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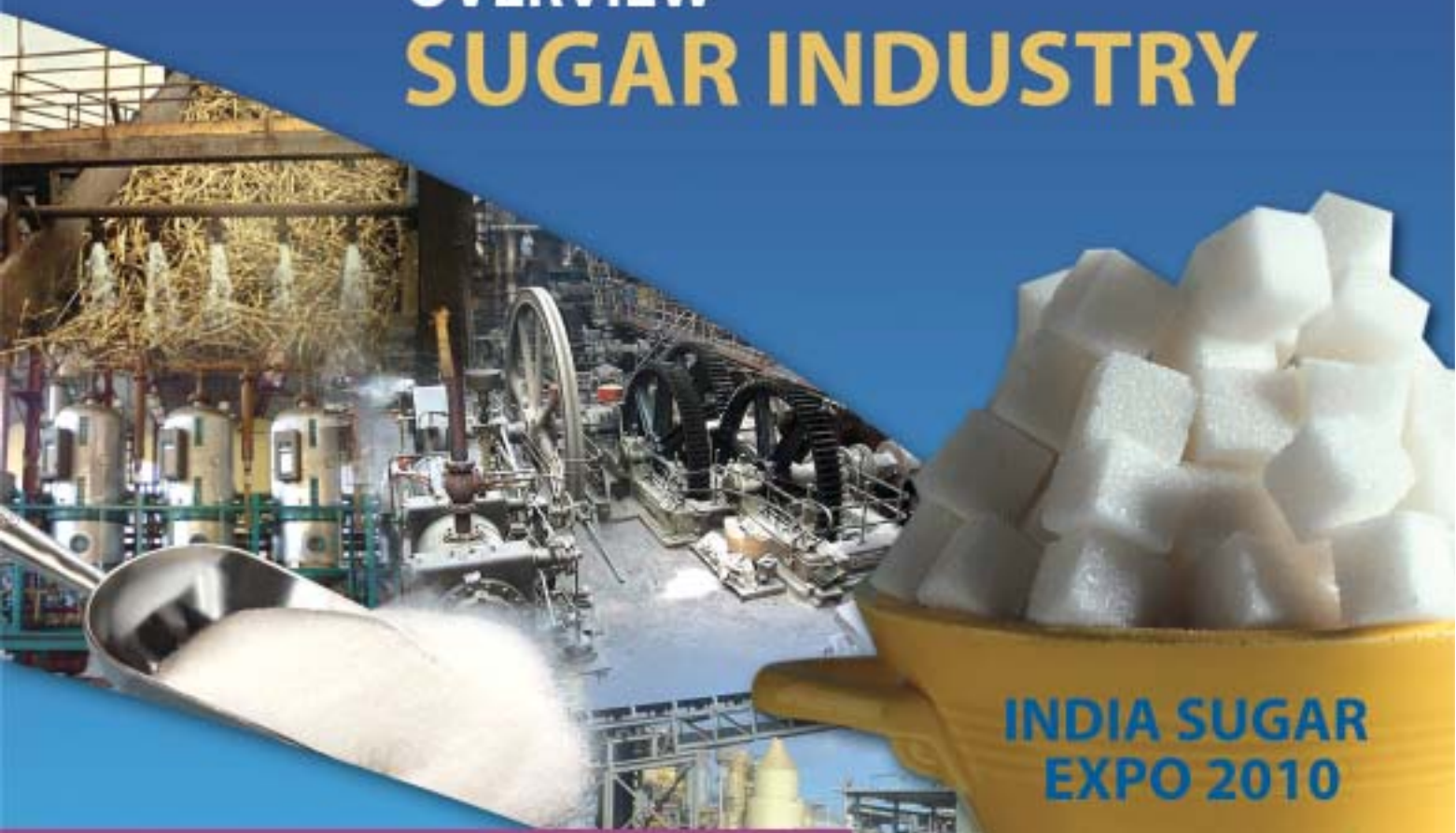

INDIA SUGAR EXPO 2010

PRECISION FARMING
TOOLS FOR SUSTAINABLE AGRICULTURE

EFFECTS OF GLOBALISATION ON INDIAN FARMERS

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EDITORIAL

Welcome to the June edition of our magazine. The forecast of the Planning Commission that a good growth in the agriculture sector is possible during the XII Plan (2012-17) will make all very happy. According to Planning Commission Deputy Chairman Montek Singh Ahluwalia a 4-percent agriculture growth will be a good target for the XII Plan, though it could not be achieved in the XI Plan. It reflects the determination of the planning bodies and policy makers to make a turn around of the sector.

The timely monsoon that hit southern coast of Kerala on the last day of May has surely raised hopes of a decent growth in agriculture as better rains will lead to better farm output and can rein in food inflation and boost economic growth. The Meteorolgical Department says the June-September monsoon rains would be 98 percent of the 50-year long-term average this year. Last year, we faced the worst rainfall since 1972 that damaged Kharif crops and pushed up prices of food articles across the board.

Betting on good monsoon rains, the Central government has projected that the economy may expand at 8.5 percent in the current fiscal. So it is reasonable to expect that the agricultural output next year will see an annual growth rate of 2 to 2.5 percent which will be a step towards food security. A good farm output can also impact the international commodity market as India is the second largest grower and consumer of rice, wheat and sugarcane.

A word about the contents of the current edition—there are many informative articles— the cover story is on Precision Farming which looks at the scope of GIS tools in terms of locating the right farming position for different crops. The impact of globalization on farming community makes an interesting study; so does the article on farmer-centric agriculture practices. It goes into the detail of approaches pursued by various corporates in India's farming sector. The sugar industry and its issues are also discussed in detail.

So, read on...

A.K. Garg
Editor-in-Chief

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Agricultural Finance Corporation Limited

Dhanraj Mahal, Chhatrapati Shivaji Maharaj Marg, Mumbai 400 001

Tel: 91-022-22028924
Fax: 91-022-22028966
Email: afcl@vsnl.com
URL: www.afcindia.org.in

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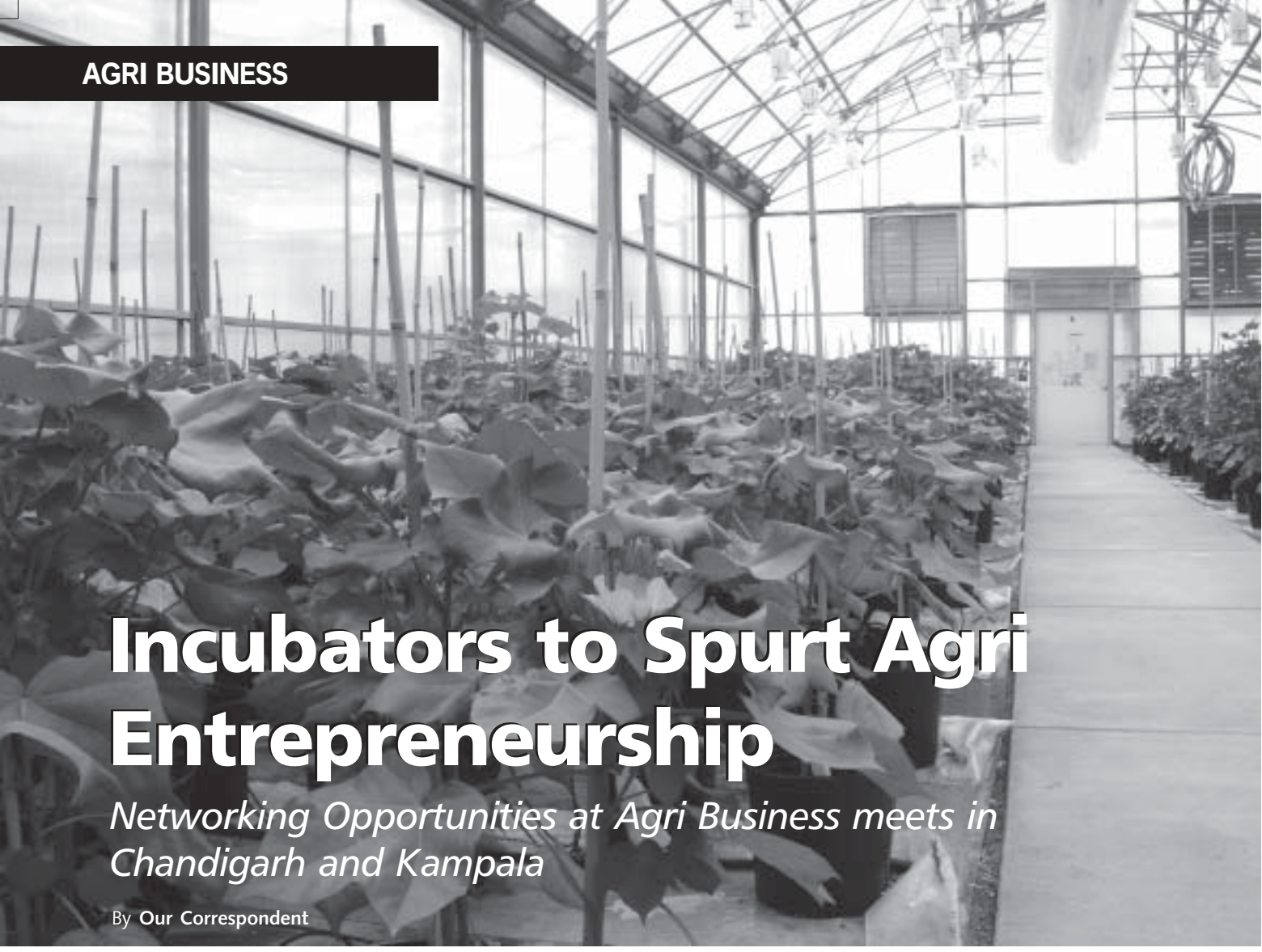

Incubators to Spurt Agri Entrepreneurship

Networking Opportunities at Agri Business meets in Chandigarh and Kampala

By **Our Correspondent**

The Indian Council of Agriculture and Research (ICAR), the apex body of Government of India for coordinating, guiding and managing research and education in agriculture has launched a new initiative called Network of Indian Agri-Business Incubators (NIABI).

