Central Institute of Post Harvest Engineering and Technology, Ludhiana
Our Slogan: Produce, Process and Prosper

CIPHET E – Newsletter for April, 2007
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Director's Column

Dear All,

Recently there has been a flood of seminars, workshops and group meetings to create awareness about post harvest management and value addition of fruits and vegetables to reduce the losses and also to produce ready to use and eat products which will compete with the inflow of processed foods from overseas. These seminars, workshop and group meetings are being held by research, development, trade and commerce organizations but the real player, who is a farmer, his opinion is missing in this debate. Hence there is a need to conduct such meetings in the production catchments. The guava growing areas, citrus growing areas, banana growing areas should be the venue for such meetings so that local players like local businesses, farmer groups could be motivated to adopt new technologies and production models suitable for them. Without their active participation in this mission we may not achieve much. If farmer remains ignorant about these latest techniques, it would widen the knowledge gap between him and the eager trading community and he may become vulnerable for further exploitation. However the efforts are praiseworthy, as this issue was never highlighted before with such an importance.

The CIPHET as usual is playing its role by generating indigenous cutting edge technologies to improve the processing efficiency and product quality. Developing a novel technology to mill sorghum to get refined sorghum flour and novel products from ber are the steps in that direction. These and other new technologies are being passed on to upcoming entrepreneurs through a 7-day training module.

The example of progress of Israel in agriculture is envy of all developing nations and we should try to emulate this example in any way possible. The Indo-Israel collaborative project being developed by ICAR, of which CIPHET is one of the partners, is a great opportunity to learn from Israelites on how to produce maximum with low resources and handle this hard earned crop wealth to get maximum out of its processing.

Though the basic structure or composition of food remains the same, the way it would be cooked and processed is going to change with advent of new technologies like extrusion, microwave, high pressure processing along with uniform code of practices to be followed internationally for food quality and safety. The association of CIPHET in ICAR-Cornell work plan will give us an opportunity to learn and implement such state of the art techniques for our crops and products and to develop a network of food quality and safety laboratories in the country.

With best regards

R.T. Patil
Director

Events:

Sorghum Post Harvest Technology

Director, Dr. Patil attended 37th Annual Group Meeting of AICRP held from April 5-7, 2007 at Maharana Pratap University of Agriculture & Technology, Udaipur (Rajasthan) on 7th April, 2007 and interacted with the sorghum scientists on "Processing and Value Addition to Grain Sorghum". The scenario of sorghum farming over last 10 year shows that the production as well as area under sorghum is getting reduced year after year. The sorghum has many nutritional qualities and can be used to develop many functional foods. It is gluten free and a low GI product due to complex carbohydrates and can be used in production of health and therapeutic foods for gluten intolerant people and diabetic patients. The important finding of research in the area of post harvest technology conducted at CIPHET as well as by the other institutions need to be adopted increase consumption of sorghum and thereby increasing the profitability of farmers. The modern milling process to get refined sorghum flour, the fermentation pilot plant to produce ethanol at CIPHET and extruded ready to eat and noodle & pasta type product being developed at CIPHET were explained to august gathering. One of the ways to popularize sorghum is that all sorghum researchers should consume sorghum at least three times a week and also act as a link between growers, doctors and health conscious people. The sorghum crop can be remunerative if each center of AICRP promotes processing and utilization of sorghum in their respective area. Dr. C.V. Ratnavathi from NRC on Sorghum has developed many good products like sorghum flakes, sorghum syrup which have potential to be scaled up to small industry level with the help of CIPHET process engineers.

