absorbed in the intestines. Additionally, about 250 mg/day of calcium enters the intestines through gastrointestinal juices and mucosal cells. Approximately, 10 percent of the ingested calcium and 9 percent of the phosphate are excreted in the urine. Kidneys, however, regulate the phosphate excretion through urine.

Formulation of a diet adequate in calcium may be complicated because of individual's ability to adapt to calcium supply and its absorption which is directed by parathyroid hormone. Vitamin D (dihydroxy cholecalciferol) controls the synthesis of a calcium-binding protein in the intestinal epithelium necessary for absorption of calcium. This capacity to modify the calcium absorption is a major factor in the ability of adults of different food cultures to subsist on calcium intakes ranging from 300 to 1000 mg per day. However, the efficiency of calcium absorption declines during ageing.

Optimum calcium: phosphorous ratio of 2:1 is recommended in the diet which may vary with the intake of both elements. Bone loss in ageing experimental animals was found to be more sensitive to a high phosphorous intake than to a low calcium intake. Eighty five percent of the phosphorous in the body occurs in bones and teeth. There is a constant exchange of calcium and phosphorous between bones and blood phosphorous is found in every tissue and cells in the form of a salt or ester of mono-, di- or tribasic phosphoric acid. Phosphorous is involved in many metabolic functions e.g. carbohydrate metabolism, ATP release from fatty acid metabolism and oxidative phosphorylation. Phosphorous is an essential compound of nucleic acids and phospholipids. Vitamin D de-

Table 2: Recommended dietary allowances for adults and nutritional content of whole milk

Nutrient	Recommended daily intake	Supplied by 100g Cow milk	Buffalo milk
Protein, g	58.0	3.29	4.52
Calcium, g	0.12	0.21	0.21
Phosphorous, g	1.2	0.08	0.13
Magnesium, mg	350	10.0	16.0
Vitamin A,	1000	37.70	68.60
Vitamin D, IU	400	41.0	52.0
Calcium/Phosphorous ratio	2:1	1.50	1.60

The average daily intake of both calcium and phosphorous in and milk products, rather than cereal based rations, must be given priority in all school feeding programmes tomake India a healthy and prosperous nation.

ficiency is a common contributory cause of osteoporosis in countries where food fortification with vitamin D is inadequate and exposure to sunlight in minimal because of confinement indoors and cultural clothing habits.

Milk is deficient in iron and its absence in the diet may lead to anaemia. It is also a poor source of vitamin D, hence vitamin D is added directly to whole milk to provide 400 IU or 10 u.g per quart. Milk contributes to human needs for virtually all the minerals and trace elements known to be essential for health. The recommended daily intakes of protein, minerals and vitamins are listed in Table 2.

It may be concluded that milk and milk products should be consumed daily and copiously to prevent age related osteoporosis. The food value of milk needs to be promoted by aggressive advertisements. It is recommended that milk and milk products, rather than cereal based rations, must be given a priority place in all the school feeding programmes to make India a healthy and prosperous nation.

REFERENCES

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(Courtesy : INDIAN DAIRYMAN, MARCH 2014)