It is set-up through National Agricultural Innovation Project (NAIP), World Bank aided project wherein the ICAR will be acting as a catalyzing agent for management of change in the Indian National Agricultural Research System (NARS).

NIABI is operating out of 10 Business Planning & Development (BPDs) units of the five ICAR research institutes and five State Agriculture Universities (SAUs) coordinated by the Agri-Business Incubator of International Crops Research Institute for the Semi-Arid Tropics (ABI-ICRISAT) located at Hyderabad.

The BPDs include Central Institute for Research on Cotton Technology (CIRCOT-Mumbai), Indian Agricultural Research Institute (IARI-New Delhi), Indian Veterinary Research Institute (IVRI-Izatnagar), National Institute of Research in Jute Allied Fiber Technology, (NIRJAFT-Kolkata), Central Institute of Fisheries Technology (CIFT-Cochin), Anand Agricultural University (AAU-Gujarat), Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV-Jabalpur), Tamil Nadu Agricultural University (TNAU-Coimbatore), Birsa Agricultural University (BAU-Ranchi) and Chaudhary Charan Singh Haryana Agricultural University (CCSHAU-Hissar).

The mission of NIABI is "to enhance agri-business development and impacts on agriculture through co-business incubation". NIABI cover a wide spectrum in agriculture and allied sectors like veterinary, fisheries, dairy, commercial crops, food processing and many other sectors making it a one-of-a-kind network in agri-business in India.

NIABI shall help innovators and entrepreneurs setup and operate successful agri business ventures by serving as one stop solution for entrepreneurs across the country through co-business incubation platform.

According to the concept, innovators and entrepreneurs will be provided with ample support and services by the NIABI, right from access to scientists, state-of-the-art research facilities, a pool of commercializable technologies, to very basic needs like providing infrastructure facilities. NIABI will also provide soft-landing support for international firms that want to set-up base in India, and

Indian companies that want to set up operations aboard.

AgroTech 2010

India's Premier Biennial Agro Technology & Business Fair Agro Tech will be held at the Parade Ground in Chandigarh from 3–6 December 2010. It is being organized by the Confederation of Indian Industry (CII), in partnership with Ministry of Agriculture, Government of India.

'Sustainable Agriculture' is the theme of Agro Tech 2010, which seeks to integrate technological advancements, environmental, ecological stewardship and technical knowledge for the farming community and other consumers' under one roof. To attain this objective, Agro Tech 2010 would be bringing together players from across the world to converge, execute meaningful agri business and develop new business relationships.

AgriBusiness Forum

Meanwhile Kampala, the capital city of Uganda is getting ready to be the official host city of the 2010 edition of the AgriBusiness Forum from 03-06 October 2010, being jointly organised by the Government of Uganda and Brussels-based EMRC.

Following the success of EMRC's AgriBusiness Forum 2009, held in Cape Town, South Africa, EMRC is keen to hold the Forum for the second time in Africa and hopes for a strong representation of the Indian agro-food sector in Kampala.

Says Idit Miller, Managing Director of EMRC, "We have chosen Uganda as the host country as it not only presents excellent business incentives to attract foreign direct investment, but also provides a great example of an African agriculture-based economy with substantial natural resources and an impressive economic growth rate"

According to him, India ranks among the top 5 countries in the world in farm output and agriculture and plays a great role in India's socio-economic development. Together with ICRISAT and CII, individually also Indian players are encouraged to the Summit in Kampala.

The EMRC AgriBusiness Forum 2010 will focus on the theme of "*Food Security: a Business Opportunity*" with the overall aim of boosting the African agro-food sector through the design, planning and implementation of diverse agricultural projects.

Discussions and presentations will explore best practices and expertise and successful case studies relating to the theme. The tailor-made EMRC Business-to-Business sessions, will enable delegates to take part in one-on-one meetings to facilitate cross-continental and inter-continental business introductions and partnerships that will propel the implementation of the collaborative ideas planted at the forum.

Current AgriBusiness Forum 2010 partners include FAO, Rabobank, USAID,

India's Premier Biennial Agro Technology & Business Fair Agro Tech will be held at the Parade Ground in Chandigarh from 3–6 December 2010. It is being organised by the Confederation of Indian Industry (CII), in partnership with Ministry of Agriculture, Government of India

Stanbic Bank, Syngenta Foundation, Africa Enterprise Challenge Fund (AECF), Forum for Agricultural Research in Africa (FARA), Windrock International, the Alliance for a Green Revolution in Africa (AGRA), KPMG as well as the host the Government of Uganda.

Over 400 delegates from Africa, Europe, America and Asia are expected from the private and public sector, international organisations, micro-financers, investors, bankers, agriculturalists, NGOs, project developers, owners and more.

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) will be coordinating the Indian representation at the AgriBusiness Forum 2010, while the Confederation of Indian Industry (CII) will mobilize its members for the event.

Says William Dar, Director General, ICRISAT, "We champion public-private partnership in agricultural research for development. Being headquartered in India, our presence and work in Africa, give us the platform and the opportunity to support and enhance South-South collaboration which includes agri-business networking and partnership between Indian and African companies."

Africa Opportunity

It is official that India is aiming to tap opportunities in the agricultural sector in Africa. According to Preneet Kaur, India's Minister of State for External Affairs. "There are many unexplored opportunities in the agri-business sector that we are looking forward to tap". Kaur told a delegation of Ambassadors and High Commissioners from several African countries such as Ethiopia, Tanzania, Uganda, Zambia and Mozambique who recently visited Patiala in Punjab for a business meeting.

"The foundation for enhancing India-Africa relations was laid during the Africa-India Summit in 2008. Since then we have improved the bilateral relations manifold," the minister said.

Kaur released a paper, *Agriculture Opportunities in Africa*, brought out by industry chamber Assocham. According to the paper, Africa provides perfect weather and moisture conditions for bumper crop and other agriculture related activities.

It has been found that out of the projected two-way trade between India and Africa; share of agri-trade would be around US$15 billion. In this, Punjab's share would be around US$3 billion, Arun Agarwal, chairman of Assocham's Africa Committee paper.

Ethiopia's ambassador to India, Gennet Zewide said: "We need investment in various sectors of agriculture like in irrigation, storage, transport infrastructure, raw material and various other inputs. By providing us its expertise India is also getting a readymade market".

"So far the response from Punjabi farmers is very good as they have bought thousands of acres of land in Ethiopia. Besides they have invested in the fields of mining, construction, floriculture and textiles," said Zewide.

Global Players

Acknowledging India's potential, AgriThority LLC, an international agribusiness company providing field and clinical research, crop and food animal production systems development and information transfer services has extended its global reach to India through a strategic alliance with the SCS Group in India. The latter specializes in agriculture marketing research, retail support, logistics and representation. The SCS Group is also focused on moving perishable agriculture produce in and around areas where deficient infrastructure is a challenge.

Terming the alliance valuable, Jerry Duff, AgriThority LLC, Managing Member mentioned, "Through its experience in the field of refrigerated warehousing, perishable logistics and distribution systems in India, the SCS Group has played a pioneering role in the creation of a valuable cold chain infrastructure in South Asia".

In addition to its marketing research, The SCS Group also conducts test marketing, offers soft launches and makes reports to clients on the latest changes in the markets. The Group also provides detailed strength, weakness, opportunity and threat (SWOT) analysis to domestic and international agribusiness companies.

Says Keith Sunderlal, MD, SCS Group, "We have worked with a number of companies who have successfully diversified into agribusiness to take advantage of the vast opportunities. We see our mission in representing agribusiness companies from all over the world to ensure liaison with key players in government, industry and media fields".

Precision Farming: **Tool for Sustainable Agriculture**

By **D.Muthamizh Vendan Murugavel ***

The concept of Precision Farming is spreading fast in developed countries as a tool to meet the challenge of sustainability in agriculture. With the rapid progress in application of information technology in agriculture, Precision Farming is gaining pace worldwide. Huge work is underway in different corners of the world on this subject.

Agriculture in India

Agriculture is a very important sector for the sustained growth of the Indian economy. About 70 percent of the rural households and 8 percent of urban households are dependent on agriculture for employment. Since three-quarters of Indian population live in rural areas, a majority of households depend on this sector for livelihood.

Agri Revolutions

Despite industrialization of the Indian economy adversely impacting the share of agriculture in the GDP, it cannot be ignored that India has undergone a series of successful agricultural revolutions-starting with the 'Green' revolution in wheat and rice in the 1960's and 1970's; the 'White' revolution in milk to the 'Yellow' revolution in oilseeds in 1980's. As a result, India has achieved self-sufficiency in agriculture.

Applications of agricultural inputs at uniform rates across the field without due regard to in-field variations in soil fertility and crop conditions do not yield desirable results in terms of crop yield. The management of in-field variability in soil fertility and crop conditions for improving the crop production and minimizing the environmental impact is the crux of precision farming.

New Technologies

Precision farming or precision agriculture is an agricultural concept relying on the existence of in-field variability. It is all about doing the right thing, in the right place, in the right way, and at the right time. It requires the use of new technologies, such as Global Positioning Systems (GPS), sensors, satellites or aerial images, and information management tools i.e. Global Information Systems (GIS) to assess and understand variations.

The collected information may be used for precise evaluation of optimum sowing density, fertilizers required and other inputs needs to predict crop yields. It seeks to avoid application of inflexible

practices to a crop, regardless of local soil/climate conditions, and tries to assess local situations of disease or lodging. It also reduces labour, water; inputs such as fertilizers, pesticides etc. and assure quality produce. Over all this translates into higher productivity, reduced production costs and minimizes environmental impact of farming.