Refined sorghum and husk+bran+germ

Post harvest value chain for fruits and vegetables

Director, CIPHET participated in a group meeting under the chairmanship of DDG (Hort.) about Indo Israel network project for the co-operation in the field of Agricultural Research on 11.04.2007 at KAB-II, Pusa Campus, New Delhi. This project will be taken up with the funding of ICAR as a network project proposed by Horticulture Division, ICAR having 4 to 5 lead centers and each lead centre will have 3-4 cooperating centers. CIPHET will be lead centre for Post Harvest Management and Value Addition and cooperating centres will be NRC Citrus, Nagpur; IIVR, Varanasi; CISH, Lucknow and NDRI, Karnal. Since India is moving ahead in developing infrastructure at a very good speed and this collaboration with Israel will accelerate the progress. We will have opportunities to get exposure to some unique technologies, which Israel has developed, so that we can modify them suitably for our conditions. In this project activities will include installing/ establishing high-tech horticulture production as well as processing facilities such as high-tech greenhouses, pack houses, cold storages at all centres along with the instrumentation for proper grading, shorting of the fruits and vegetables. The modern packaging concept and technique will also be developed at all centers. A group meeting was held at CIPHET Ludhiana on 24.04.2007 to prepare a project document where scientists from CIPHET **(Dr. RK Gupta, Head, HCP, Dr. DB Singh, Sr. Scientist (Hort.))** and from other cooperating centers **(Dr. D. K. Tandon, Principal Scientist (Biochem.), CISH, Lucknow, Dr. Lallan Ram, Sr. Scientist (Hort.), NRCC, Nagpur, Dr. A.D. Huchche, Sr. Scientist (Hort.), NRCC, Nagpur, Dr. Sudhir Singh, Senior Scientist (FT), IIVR, Varanasi and Dr. R. R. B. Singh, Senior Scientist (DT), NDRI, Karnal)** discussed at length and finalized issues to be addressed through this joint program. The CIPHET has also been given responsibility for infrastructure development for greenhouse cultivation in semi arid and arid region at its Abohar centre for which IARI is a lead centre. Under this sub-project CIPHET, Abohar has been given the responsibility of prorogating date palm cultivation.

CIPHET scientists attend 2nd Indian Horticulture Congress-2007

Dr. RT Patil, Director, Drs. D S Singh and Jangra, Sr, Scientits(Horti.) and Drs. SK Nanda and SN Jha, Project Coordinator (PHT) and Sr. Scientist (AS&PE) respectively, attended 2nd Indian Horticulture Congress-2007 held at the ICAR Complex for North Eastern Region, Barapani, Meghalaya from 18-21 April, 2007. The theme of the congress was "Opportunities and Linkages for Horticulture Research and Development (Focus: North-Eastern Region)". The participation of a team of scientists from CIPHET was with purpose to expose the participants to the technologies developed by CIPHET and its AICRP for post harvest management and value addition of horticultural produce. The key to increase processing activity of these crops is development of indigenous processes and equipment by engineering and technology inputs so that production catchment processing of these crops becomes techno-economically feasible. There was a separate session on "Post Harvest Management, Processing, Marketing and Export" on 21st April, 2007 which was co-chaired Director CIPHET and included two key note presentations from CIPHET as follows:

- Post Harvest Infrastructure – A key to post harvest management and value addition, by Dr. R.T. Patil, Director, CIPHET
- Post Harvest Management, Dr. S.K. Nanda, Project Coordinator (PHT), CIPHET

Role of CIPHET in the ICAR – Cornell work plan under AKI in the area of food processing

Under the Indo US Agricultural Knowledge Initiate the ICAR – Cornell work plan under AKI in the area of food processing was discussed under the chairmanship of DDG (Engg) on 24.04.07. This program includes food quality and safety as one of the important program to help proper growth post harvest sector in the country. The CIPHET has been given the responsibility to establish a centre for food quality and safety and for this purpose 4 trainings are allocated to CIPHET. It was decided that the CIPHET should develop state of the art food quality and safety laboratory, manual or book of standards on food quality and safety including their testing protocols for determining the micro organisms and other toxic residues which are detrimental to health and hygiene of consumer. The four scientists from CIPHET will be trained on this topic in US and get experience and exposure to advance detection technologies, instrumentation, the lab methods and also international standards related to food quality and safety. As a followup to this training the CIPHET will establish referral and accredited laboratory on food quality and safety and will also act as lead centre to establish food quality and safety laboratories network in the country to cater to different regions.