Efficiency of Crop Inputs

The main goal of precision farming is to gather and analyze information about the variability of soil and crop conditions to maximize the efficiency of crop inputs within small areas of the farm field. To boost this efficiency goal, the variability within the field must be controllable.

Efficiency in the use of crop inputs means that fewer crop inputs such as fertilizer and chemicals will be used and placed wherever they are needed. The benefits flowing from this efficiency will be both economical and environmental. Environmental costs are difficult to quantify in monetary terms. The reduction of soil and groundwater pollution from farming activities has a desirable benefit to the farmer and to society.

Precision Farming Equipments

Crop, soil, and positioning sensors include both remote and vehicle-mounted, "on-the-go" sensors that detect soil texture, soil moisture levels, crop stress and disease and weed infestations.

Machine Controls

Precision Farming is used to guide field equipment and can vary the rate, mix, and location of water, seeds, nutrients, or chemical applications.

Computer-based systems

These include GIS maps and databases that use sensor information to "prescribe" specific machine controls.

Satellite based Soil Maps

Fertilizer application and soil management based on the Satellite based Soil Maps. This technology helps in identifying the exact nutrient status of the particular area soil.

Chisel ploughing

Due to the usage of tractor for many years and flood irrigation practices, the upper layer of the soil becomes hard up to 45 cm and affects the proper drainage and aeration of soil. Chisel ploughing helps to overcome this problem. It is recommended twice annually.

Drip Irrigation Drip laterals are installed in a spacing of 1.5 x 0.6 m.

It has many advantages.

- Reduced water and fertilizer requirement per acre
- Less weed infestation due to the dryness of the top soil
- Reduced flower and fruit drop due to proper moisture maintenance and soil aeration
- Less infestation of disease and pests due to the maintenance of relative humidity less than 60 percent
- 40 percent increased aeration that can help increased root growth

Community nurseries: Community nurseries help the farmers to produce 100 percent healthy vegetable seedlings.

Pest and disease control: Precautionary measures based on the climatic conditions and need based application of pesticides and fungicides help in reducing one third of the expenses.

Strategy for India: The implementation of precision farming in India should have two different strategies - one for the low input subsistence agriculture and the other for input intensive profit making agriculture. In case of the former, the increase in productivity is of prime concern.

Information-based Agriculture

Here, the system has to be converted to information based agriculture, where the farmer has spatial information about the soil and crop. This information can be used for efficient input application. Since the field sizes are small in this situation, individually bundled field or a group of fields can be considered as a unit for variable rate application. However, for the latter, such as rice and wheat of Indo-Gangetic belt and the horticultural crops like grape (Mahrashtra), potato (Punjab), tea (Assam), the field sizes are large and the farmers are rich.

Focus on Inputs

Already input for farming is high and is causing ecological imbalances in many places. Thus the input use efficiency is the prime concern here, apart from enhancing the productivity.

Here, remote-sensing data can be used to identify the spatial and temporal variability and necessary actions to be adopted using sophisticated instruments like variable rate applicators. This

The profitability of precision agriculture is the value derived from the application of the data and not from the use of the technology

situation will also benefit from GIS based Decision Support Systems for better management of agriculture.

Reasons for adoption of precision farming

- Lack of finance and credit facilities
- High Cost of Drip installation and water-soluble fertilizers
- Lack of knowledge about precision farming technologies
- Labour scarcity
- Farmers' perception on yield impact from low quantity of inputs
- Lack of water availability and pumping efficiency

Benefits

The profitability of precision agriculture is the value derived from the application of the data and not from the use of the technology. Potential improvements in environmental quality are often cited as a reason for using precision agriculture.

Benefits

Reduced agrochemical use, higher nutrient use, increased efficiency of managed inputs and increased production of soils from degradation is frequently cited as potential benefits to the environment. Enabling technologies can make precision agriculture feasible, induce agronomic principles and apply decision rules to make it applicable and more efficiency oriented than other forms and can make it profitable. The technology can also be adapted to do insect scouting, which in some cases is a tedious process and involve turning over virtually every leaf in a field or pasture to detect the presence of pests and an equally daunting task when soil borne pests are involved.

Management is the Key

The term technology transfer could imply that precision agriculture occurs when individuals or firms simply acquire and use the enabling technologies. While precision agriculture does involve the application of enabling technologies and agronomic principles to manage spatial and temporal variability, the key is management. Much of the attention is on technology transfer focused on the communication aspect with the farmer. These issues associated with the managerial capability of the operator; the spatial distribution of infrastructure and the compatibility of technology to individual farms will change radically, as precision agriculture continues to develop (Pierce and Peter, 1999).

Constraints in India

- Lack of technical skill to follow precision farming recommendations
- Cost/benefit aspect of Precision Farming system
- Market tie-ups lead to low price fixation for the produce/unprofitable negotiations
- Inadequate training and demonstrations and weak research – extension – farmer relationship
- Inadequate size of landholdings for adoption of precision farming
- Heterogeneity of cropping systems
- Culture and perceptions of the users
- Knowledge and technological gaps

Conclusion

Though precision farming is being talked about in developed countries, it is still at a nascent stage in developing countries including India where it has already been initiated in many research institutes. There is a scope for implementing precision farming for major food-grain crops such as rice and wheat. However many horticultural crops in India which are high profit making crops offer wide scope for precision farming.

The farmers can embrace it fully only if they are satisfied with both economic and environmental aspects of the concept. Despite the presence of many constraints, precision farming may help the Indian farmers in the coming years, to harvest the fruits of frontier technologies without compromising the quality of land.

** The writer is an Assistant Professor, PG & Research Department of Commerce, Gobi Arts & Science College, Gobi, Tamil Nadu, India*

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AGRICULTURAL REFORMS

Towards A Farmer Centric Corporate Model

By **Dr. R. Balakrishnan** *

"The business of business is to add wealth to the society and take a small share as profit", observed N. R. Narayanamurthy, the most admired business leader of India and founder of Infosys. This is the broad approach that corporates have to adopt while dealing with farmers and farming. In this context, the report of the National Commission on Farmers http://krishakayog.gov.in/) is a path breaking document on agriculture in recent times. It is relevant to India and all other developing countries.

Prime Goals

Two of the ten goals of Agricultural Policy recommended by the Commission are

a) To make India a global outsourcing hub in the production and supply of the inputs needed for sustainable agriculture, and products and processes developed through biotechnology and Information and Communication Technology and

b) To introduce measures which can help to attract and retain youth in farming by making it both intellectually stimulating and economically rewarding, by conferring the power and economy of scale to small and marginal farmers both in the production and post-harvest phases of farming.

Rationale

The importance of a corporate role in agriculture logically flows from these objectives. According to the Economic Survey 2010, agriculture and allied activities accounted for 15.7 percent of GDP 2008-09 whereas the employment in the sector constituted 52 percent. The agriculture growth target of successive five year plans at four percent per annum is in fact a lower achievement and calls for bigger growth targets. This trend is clearly undesirable, unsustainable and dangerous. The sector needs urgent farmer centric reforms.

Gujarat Shines

A semi-arid state like Gujarat has demonstrated the feasibility of up scaling the sectoral growth to as much as 10 percent. Between 2000-01 and 2007-08 agricultural value added there grew at 9.6 percent per year despite a drought in 2002. In fact, the electoral success of the ruling party there has been attributed this fact more than anything else. *(Agriculture: Secret of Gujarat's Success-Swaminathan S Anklesaria Iyer – Economic Times of July 22, 2009)*

Agriculture generically means farming and animal husbandry including fisheries. NABARD Act 1981 has adopted an inclusive definition viz., "agriculture" includes horticulture, animal husbandry, forestry, dairy and poultry farming, pisciculture, and other allied activities, whether or not undertaken jointly with agriculture and the expression "agricultural operations" shall be construed accordingly. The definition needs a human touch.

Defining Agriculture

A working definition of Agriculture could cover all the economic activities of the families that primarily depend on agriculture for their livelihood as cultivators or labourers or both. It is in

recognition of this concept the successor to National Commission on Agriculture became the 'National Commission on Farmers'. The Commission affirms that the human dimension must be the principal determinant of agricultural policies and not just production in physical terms. This broader approach immediately opens up the possibilities of how farmers can benefit from value addition to the produce in their own hands.

Value of Networks

I have discussed this aspect in my book on *"Supply Chain Management for Indian Agriculture – A blueprint for Agriculture led Prosperity"* (www.agrichain.com). It is a farmer centric document strongly advocating win- win network between farmers and the organized sector. Endorsing the concept, late Prof. CK Prahalad, most respected strategic management expert, observed that "yes, networks are important and the governance of networks more so. We have to move from an exploitative, transaction oriented system to an equitable relationships oriented system. Hope you will have this published somewhere in India and get more people to reflect on your point of view".

Missed Reforms

It must be discussed how the reform process has missed farming and farmers. It advocates infusion of the managerial culture of the corporates to synergise technology, marketing and organization with farmer collectives as the nodal point. The idea is to increase the bargaining power of farmers vis-a-vis the rest of the economy through collective strength and managerial leverage.

It is worth recalling the address of our Prime Minister to captains of industry on May 25, 2007 unfolding his ten point social charter: "Indian industry must, therefore, rise to the challenge of making our growth processes both efficient and inclusive. If those who are better off do not act in a more socially responsible manner, our growth process may be at risk, our polity may become anarchic and our society may get further divided. I invite corporate India to be a partner in making ours a more humane and just society."

Farmers do not need charity or patronage from those who wield political or financial power. Considering that the farmers take significant risks, they are entitled to subsidies on economic logic in the form of insurance premium, cheap credit, managerial subsidies the last one for their economic collectives and relief in disaster conditions. They have a right to participate in the prosperity of the nation.

Space for Corporates

The corporates have a traditional role in providing agricultural inputs, both as capital goods and consumables. The significance of this role is obvious. The drudgery associated with farming is not fully appreciated. Policy makers have to understand that drudgery, apart from short term pain, has a lasting adverse effect on the health of the workers. They cannot be working to death. The use of appropriate farm machinery relieves the suffering of the farm labour and improves their productivity to a great extent.

The use of machinery has become important with the movement of farm labour to the non-farm sector and employment guarantee schemes. Optimal use of resources like water and power is a beneficial fall out. One important indicator of development is where the man becomes costlier and the materials become relatively cheaper.

The farm equipment manufacturers have developed various machines that suit Indian conditions such as small holdings, low level of skill sets, limited irrigation and shortage of power. Tractors, power tillers, power threshers, sprinklers, drip irrigation, horticultural tools, plant protection equipment, self-propelled reapers, paddy transplanter, and specialised power equipment such as sugarcane cutter planter, potato planter, and strip till drill and so on. The debate on the use of farm machinery on the grounds that it reduces employment opportunities to labour has almost died down.

On the other hand, it is seen as a prerequisite for retaining the interest of educated youth in farming. There are many innovations at the micro level encouraged and popularised by the National Innovation Foundation. One of the most demanded skill development programmes under NABARDs Rural Innovation Fund is for repairs to farm machinery. The role of corporates in farm equipment supplies has been non-controversial. However, it is not the case for testing facilities. There is a need to identify more testing facilities and reduce delays.

There are many facets to the debate on seeds and fertilizers. While the debate on seed is global that on fertilizers is local. The world has to double the food production by 2050 when the population is expected to be of the order of 9 billion. This is a tall order given the problems of climate change, dwindling water resources, energy crunch and soil fertility. The challenge is to produce and conserve. Advancements in hybrid and biotech seeds, fertilizer and agricultural practices are seen as one answer. While this is

inescapable, there is apprehension on the exploitative pricing and encroachment into *sui generis* rights of farmers.

Innovations

The widespread use of Bt cotton is an example of corporate entry into innovative inputs. The Mahyco-Monsanto Biotech Limited introduced Bt cotton (transgenic technology) in the year 2005. The two genes—Bollgard and Bollgard II was introduced next year. The new seed now covers about 10 million acres or 2.2 million farmers in nine states. The consensus is that farmers adopted the new technology and saved costs on pesticides.

Alarm bells started ringing when there were quite a few suicides by cotton farmers in Vidharba region of Maharashtra. There are critics who attribute the suicides to the seed

"monopoly". However, a study by Indira Gandhi Institute of Development Research, Mumbai in 2006 submitted to Government of Maharashtra attributed the suicides to indebtedness from informal sources and for social needs and other socio economic factors.

The suicides were not linked to Bt cotton. Bt cotton has been accepted widely leading to a record production of 27 million bales in 2006-07. The success demonstrated by Gujarat is remarkable. The cotton growers there achieved yields of 728 kg/ha during 2005-06 that was higher than the world average of 715kg/ha. (*Potential to Improve Lives of Ryots by Dr. BM Khadi, Director, Central Institute for Cotton Research, Nagpur and others– The Hindu Survey of Indian Agriculture, 2007*).

What is more important is that this innovation has the acceptance of regulators and a large majority of cotton farmers. In fact the Government of India has assisted Biotech Consortium of India Ltd., an expert agency with Rs.26.65 lakh to create awareness about Bt cotton in the nine cotton growing states last year. The problem of high royalty to Monsanto and consequent high prices on Bt cotton seeds remains. There has been a partial cut in the prices consequent on the initiative by AP Government. The main indicator and measure whether the corporate entry is beneficial or not is the increase in farmer's net income as a result of the entry. It is clear that Monsanto has passed this test.

The low rate of seed replacement is an issue that affects productivity. Ideally, hybrid seeds need replacement every year and non-hybrids once in three years. According to Ministry of Agriculture & Cooperation, the seed replacement rate for wheat and rice for 2003-04 were 13 percent and 19 percent respectively. This fact offers scope for seed companies to collaborate with farmers to produce certified seeds and promote seed villages as part of the farmer-corporate joint venture.

Fertilizers

The chemical fertilizers are produced exclusively by the corporate sector. There are about 50 major fertilizer companies in India. The inputs are mostly imported. The Government has been keeping the prices of fertilizers at 2002 level with subsidies which amounted to Rs.99,456 crore in 2008-09. It is recognized that the application of fertilizers has not resulted in additional productivity. The reasons are well known – the imbalance of fertilizer application not related to soil quality and deficiency in micro nutrients.

The Government is moving towards nutrient based subsidies, creating more competition and finally towards direct subsidy to farmers.

Israel has demonstrated great success in the use of liquid fertilizers with drip systems. This is called fertigation – combining fertilizers with irrigation. The fertilizer companies will do well to manufacture the liquid fertilizers and join hands with irrigation equipment suppliers like Jain Irrigation. There are quite a few small companies producing and exporting organic and inorganic liquid fertilizers in India

Retailing

Wholesale and retail merchants dominate trade in the food grains, oil seeds, cotton and perishables. The local traders have been also providing loans to the farmers with hidden costs. Corporates have been procuring agriculture produce for processing and retailing.

Large scale organised retailing in food sector is a relatively new phenomenon. Already it has shaken the traditional trading community. Here too, competition as in other areas is proving beneficial to the primary producer and the consumer. The story of ITC's network with farmers is well documented. The ITC Ltd. has a strong farmer value chain network first with tobacco growers and later with other farmers. Major export earnings of the company come from agribusiness.

Bottom Line

The company has been serving as a link between small farmers and international markets. ITC has been voicing the concept of triple bottom line – building financial, social and natural capital. For the latest data, I would like to borrow from the Chairman's speech at the AGM on July 24, 2009.

"The company's e-choupal network, leverages information technology to empower farmers. The programme not only addresses needs of farmers in terms of infrastructure, connectivity, price discovery and market access, but also provide a significant boost to farm productivity through extension services and research based agro-inputs. Initiatives like the "*Choupal Pradarshan Khet*" bring sustainable agricultural best practices to farmers and demonstrated significant productivity gains. These

interventions have helped transform village communities into vibrant economic organisations, by enhancing incomes and co-creating markets.

ITC's e-choupals serve 40,000 villages and 4 million farmers, making it the world's largest rural digital infrastructure. This extensive network also provides a unique source of competitiveness to the Company's Packaged Foods Business, through its efficient supply chain and identity preserved procurement. It also strengthens the company's competitiveness in servicing the requirements of international buyers who demand agro-products based on sustainable agricultural practices with associated stringent traceability assurance.

The e-Choupal Infrastructure also enables an efficient two-way flow of goods in and out of the villages. Apart from ITCs FMCG products, almost 70 other companies also ride this channel to offer rural consumers a wide spectrum of choice.

Organic Inputs

Recognising the growing role of chemical free fertilizers in sustainable agriculture, ITC has launched organic based farm inputs for integrated farm management. The neem-based branded Organic manures such as Wellgro Soil, Wellgro Crops and Wellgro Grains have already gained wide acceptance for their superior efficacy in soil nutrition and crop management.

The company has set up a dedicated state-of-the-art R&D Centre in Hyderabad with a focus on agri-sciences. It is to engage in several competency areas such as Plant Breeding and Genetics, Agronomy, Microbiology, Molecular Biology and Silviculture. ITC's Integrated Watershed Development initiative has helped create freshwater potential covering over 46,000 hectares in water-stressed areas.

In addition, the Company's integrated animal husbandry services have reached out to over 3,00,000 milch animals creating avenues for non-farm based livelihoods. Nearly 2,00,000 children attend our rural supplementary education centres, and 20,000 women entrepreneurs have been created through 1000 self-help groups. This is enlightened corporate interest at its best".

Contract Farming

There are other important but not so spectacular examples of win-win contracts. In Punjab HLL contacts farmers well before the transplanting season of the crop, and area to be grown by each farmer is agreed. Total area to be grown is decided on the basis of yield per acre and total capacity of the plant or the tonnage to be processed.

The farmers are selected on the basis of ability of a farmer to adopt new technology, suitability of land, assured irrigation, financial position, and commitment and literacy level.

The HLL contracts are Procurement and Input (P&I) contracts under which the firm not only agrees to buy the contracted acreage and specified quality produce at a fixed time and price, but also provides inputs like seedlings on credit, technical advice, and various equipment, free of cost but on returnable basis.

The contracts are only verbal commitments as there is no written evidence with the farmers. The acreage for tomato production should not be less than 5 acres. The seedlings of tomato cost to the farmer Rs. 1800/- per acre which are supplied by HLL on part payment in advance (25 percent).

The rest is deducted at the time of payment for the produce to the farmer. The company gives a set of equipment free of cost on returnable basis to a group of 5-10 farmers in a village or for 50 acres of tomato crop. These equipments include bed makers, chiselers, fertilizer application cum bed shapers, and transplanters which are all mechanized. It also recommends a schedule of pesticide sprays for each area and even the type and brand of pesticide to be used each time.

At the time of harvest, each farmer is given 30-40 crates free of cost on returnable basis. Quota slips are issued to farmers two days before actual harvest. These slips specify quantities and dates on which farmers may deliver contracted produce at the factory. They are based on the date of transplantation and expected size of the produce which is calculated well in advance based on field information. The slip is generally for 4.5 tons of produce and two slips are given for a truckload. The farmer has to adhere to the given date. Diseased and rotten fruits are discarded, yellow and pink fruits are sorted separately and taken to factory only when ripe, whereas healthy red fruit is transported to the factory immediately.