Exhibition & Conference on Post Harvest- 2007

Dr. RT Patil attended "Exhibition & Conference on Post Harvest- 2007" at Pragati Maidan, New Delhi on 24.04.07. In this exhibition modern techniques of pre-cooling, post harvest logistics, grading, sorting and packaging were displayed by Indian as well as multi-national companies. The nano-technology based TMS cold storage and transportation box by "Infrachill" was found to be the technology which has got very good scope for introduction in Indian value chain. Since electric power availability is very unreliable in India the cold chain equipment based this technology can keep the desired low temperature for 24-48 hours without power supply. The manufacturer expressed desire to provide this technology free to CIPHET for it's testing, evaluation and demonstration to up-coming entrepreneurs.

Important research programmes in PHT sector XI plan

During the meeting of under the chairmanship of DDG(Engg.) the following three programmes have been short listed as the major activities in the XI plan at CIPHET and other institutions engaged in post harvest engineering and technology research in the country.

1. **High density composite feed from organic residues and by- products for livestock and fisheries.**

India has about 11% of the world livestock population (485 million) and a large number of water bodies (7 M ha), but its overall productivity is low. One of the major causes is paucity of good quality low cost livestock and aqua feeds. Indian agro processing industries generate about 100 Mt of byproducts and organic residues in the form of hulls, bran, deoiled cake (DOC), pomace, trimmings, etc. The individual by-product and residue is rich in specific ingredients and hence an appropriate mixture of such by-products/residues can be used as a livestock and fish feed. The

mix of organic residues and micronutrients processed as densified cubes and pellets would have adequate nutrition and help in an increased livestock and fish productivity at an affordable cost. This can be achieved through collection and characterization of various organic residues and by-products, development of process protocol to convert the mix of organic residues and byproducts into densified livestock and feeds and pilot plant development and product quality assessment. The programme will be implemented involving CIPHET, NDRI, IVRI, NIAN&P, AICRP on PHT and relevant animal and fishery science institutions and universities.

2. Utilization of deoiled cake for augmenting vegetable protein supply in India.

The major deoiled cakes (DOC) available in India are from soybean, groundnut and mustard. The DOC from soybean and groundnut could be used as a source for edible vegetable protein. India produces about 3.5 Mt of deoiled cake from groundnut having about 33% protein and about 5 Mt of soybean meal containing about 50% protein. Protein available in soybean and groundnut cake is equivalent to about 15 Mt of pulses that is equal to country's total pulse production. Cost of these proteins in edible form is about Rs 30 per kg whereas that from pulses is about Rs 180 per kg (6 times more). One of the ways of using these deoiled cakes is to produce edible flours, protein isolates and concentrates to augment the vegetable protein supply of India. Another approach is to produce edible quality deoiled cake using CIAE developed integral extrusion-expelling technique to get medium fat deoiled cake from soybean to produce medium fat soyflour. Similar technology can be developed for producing edible quality deoiled cake from groundnut. This programme will be implemented involving CIAE and CIPHET in collaboration with oil seed processing and flour milling industry.

3. Bio based novel products.

The agricultural produce and its by-products are major sources of many phytochemicals, biochemicals, bio colors and essential micronutrients like vitamins and minerals. The soybean is richest source of phytochemical called Isoflavones and which can be extracted from soybean meal for use in pharmaceuticals. Among biocolors, the red color can be obtained from the peels of red pomogranate and petals of red rose, yellow from marigold flower, green from mint, spinach and Mehandi, blue from indigo berries and jacaranda flowers, magenta from beet root and onion peels, violet from grape skins and Jamun and also maroon from lac. The other biochemical compounds such as ascorbic acid (Vitamin C) from Amala, lycopene from Tomato and watermelon, bromelein enzyme from pineapple. These essential biochemicals can be extracted using membrane separation and super critical fluid extraction techniques. This programme will be implemented through characterization of active compounds in the raw materials for specific use, development of pilot plants for their extraction and assessment of their stability and shelf life. This programme will be implemented involving CIPHET and AICRP on PHT and AICRP on Medicinal and Aromatic Plants.