To reduce losses in transportation, the farmers are given tarpaulin free of cost by HLL and are advised that the truck be divided into parts by plywood partings. Thus, the pressure on the lower set of tomatoes is reduced and the juice losses are reduced to seven percent from that of 15 percent earlier. The tomatoes are transported loose, as crate transport is not commercially viable. The farmers are paid by cheque within a week after delivery. In the case of crop failure, the company compensates the farmer to the extent of waiving the seedlings cost. The amount of damage and loss is assessed by the company.

Pepsi introduced new technology of deep chiseling, new methods of transplantation, besides introducing new seed varieties. Deep chiseling involves the breaking of the hard bed formed by tractors about two feet below the farm surface which results in better drainage, more room for roots and thus greater access to nutrition which translates into higher yield to the extent of 20-25 percent.

The method of transplanting used earlier meant that farmers used to press the lower end of the seedling with the thumb into the ground which resulted in the main root growing in an upward direction and plant got lesser nutrition.

The shovel technique introduced by the company ensures proper placement of seedling in soil. The company also introduced the system of planting seedlings on the bed head instead of both sides. The varieties of tomato seeds introduced by Pepsi are of the indeterminate variety whose plants grow vertically and as long as 15 feet. Its fruit also matures in a phased manner which helps space out plucking. This requires lesser but continuous labour for pruning and plucking and helps tailoring the produce to the requirements of processing plant in terms of supplies for each day.

The Pepsi company has printed farmer booklets in English and local language about the farm and off-farm practices for the said crop which give specific details about the selection of fields, soil testing and fertiliser application, bed preparation, transplanting of seeds, irrigation, weeding, plant growth management, insect-pest management, safe use of pesticides, harvesting, transport, and storage for the crop grown.

Even schedules of pesticide spray are specified giving names of chemicals, brands of the same, and doze to be given each time. The farmers are also advised to apply insecticide just after the white borer larvae have broken out of their eggs and not when they mature as farmers used to do earlier.

This way, lesser insecticide is used more effectively (Fernandes 1991) and the extension workers of the company remain in constant touch with the farmers and provide them with advice on when, how much and which input to use. The company extension staff inspects plants frequently and replaces defective plants without cost. The selected farmers are educated at farmer training camps organised by the company's extension staff where they are exposed to different aspects of production technology with the help of video cassettes, slides, charts, and exhibiting materials.

They are also given a demonstration of the various agricultural implements. The company has basically adapted imported varieties of tomato to the local conditions. Much more important has been the extension work which ensured that these varieties were adopted soon and grew successfully. Also, the company promoted the use of locally relevant traditional techniques like use of a local grass called "*Sarkanda* Optimal use of resources like water and power is a beneficial fall out." for protection of plants from winter, and black ash for covering the soil to prevent crust formation and to give warmth to seeds.

The contract farmers, for 80 percent of whom the crop itself was new, have adopted the Multi-National Corporations and Agricultural Technology Transfer. The farmers are generally happy with contracting even though they may be facing some day-to-day problems having implications in their incomes and livelihoods. On the other hand, Companies are also sticking to the system though they do face problem of defaults from the farmers' side. They are trying to manage the situation with new strategies and tactics every time it occurs.

The farmers often find the multinational company better than the local one so far as farmer treatment was concerned and many of them had experience with more than one company each. Contract production of tomato has brought a big employment boom in these areas as the mechanization of sowing and harvesting operations of paddy and wheat crops had reduced manual work in these major crops of the region to negligible. That contracting has led to better employment opportunities for labour, especially women, is acknowledged by all.

Banana Boom

Bharuch and Narmada are major banana producing districts in Gujarat. M/S. Desai Fruits & Vegetables, a Mumbai based firm is involved in Contract farming of Banana in Jhagadia taluka of Bharuch district and Nandod taluka of Narmada district. The firm has tied up with banana growers in around 2000 hactares in both the blocks. The firm takes care of the entire operations right from providing tissue cultured plants to harvesting and has set up a ripening chamber in Jhagadia taluka from where the banana is exported to Middle East. The firm has also established a number of pack houses in both the taluks from where after washing, cleaning, grading and packing the banana are sent to the ripening chamber. The sale price of the banana is pre-determined and farmers have expressed satisfaction as the bunch weight has gone up to 45 Kg. The firm provides all types of services to the enrolled farmers including technical advice, etc. The standing banana crop in Jhagadia taluka was severely affected by cyclonic storms on 5 July 2009, bringing heavy loss to the banana growers. Immediately thereafter, the firm provided Rs. 10000/- to each of the affected farmers as interim relief.

Negative Side

The positive aspect is that the land, dear to the farmer is not alienated. Despite the benefits, the farmers are not entirely happy. Disputes arise when the market price is higher than what was contracted, when the produce is rejected on quality or when there are deductions from payments on various counts. **There is also apprehension that farmers may benefit in the short term, through tie ups with organised retail, in the long run they may become subordinate to them, losing their bargaining power in the medium term.** The National Commission repeatedly refers to a need for code of ethics for contract farming.

There is also apprehension that farmers may benefit in the short term, through tie ups with organised retail, in the long run they may become subordinate to them, losing their bargaining power in the medium term

There is no elaboration. Presumably the code will cover fair price, independent assessment of quality and dispute referral.

Farmer Clubs

There are noteworthy examples of what farmers can do in Gujarat. Creative Farmers Club in Bharuch district is a very active club in the area of joint marketing efforts of farm produce like papaya, watermelon, vegetables, etc. The Club has taken up joint marketing of Papaya fruits to faraway Ludhiana market by negotiating better price. During the last season (2009) the Club despatched about 150 trucks of 16 tons of papaya each to Ludhiana market.

The trucks go to the farms for loading the fruits. The club arranged labour to pluck the fruits, pack the produce with wrappers/boxes and members of the club camp at Ludhiana in turns to negotiate he prices. Similarly, Pragati Farmers Club, Hansot taluka, Bharuch district took up joint marketing of Vegetables grown by farmer members from villages in and around Ryma to Mumbai market thus eliminating local traders. The club arranges for collection of vegetables from the farmers fields, sorting, grading, packing and transport to Mumbai. The farmers have benefitted by increased income.

The Amalsad Vibhag Vividh Karyakari Sahakari Khedut Mandili Ltd i.e. Amalsad PACS, Gandevi block, Navsari district had supplied around 15 MT of Chikoo (Sapota) to Reliance Fresh during 2007-

08. It also supplied around 10 MT of Chikoo to Subhikhsha (retail chain since closed) during 2007-08. However, the society did not supply any commodity to any Corporates thereafter. (Source: NABARD, Ahmedabad)

Not Patronage

Irrespective of what the corporate sector may or may not do to farming and farmers, sustainable prosperity will accrue to farmers only through empowerment, leadership, organisation and managerial culture. Patronage will never bring sustained prosperity. Fortunately we have a unique but replicable model to look upto. It is the Masuta Producers Company created, managed and run by Santhal women of Bihar, Jharkhand and Chhattisgarh.

I had an opportunity to attend their AGM where the attendance was more than 2000. The company is promoted by the well known NGO PRADAN. It may be recalled that Mr. Deep Joshi, the founder of PRADAN was recently honoured with Ramon Magsaysay Award, also known as the Asian Nobel Prize.

Good Model

Masuta Producers Company Limited (www.masuta.org) is the biggest producer of Tasar yarn in India. It manages the entire supply chain of Tasar yarn from planting arjun trees, seeding larva, harvesting cocoons, and reeling, spinning and making fabrics of high sophistication. It is a company of 2500 yarn producers, all of them women hailing from disadvantaged rural families living across three eastern states of India. It is the only collective of its kind in the country. Masuta has also promoted two joint venture companies. One has already started functioning and produces finest quality Tasar fabric and markets them in India and abroad. The other, in the process of registration, will procure Tasar cocoons, the raw material for tasar yarn and supplies to yarn producers throughout the year.

Masuta Producers Company Limited was registered on 26th December 2005 as a Producers Company. Producers Company is often called a Cooperative Company or 'New Generation Cooperative (NGC), a term made popular

by Dr. Amrita Patel, because such a company operates on cooperative principles even though it is registered under the Companies Act.

Masuta is owned by the village level primary groups of shareholders, formalized as Mutual Benefiting Trusts (MBT) comprising of women from tribal communities. They hail from interior villages of Bihar, Jharkhand and Chhattisgarh where alternative and dignified work opportunities for them are scarce. A Tasar yarn producer undertakes her production activity as an individual enterprise even though a group of producers often work under a common facility centre and formalized as MBTs. Masuta helps them acquire productive assets for yarn making (like reeling machines etc.), supplies them with raw-materials and other inputs, provide on-job trouble-shooting support and finally market their produce.

Empowerment

The enterprise of Tasar yarn making has helped the women to have control over their own earning, create space for their leadership, make business decisions and run their own business. They now have an enhanced say in their family and the community.

PRADAN, a voluntary organization working in the poverty stricken regions of India has helped the women promote Masuta. PRADAN provides Masuta with the required professional management support. This involves organizing them to enhance capabilities, introducing ways to improve their incomes and linking them to various economic services. The shareholders of Masuta are participants of PRADANs development interventions. PRADAN helped them in transfer of technology, capacity building and membership development. Masuta has availed of institutional credit for its working capital needs. The main difference between contract farming and the producer company is the equality in bargaining power in the latter case.

Masuta has gone beyond what has been envisaged by the NCF in this regard. The Commission has observed that private limited companies registered under the Companies (Amendment) Act, 2002, are now coming in the area of seed production and the production of bio-fertilizers, bio-pesticides and other forms of biological software essential for sustainable agriculture. Small farmers and SHGs should be associated in such companies as stake holders and not just share holders.

McKinsey Report

Farmers need corporate involvement in making innovative machinery, inputs and in creating national and international markets for them. The McKinsey study of March 1997 has recommended corporate investment in upstream food chain, implicitly leaving other elements to farmer collectives. However, farmers have to be facilitated and financed with initial subsidies to adopt the corporate culture of organization and professional management to stay free of political affiliations in order to earn the well-deserved equality with other sectors.

** The author is a former Executive Director, NABARD and now serving as Director of School of Management at VLB Janakiammal College of Engineering & Technology, Coimbatore*

Effects of Globalization on Indian Farmers

By **A.V.Tak and Dr. V.B. Tak** *

The liberalisation of India's economy started in 1991. Faced with a severe economic crisis, India approached the IMF for a loan, and the IMF granted what is called a 'structural adjustment' loan, which is a loan with certain conditions related to a structural change in the economy. The government ushered in a new era of economic reforms based on these conditions. These reforms (broadly called 'Liberalisation' by the Indian media) can be broadly classified into three areas: Liberalisation, Privatization and Globalization.

The economic reforms sought to gradually phase out government control of the market (liberalisation), privatize public sector organizations (privatization), and reduce export subsidies and import barriers to enable free trade (globalization). India witnessed considerable debate on the pros and cons of the reforms, which were a dramatic departure from the protectionist, socialist nature of the Indian economy up until then.

Agri Sector

Reforms in the agricultural sector in particular came in for severe criticism in the late 1990s, when 221 farmers in the south Indian state of Andhra Pradesh committed suicide. (*The damage done, 2005*) The trend repeated in several other states, and the figure today, according to a leading journalist and activist, P. Sainath, stands at 100,000 across the country. (*Sainath, 2006*) Coupled with this was a sharp drop in agricultural growth from 4.69 percent in 1991 to

India witnessed considerable debate on the pros and cons of the reforms, which were a dramatic departure from the protectionist, socialist nature of the Indian economy up until then

2.06 percent in 1997. (*Agriculture Statistics at a Glance, 2006*).

This paper seeks to look into these trends in Indian agriculture and to trace their causes and map the extent to which liberalisation reforms have contributed to the current condition. It will look at supporting data from three Indian states which have been badly affected by the crisis – Andhra Pradesh, Maharashtra and Kerala. Andhra Pradesh's (AP's) experience is particularly critical in this debate because it was headed by Chandrababu Naidu as Chief Minister, who pursued liberalization with enthusiasm. As a result, liberalization in AP has been faster than other states, and the extent of its impact has been wider and deeper. (*Sainath, 2005*)

Today, agriculture employs 60 percent of the Indian population, yet it contributes only 20.6 percent to the GDP. (*Isaac, 2005*) Agricultural production fell by 12.6 percent in 2003, one of the sharpest drops in independent India's history. Agricultural growth slowed from 4.69 percent in 1991 to 2.6 percent in 1997-1998 and to 1.1 percent in 2002-2003. (*Agricultural Statistics at a Glance, 2006*) This slowdown in agriculture is in contrast to the 6 percent growth rate of the Indian economy for almost the whole of the past decade.

Farmer suicides were 12 percent of the total suicides in the country in the year 2000, the highest ever in independent India's history. (Unofficial estimates put them as high as 100,000 across the country, while government estimates are much lower at 25,000. This is largely because only those who hold the title of land in their names are considered farmers, and this ignores women farmers who rarely hold land titles, and other family members who run the farms.) (*Sainath, P*) Agricultural wages even today are US$1.50 to $2.00 a day, some of the lowest in the world. (*Issac, 2005*)

Institutional credit (or regulated credit) accounts for only 20 percent of credit taken among small and marginal farmers in rural areas, with the remaining being provided by private moneylenders who charge interest rates as high as 24 percent a month. (*Sainath, 2005*) An NSSO2 survey in 2005 found that 66 percent of all farm households own less than one hectare of land. It also found that 48.6 percent of all farmer households are in debt. The same year, a report by the Commission of Farmer's welfare in Andhra Pradesh concluded that agriculture in the state was in 'an advanced stage of crisis,' the most extreme manifestation of which was the rise in suicides among farmers. Given the performance of agriculture and figures of farmer suicides across the country, this can be said to apply to Indian agriculture as a whole.

The biggest problem faced by Indian agriculture today is burden of debt which often drives hapless farmers to suicide. Soaring input costs have led farmers into a debt trap. The plummeting price of produce and lack of proper credit facilities make farmers turn to private moneylenders who charge exorbitant rates of interest. In order to repay these debts, farmers borrow again and get caught in a debt trap. We will examine each one these causes which led to the current crisis in Andhra Pradesh, Kerala and Maharashtra, and analyse the role that liberalisation policies have played.

Andhra Pradesh

As was mentioned earlier, AP's experience is particularly relevant in this analysis because of its leadership by N. Chandrababu Naidu, then Chief Minister of Andhra Pradesh from 1995-2004, who was an IT savvy neo-liberal, and believed that the way to lead Andhra Pradesh into the future was through technology and IT revolution. His zeal led to the first ever state level (as opposed to national level) agreement with the World Bank, which entailed a loan of US$830 million in exchange for a series of reforms in AP's industry and government.

Naidu envisaged corporate style agriculture in AP, and implemented World Bank liberalisation policies with great enthusiasm and gusto. He drew severe criticism from opponents, saying he was using AP as a laboratory for extreme neo-liberal experiments. Hence, AP's experience with liberalization is critical.

High Input Costs

Seeds: The biggest input for farmers is seeds. Before liberalisation, farmers across the country had access to seeds from state government institutions. For example, AP's APSSDC produced its own seeds, was responsible for their quality and price, and had a statutory duty to ensure seeds were supplied to all regions in the state, no matter how remote. The seed market was well regulated, and this also ensured quality in privately sold seeds. (*The damage done, 2005*) With liberalization, India's seed market was opened up to global agribusinesses like Monsanto, Cargill and Syn Genta. Also, following the deregulation guidelines of the IMF, 14 of the 24 units of the APSSDC's seed processing units were closed down in 2003, with similar closures in other states. This reform hit the farmers hard. In an unregulated market, seed prices shot up, and fake seeds made an appearance in a big way.

Seed cost per acre in 1991 was Rs. 70 (AUD 2) but in 2005, after the dismantling of APSSDC and other similar organizations, the price jumped to Rs. 1000 (AUD 28), a hike of 1428 percent, with the cost of genetically modified pest resistant seeds like Monsanto's BT Cotton costing Rs. 3200 or more per acre, (AUD 91) a hike of 3555 percent. (*Sainath, 2005*) BT Cotton is cotton seed that is genetically modified to resist pests, the success of which is disputed: farmers in Andhra Pradesh and Maharashtra now claim that yields are far lower than promised by Monsanto, and there are fears that pests are developing resistance to the seeds. (*Parbhani, 2002*) Expecting high yields, farmers invest heavily in such seeds.

Also BT Cotton and other new seeds guarantee a much lower germination rate of 65 percent as opposed to a 90 percent rate of state certified seeds. Hence 35 percent of the farmer's investment in seeds is a waste. (*Sainath, 2004*) Output is not commensurate with the heavy investment in the seeds, and farmers are pushed into debt. The abundant availability of spurious seeds is another problem which leads to crop failures. Either tempted by their lower price, or unable to discern the difference, farmers invest heavily in these seeds, and again, low output pushes them into debt. Earlier, farmers could save a part of the harvest and use the seeds for the next cultivation, but some genetically modified seeds, known as Terminator, prevent harvested seeds from germinating, hence forcing the farmers to invest in them every season.

Fertilizer and Pesticide

One measure of the liberalisation policy which had an immediate adverse effect on farmers was the devaluation of the Indian Rupee in 1991 by 25 percent (an explicit condition of the IMF loan). Indian crops became very cheap and attractive in the global market, and led to an export drive. Farmers were encouraged to shift from growing a mixture of traditional crops to export oriented 'cash crops' like chilli, cotton and tobacco. (*The damage done, 2005*) These warranted far more inputs of pesticide, fertilizer and water than traditional crops. Liberalisation policies reduced pesticide subsidy (another explicit condition of the IMF agreement) by two thirds by 2000. Farmers in Maharashtra who spent Rs. 90 an acre (US$ 2.5) now spend between Rs. 1000 and 3000 representing a hike of 1000 percent to 3333 percent.

Fertilizer prices have increased 300 percent. (*Parbhani 2005*) Electricity tariffs have also been increased; in Andhra Pradesh the tariff was increased 5 times between 1998 and 2003. (*Seeds of ruin, 2005*) Pre-liberalisation, subsidised electricity was a success, allowing farmers to keep costs of production low. These costs increased dramatically when farmers turned to cultivation of cash crops, needing more water, hence more water pumps and higher consumption of electricity. Andhra Pradesh being traditionally drought prone worsened the situation.

This caused huge, unsustainable losses for the Andhra Pradesh State Electricity Board, which increased tariffs. (This was initiated by Chandrababu Naidu in partnership with Britain's DFID4 and the World Bank.) Also, the fact that only 39 percent of India's cultivable land is irrigated makes cultivation of cash crops largely unviable, but export oriented liberalisation policies and seed companies looking for profits continue to push farmers in that direction.

Debt Trap

With a view to open India's markets, the liberalization reforms also withdrew tariffs and duties on imports, which protect and encourage domestic industry. By 2001, India completely removed restrictions on imports of almost 1,500 items including food. (*The damage done, 2005*) As a result, cheap imports flooded the market, pushing prices of crops like cotton and pepper down. Import tariffs on cotton now stand between 0 – 10 percent, encouraging imports into the country.