CIPHET Scientist Participates in 1st International Food Regulatory Summit

Dr. R.K. Goyal, Sr. Scientist participated in the summit held at New Delhi during, April 10-11, 2007. The seminar covered following key topics:

- Emerging Global Food Regulations and Worldwide Harmonization Initiatives
- Building Consumer Confidence – Ensuring Safe Food from Farm to Fork.
- Food Safety and Quality Need for Capacity Building and Infrastructure.

The summit was first of its kind in India and unique in the sense that it could address the issue related to food safety of developed as well as developing countries. About 300 delegates mainly from industry, R&D institutes, consumer forums participated in the summit.

Joining: New Head of Divisions at CIPHET

Dr. O.D. Wanjari, doctorate in Agricultural Engineering from I.I.T. Kharagpur has joined as **Head of Agricultural Structures and Environmental Control** on 12/04/2007.. Dr. Wanjari, honorary DAAD Advisor, has undergone advanced trainings in West Germany and USA. He is one of the fonder members of CIPHET. His leadership will promote research in the areas of agricultural structures and environmental control for enhancing the shelf life of perishable foods of plant & animal origin in India.

Dr. R. K. Gupta, doctorate in post harvest engineering from I. I. T. Kharagpur has joined as **Head of Horticultural Crops Processing Division** on 11/04/2007. Dr. Gupta has also done Post Graduate Diploma in Food Processing from International Institute of Management, Netherland. He has an excellent track record of 21 years in the areas of research teaching and training in the field of food processing and post harvest technology. His selection as head will surely benefit the fruit & vegetable growers and processors of Punjab as well as India.

Dr. K. K. Singh has joined as head of the **Food Grains and Oilseeds Processing Division** on 16/04/2007. Dr. Singh obtained his Ph.D. from I. I. T. Kharagpur and post doctoral from North Dakota State University, U.S.A. He was awarded the prestigious Jawarhar Lal Nehru Award for his Ph.D. thesis and best book award by Indian Society of Agricultural Engineers. His research work and books are widely referred by researchers and students in India and abroad. His selection will immensely benefit the farmers of Punjab who are known for producing food grains for the entire country.

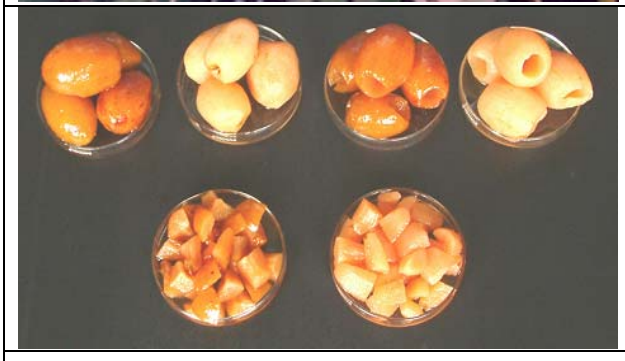
Technology of the month

Value added preserves and intermediate moisture products from *ber* fruits.

Ber (*Zizyphus mauritiana* L.) is an important fruit of arid and semi arid regions of the country. Ber is a delicious, nutritious fruit and has therapeutical value. The tree yields 50-200 kg fruits annually but the harvest season is limited to 4-5 weeks depending on the variety. A large surplus during glut gives low returns due to perishable nature of the fruit, and lack of simple technology and efficient processing facilities in the production catchment. With a view to overcome these problems and make the fruit products available throughout the year and develop entrepreneurship and generate employment in rural areas this technology package has been developed by CIPHET at its Abohar center.

Ber Preserves & Osmo dehydrated ber products

The ber preserves without peel and the osmo-dehydrated products at 60ºC (Destoned ber without peel into ber cubes and rings) were found to be highly acceptable, shelf stable with very high ascorbic acid content. (45.8-50.8mg/100g). The ber preserves as well as osmo-dehydrated products can be stored in glass jars up to 4 months at ambient conditions and 180 days at low temperature (8-10ºC).