This excess supply of cotton in the market led cotton prices to crash more than 60 percent since 1995. As a result, most of the farmer suicides in Maharashtra were concentrated in the cotton belt till 2003 (after which paddy farmers followed the suicide trend). (*Hardikar, 2006*) Similarly, Kerala, which is world renowned for pepper, has suffered as a result of 0 percent duty on imports of pepper from SAARC5 countries. Pepper, which sold at Rs. 27,000 a quintal (AUD 771) in 1998, crashed to Rs. 5000 (AUD 142) in 2004, a decline of 81 percent. As a result, Indian exports of pepper fell 31 percent in 2003 from the previous year. (*Sainath, 2005*)

Combined with this, drought and crop failure has hit the pepper farmers of Kerala hard, and have forced them into a debt trap. Close to 50 percent of suicides among Kerala's farmers have been in pepper producing districts. (Mohankumar & Sharma, 2006)

Decline of Credit

In 1969, major Indian banks were nationalized, and priority was given to agrarian credit which was hitherto severely neglected. However, with liberalisation, efficiency became most important, and lending to agriculture was deemed as low-profit and inefficient.

Hence credit extended to farmers was reduced dramatically, falling to 10.3 percent in 2001 against a recommended target of 18 percent. (*Seeds of ruin, 2005*) The lack of rural infrastructure deters private banks from setting up rural branches and the responsibility fell on the shoulders of the government, which has reduced rural spending as a result of its liberalisation policies.

Rural development expenditure, which averaged 14.5 percent of GDP between 1985 & 1990, was reduced to 8 percent by 1998, and further to 6 percent since then. This came at a time when agriculture was going through a crisis proved disastrous for farmers, who turned to private money lenders who charge exorbitant rates of interest, sometimes up to 24 percent a month. (*Seeds of Suicide, 2005*) With input costs and output prices being what they are, coupled with crop failures and drought, they are pushed into debt which is impossible to repay.

Burden of States

India's 12 states out of 28 have 50 percent and more indebtedness among farm households. Andhra Pradesh has the highest percentage of indebted farm households at 82 percent. About 64.4 percent of Kerala's and 54.8 percent of Maharashtra's farm households are indebted (*NSSO, 2003*). In fact, indebtedness has been identified as the single major cause of suicides in Andhra Pradesh, Kerala and Maharashtra. (*Analysis of Farmer Suicides in Kerala, 2006, Whose Suicide is it anyway, 2005, Saving small farmers, 2005*)

Failure

Branco Milanovic, a World Bank economist describes how he believes liberalisation can help developing countries to achieve growth: "When a country lowers trade barriers, reduces government intervention in the market in order to allow market forces to operate freely, increases competition and attracts foreign investment, it will increase productivity and reduce inefficiency, which will lead to economic growth, and in a few generations, if not less, the poor will become rich, illiteracy will disappear, and poor countries will catch up with the rich." (*The damage done, 2005*). This argument is an economically rationalist one, which views government intervention with profound suspicion, and has equally profound faith in unfettered market forces. (*Whitwell quoting Robert Manne, 1998*)

What Mr. Milanovic neglects to mention, though, is that rich countries, which now preach liberalisation, protected their 'infant industries' at the time they began to industrialize, until they were strong enough to compete globally. The US government, for example, had a protectionist trade policy in the late 19th century to help US companies become competitive in the world. Besides wool, the US, Germany, Britain and France were all almost self-sufficient in the raw materials that they needed for industrialization, and took off from that platform, a luxury that India and other developing countries never had. (*Issac, 2005*)

As German economist Friedrich List says, "The adoption of these values (of liberalisation) assumes that all countries are at the same starting place, which (as we have seen above) is clearly not the case. (*Issac, 2005*) In fact, it is this very reason that has brought about the crisis that Indian agriculture is facing today".

Loss of Support

Most farmers in India were already in a position of minimum security, with no education system, credit facilities, access to alternative employment, or efficient technology. Their only support was government subsidy and regulation. Liberalisation policies came in and dismantled their only support structure. It halted the sharp reduction in rural poverty from 55 percent in the 1970s to 34 percent in the 1980s. Not only has the incidence of poverty in rural areas not gone lower than 34 percent in the 1990s, it has gone to higher levels of 42 percent in individual years. (*Ghosh, 2000*)

The second most popular argument of the economic rationalists in favour of liberalisation is that competition will weed out the inefficient, and in the growth that ensues, employment will be provided in other areas of the economy, thus lifting the poor out of poverty. This argument however assumes that the poor will be able to take advantage of the opportunities presented to them.

As Robert Issac says in '*The Globalization Gap*', "Globalization encourages the well positioned to use tools of economics and politics to exploit market opportunities, boost technical productivity, and maximize short-term material interests." This is compounded in India, where the gap between one who is 'well positioned' and one who is not, can be extreme. Lack of investment hinders generation of rural employment. Unemployment and underemployment are chronic problems in India, with the rate of unemployment being close to 10 percent in 2004. (*Parbhani, 2005*)

Woes of Education

Primary education in rural areas is mismanaged and of bad quality, and there is no system which helps agricultural workers find alternate employment, or develop alternate skills. (*Aurangabad 1997*) In the face of such obstacles, it is nearly impossible to expect agricultural workers to shift to alternate fields.

Coming back to AP, the IT Revolution spearheaded by Chandrababu Naidu attracted companies like Google, Amazon, Microsoft and Dell, and created thousands of jobs. However, given the skills and education of most farmers, it is obvious that none of this translated into job opportunities for them.

The final argument that supporters of globalization have is the much-touted 10 percent reduction in poverty (a 60 million decline in poor) in India in the year 2000. However, this figure was challenged by experts. Poverty is defined according to how many people consume less than the nutritional minimum prescribed. (2400 calories for rural areas, and 2100 for urban areas)

Major changes in survey design in 1999-2000 not only made the resultant estimates incomparable to previous years' estimates, but an over-estimation of consumption (meaning people were getting enough food, hence were not considered poor) meant a sharp reduction in poverty figures. After experts challenged it, the Planning Commission of India accepted that the figure was inaccurate, and could not be compared to previous years' estimates hence the 10 percent drop in poverty is incorrect. With adjusted figures, experts have determined that the decrease in poverty was a mere 2.3 percent and that the number of poor increased by 9 million in 2002 as compared to 1999.

Link with Growth

Many economists now concede that the relationship between liberalisation and growth are 'uncertain at best'. According to the Centre for Economic and Policy Research, which studied impact of liberalisation on the developing world, key economic and social indicators such as increases in life expectancy, infant and child mortality, education and literacy levels slowed down in the 20 years between 1980 and 2000 when liberalisation policies were implemented, compared to the 20 years leading to 1980. (*The damage done, 2005*) This defeats the economic rationalist argument of free trade eliminating poverty, since the 20 years leading up to 1980 witnessed high protectionist policies and trade barriers.

Following the suicides in 2000, the World Bank and Britain's DFID abandoned power reforms in Andhra Pradesh four years before schedule. It admitted that it had 'substantially underestimated' the 'complexity of the process' and that there must be 'increased consultation with the farmers to get their acceptance' of any further reform. (*The damage done, 2005*).

Primary education in rural areas is mismanaged and of bad quality, and there is no system which helps agricultural workers find alternate employment, or develop alternate skills

The Andhra Pradesh government sponsored report by the Commission of Farmer's Welfare squarely laid the blame for its agrarian crisis on the state and central government's policies: "While the causes of this crisis are complex and manifold, they are they are dominantly related to public policy. The economic strategy of the past decade at both central government and state government levels has systematically reduced the protection afforded to farmers and exposed them to market volatility and private profiteering without adequate regulation; has reduced critical forms of public expenditure; has destroyed important public institutions, and has not adequately generated other non-agricultural economic activities." A report on suicides in Kerala similarly held the liberalization policies of the government responsible. (*Mohankumar & Sharma, 2006*)

Conclusion

It is clear that the liberalisation policies adopted by the government of India played a dominant role in the agrarian crisis that is now being played out. However, this is not to say that privatisation, liberalisation and globalization are, per say, bad or inherently inimical to an economy.

It is the 'one size fits all' brand of liberalisation adopted by the IMF and the World Bank that forces countries to privatize, liberalise and globalize without exception which has failed. Without taking into account the state of an economy, and in this case, the state and nature of the agricultural sector in India, the IMF and the World Bank, with the cooperation of the Indian government, embarked on mismatched reforms, which have caused misery and despair among millions of Indian farmers, driving large numbers of them to suicide.

It is also essential to break the link between aid and liberalisation, which caused India in the first place to accept the conditions of the IMF. Remember that India was on the brink of a financial crisis in 1991 when it applied for the IMF loan and accepted its conditions – perhaps the course of economic reform in India would have taken a very different course if there was no urgent need to borrow from the IMF. The start to this process may have already occurred – recognizing the failure of its liberalisation policies, (and perhaps also the failure of DFID with AP's power reforms) the Blair government of Britain announced in 2004 that it will no longer make liberalisation and privatization conditions of aid.

In another blow to the neo-liberal lobby, Chandrababu Naidu suffered the worst ever defeat in the 2004 state elections, with rural AP clearly rejecting his brand of World Bank sponsored liberalisation.

The battle, however, has not yet been won. It is essential for the rest of the G8 to follow Britain's example to impress upon the World Bank and IMF not to prescribe policies of blind liberalization for countries like India.

** The writers are specialists in Agricultural Economics and faculty members of Marathwada Agricultural University (MAU), Parbhani*

Biopestisides: **Expanding Reach Abets Rural Prosperity**

By **Bikramjit Sinha and Indranil Biswas ***

In spite of certain constraints such as skewed availability of biopesticides in the market, and, the gradual disappearance of mixed/multiple cropping affecting their adoption, biopesticides continue to play a vital role in the development of Indian agriculture and contribute to the development of the rural economy in particular. This is possible by emphasizing more usage of biopesticides as a component of the Integrated Pest Management System and creating a mechanism for producing the biopesticdes in the rural areas.

Scenario in India

It has been observed that India occupies a comparatively better position in the arena of biopesticides; in terms of growth of usage, percentage share of the total pesticide market and also in research publications. The driving forces behind this are huge research infrastructure (universities and bio-control labs) and favorable public support system/policies. Subsequently, it delves on strategies to incorporate the promotion of biopesticides into rural development efforts like recognition of the huge traditional knowledge base through a Public Guarantee System and incentivize/support the purchase and use of biopesticides developed using indigenous technologies including traditional knowledge.