Ber Preserves	Osmo-dehydrated Ber Products

Project Profile of the month

GINGER POWDER

INTRODUCTION

Ginger (*Zingiber officinale*) is one of the oldest spices with a distinct flavour and pungency. It is widely used in many cuisines in India. It also finds use as a flavouring substance in soft drinks, alcoholic and non-alcoholic beverages and confectionery. A variety of pickles are prepared from ginger. As it is known to possess medicinal properties, it is also used in pharmaceutical preparations. India is the largest grower of ginger and also the largest producer of dry ginger in the world. Other countries cultivating ginger extensively are West Indies, Brazil, China, Japan and Indonesia. In India Kerala, Orissa, Andhra Pradesh, Himachal Pradesh, Meghalaya and West Bengal are important ginger growing states. About 60% of the area is confined to Kerala, accounting for 25% of the country's total production. The total production of ginger in India was 2,75,000 million tonnes in the year 2003. The average yield of ginger is 3.43 metric tonnes per hectare.

India exports fresh, bleached, unbleached and dried ginger. In the year 2001-2002, 2882 metric tonnes of fresh ginger, 1490.87 metric tonnes of unbleached ginger, 242.40 metric tonnes of bleached ginger and 672.78 metric tonnes of ginger powder were exported from India. Ginger oil and ginger oleoresins are also exported from India, mainly to UK, USA, the Netherlands, France, Germany, Korea Rep. and Japan etc. India's exports of ginger oil fell from 17,309 kg in 2000-01 to 11,400 kg in 2001-02 but rose in value from Rs 260.14 lakhs to Rs. 311.75 lakhs. India's exports of oleoresin of ginger went up from 47.73 metric tonnes valued at Rs. 5.56 crores in 2000-01 to 93.53 metric tonnes valued at Rs. 9.37 crores in 2001-02.

Our country also imports ginger (mainly in fresh form, i.e. green ginger) from Myanmar, Nepal, China, Nigeria, etc. India imported 12,651 tonnes of ginger valued at Rs. 15.34 crores in 2001-02. More than eighty per cent of total ginger imported is in the form of fresh ginger / green ginger.

POST HARVEST PROCESSING

Out of the total production of ginger approximate 15-20 % is retained by farmers for planting 35-40 % is consumed as green ginger, 40-45 % is dried for export and domestic consumption and 3-5 % of the produce is wasted in both green and dry forms during assembling and distribution. The crop is harvested in 5-6 months for marketing it as green ginger. The harvested rhizomes are washed thoroughly in water 2 or 3 times to remove the soil and dirt and sun dried for a day. Green ginger finds use in many traditional curries, dishes, pickles, preserves etc.

Ginger crop matures in about eight months. The maturity time varies from variety to variety. The crop is harvested when the leaves turn yellow and start drying. The value added products such as dried ginger (bleached or unbleached), ginger powder, ginger oil and ginger oleoresin are of commercial interest. These are exported from India to many countries. The technology of drying of ginger is described as follows:

Dehydrated Ginger

The dried ginger is a high value commodity of trade. It is mainly used for the extraction of ginger oil and ginger oleoresin. Fresh ginger contains about 85% moisture and it is dried to final moisture content of 10%. The ginger is sun-dried or dehydrated mechanically. Dried ginger is available in various forms: unpeeled (un-scraped), peeled (scraped) and bleached. Raw ginger rhizomes are thoroughly washed to remove the adhered soil. The cleaning step is necessary to get good quality final product. The cleaned rhizomes are then sun-dried. Sun drying is the most preferred method of drying. However, mechanical drying can be accomplished in a cabinet / tray drier at a temperature not exceeding 60^0 C.

The peeled dried ginger is obtained by peeling ginger rhizomes prior to drying. It facilitates faster drying of ginger, but it damages the oil cells, which are located close to the vicinity of the outer skin, and many of the flavour molecules are lost. The peel can be immediately steam distilled to recover the ginger oil. Hand peeling of ginger is commonly practiced and has been found to be superior to mechanical peeling. During peeling the epidermal layer of the fresh rhizome is scraped off with a bamboo splinter and then rhizomes are washed in water and dried in the sun for 7-10 days. The produce is uniformly turned during drying. As the essential oil is in the epidermal cells, excessive or careless scraping results in the loss of oil and depreciated quality of the spice.

If the ginger is to be converted into ginger powder it is preferable to slice the fresh ginger before drying, as it reduces the drying time and improves the quality of the end product. The dried ginger slices are then grounded in a hammer mill. The benefit cost analysis of a ginger powder unit is as under:

BENEFIT COST ANALYSIS

1.1 Assumptions

- Land & building will be obtained on rent.
- Average capacity of unit : 60 kg /day (1.50 ton/month)
- Recovery : 15% of fresh ginger
- Monthly repair and maintenance charges : 1 % of the cost of machines
- Depreciation on machines and equipment : 10 % p.a.
- Depreciation on furniture & tools : 20 % p.a.
- Rate of interest : 12 %
- No of working days in a month : 25
- Total no. of working days in year : 150
- Working hours per day : 8
- Space required : 15 m^2

- Capacity utilization : 1st year 50% ; 2nd year 60%; 3rd year 70%; 4th year 80%; 5th & subsequent years 90%.

1.2 Fixed Capital

Machinery and Equipment

Ginger slicer (Capacity 25 kg / h)	Rs. 25,000-00
Tray dryer (12 trays of 800 x 400 mm; 30 kg/batch)	Rs. 75,000-00
Hammer mill (15 kg / h)	Rs. 35,000-00
Weighing and measuring equipment	Rs. 5,000-00
Furniture	Rs. 5,000-00
Cost of electrification & installation	Rs. 15,000-00
Total	**Rs.1, 60,000-00**

1.3 Working Capital

Staff and labour cost (per month)

Skilled	One	Rs. 2,500-00
Un-skilled	One	Rs. 2,000-00

Raw Material (per month)

Ginger	1.50 tons @ Rs.5/kg	Rs. 7,500-00
Packaging material	5 kg @ Rs.100/-kg	Rs. 500-00

Utilities

Cost of electricity 1000 kWh / month @ Rs.5 / kWh	Rs. 5,000-00

Other expenses

Rent	Rs. 1,000-00
Telephone	Rs. 300-00
Repair & maintenance (1% cost of machines)	Rs. 1,450-00
Transport charges	Rs. 500-00
Total	**Rs. 20,750-00**

Working capital for 3 months = Rs. 62,250-00

1.4 Total Capital Investment

Fixed capital	Rs. 1,60,000-00
Working capital for 3 months	Rs. 62,250-00
Total	**Rs. 2,22,250-00**

1.5 Annual Cost

Total working capital	Rs. 1,50,300-00
Depreciation on machines / equipment	Rs. 14,500-00
Depreciation on furniture	Rs. 1,000-00
Interest on total capital investment	Rs. 26,670-00
Total	**Rs. 1,92,470-00**

1.6 Total sales (per annum)

Ginger powder (1350 kg @ Rs. 200 / kg)	Rs. 2,70,000-00

1.7 Profitability

Annual profit (Total sales-Annual cost)	Rs. 77,530-00
Profit on sale	28.7 %
Return on capital investment	34.8 %

1.8 Break even point (B.E.P)

	Fixed cost
Interest on total capital investment @ 12% p.a	Rs. 26,670-00
Depreciation on machines / equipment	Rs. 14,500-00
Depreciation on furniture	Rs. 1,000-00
40 % on annual wages of workers	Rs. 21,600-00
40 % of overheads (incl. utilities)	Rs. 25,440-00
Rent	Rs. 12,000-00
Total	**Rs.1,01,210-00**

Break Even Point (B.E.P.) = 56.62%

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