Addressing the Loss

Pests and diseases cause a cumulative loss of around 45 percent of the potential gross crop yield annually. In India alone, this loss, in economic terms is valued at Rs. 900 billion per annum (Jha 2009). As a substantially agriculture-oriented economy with an agriculture-dependent population, this is not only a huge loss to the exchequer but also critical consequence for the survival and livelihood of millions of people.

So far, synthetic chemical pesticides had been widely used to tackle low production caused by pests and diseases. More and more quantities of chemicals are used for agricultural intensification to feed an ever growing population in India as well as the world. In fact, the pest induced loss is on the rise despite increasing usage of pesticides.

Eco Awareness

Fortunately, realization of the negative effects of these chemicals on nature and natural resources like pollution, pesticide residue, pesticide resistance etc, have forced–many to shift focus on to more reliable, sustainable and environment friendly agents of pest control, the biopesticides. In spite of the claimed efficacy, their use, however, has remained very low due to a number of socio-economic, technological and institutional constraints.

Nonetheless, rise in income levels due to a growing economy coupled with increasing awareness of health related effects of chemical pesticides, the demand for organic food has gone up. In view of this demand and the government's efforts to mitigate climate change (from a wider perspective of reducing greenhouse gas emissions as a result of use of biopesticides), biopesticides are going to play an important role in future pest management programs.

Intensified usage of bio-pesticides across the country would lead to

i) Saving of billions of rupee to the exchequer,
ii) Sufficient food and livelihood to millions of people,
iii) Will reduce loss of hundreds of lives due to pesticide poisoning, and,
iv) Saving of billions of rupees spent on mitigating pesticide-induced effects on nature and natural resources including human beings.

Scope of Biopesticides

Both literally as well as technically, biopesticides are pesticides of biological

origin i.e., viruses, bacteria, pheromones, plant or animal compounds. Or simply, origin of the active ingredient of a biopesticide is natural not synthetic. They are highly specific affecting only the targeted pest or closely related pests and do not harm humans or beneficial organisms. While chemical pesticides are of a broad spectrum and known to affect non-target organisms including predators and parasites as well as humans.

Merits

The striking feature of biopesticides is environment friendliness and easy biodegradability, thereby resulting in lower pesticide residues and largely avoiding pollution problems associated with chemical pesticides. Further, use of biopesticides as a component of Integrated Pest Management (IPM) programmes can greatly decrease the use of conventional (chemical) pesticides, while achieving almost the same level of crop yield. However, effective use of biopesticides demands greater awareness of pests' management by the end users.

In terms of production and commercialization also biopesticides have an edge over chemical pesticides in terms of lower research expenditure, faster rate of product development as well as flexible registration process.

Constraints

However, some of the factors which have restricted the growth of biopesticides are:

- Low reliability because of low stability in effect
- Target specificity which distracts farmers
- Slow in action compared to synthetics
- Shorter shelf life
- Erratic availability of biopesticides in the market
- Already established and strong market of chemical pesticides
- Regulatory system favorable to chemical pesticides, and
- The gradual disappearance of multiple or mixed cropping, which is known to keep away the magic bullet-chemical pesticide.

R&D in Bio-pesticides

The research and development (R&D) status of biopesticide presented here is based on two parameters; publications and patents. This status is based on the information available in the Scopus database which was searched with the keyword 'biopesticide' for the time period up 1991 to 2009.

During the period 1991-2009, India published 518 papers on different fields of biopesticide research accounting 13.1 percent of the world publication during this period. During the reference period a total of 580 patents were granted worldwide of which 25 were held by India—a meagre 4.3 percent of the global patents. The patent information is based on those reported in US Patent Office (USPTO), World Intellectual Property Organization (WIPO), European Patent Office (EPO), UK Patent Office and Japanese Patent Office (JPO).

Research publications in biopesticides from India, as well as the world, are increasing but the degree of increase is very high in case of global publications. The average annual growth rate of global publications during the specified period is 53 percent while that of India is 21.4 percent. In terms of patenting, Indian condition appears to be very poor

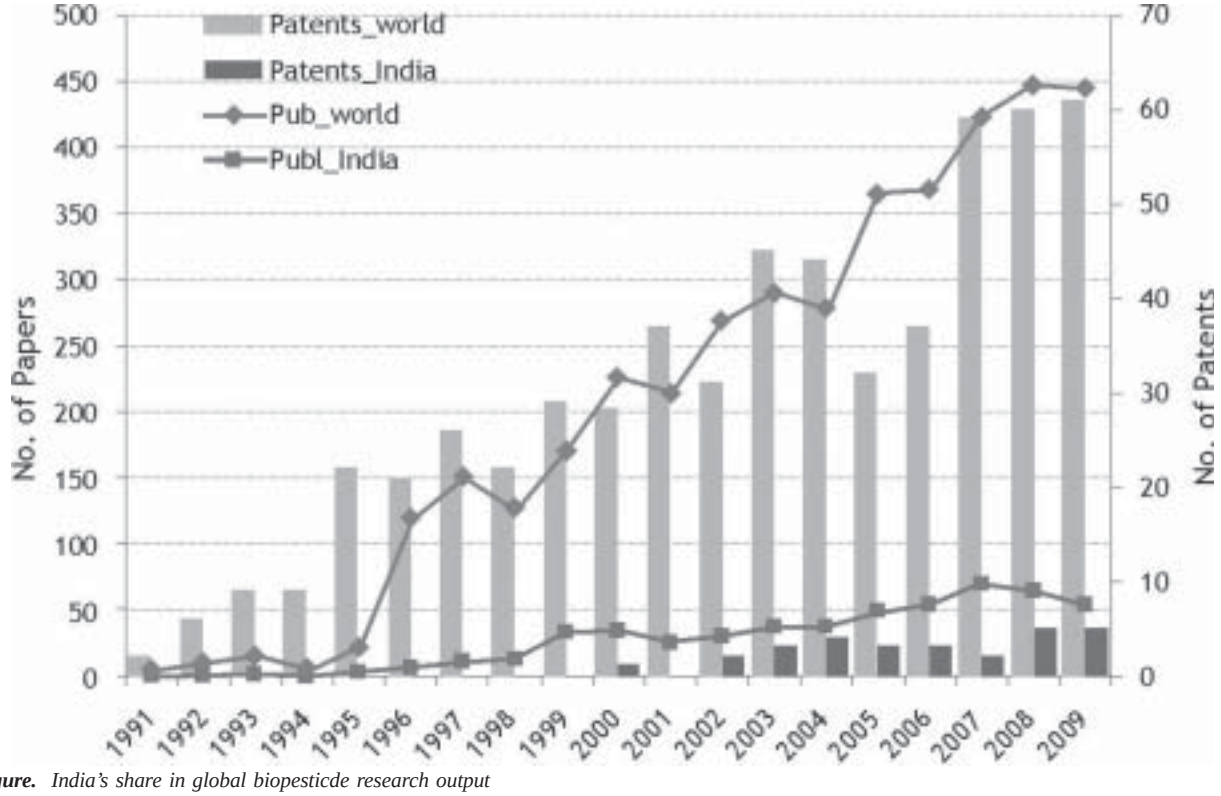

Figure. *India's share in global biopesticde research output*
Source: *Scopus; keyword-biopesticide*

whereas in the case of global patents it is showing a slight increase over the years.

Usage of Biopesticides

The global weighted average consumption level of biopesticide is approximately 1 kg/ha. With the global organic farming area comprising about 24 million hectares, global biopesticide consumption is thus estimated at about 24 million kg.

Industry Overview

The bio-pesticide market is growing much rapidly than the overall pesticide industry. In 2005, biopesticides accounted for about 2.5 percent of the total pesticide market, which was merely 0.2 percent during 2000. In 2009, the global biopesticide market has reached the market size of US$1.6 billion and accounted for 3.9 percent (up by 0.9% from the 3% share during 2008) of the global pesticide market worth of US$41.2 billion (*Source: BCC research*).

Projections

In the next 5 years, the biopesticide market is expected to grow by a compound annual growth rate (CAGR) of 15.6 percent with a valued of US$3.3 billion by 2014. In contrast, the overall pesticide market is expected to increase to US$48 billion at a much slower CAGR of 3 percent. Thus, by 2014, the biopesticide market is expected to account for about 6.9 percent of the much larger segment of the global pesticide market.

Use in Orchards

In terms of use, orchards claim the largest share (55%t) of the total biopesticides used. Region wise, North America consumes the largest share (40%) of the global biopesticide production followed by Europe and Oceanic countries accounting for 20 percent each.

Of late, there has been a substantial change in the pattern of chemical pesticide consumption in India. As a consequence of adoption of bio-intensive Integrated Pest Management Programs and use of bio-pesticides in various crops the consumption of chemical pesticide (technical grade) has come down from 61.36 thousand MT during 1994-95 to 43.59 thousand MT during 2000-01 with a reduction of 27.69 percent (s*ource: 37th Report of Standing Committee on Petroleum and Chemicals, 2002*), which has further declined to 39.77 thousand MT by 2005-06.

Correspondingly, consumption of biopesticides has increased from 123 metric tons (tech. grade) in 1994-95 to 683 metric tons in 2000-01, and almost 85 percent of the biopesticides used are neem based products. Recent statistics indicate that the consumption of biopesticide in India has increased to 1920 MT during 2005-06 (1717 MT need based and 203 MT Bt-based). It is worth mentioning here that, during 1994-95 biopesticide accounted for only 0.2 percent of the overall pesticide use in the country which has increased to about 5 percent by 2005-06, recording a CAGR of almost 38 percent in the share of overall pesticide use during the period.

Rising Use

The use of biopesticide is increasing while the use of its chemical counterpart is decreasing. This is really an encouraging piece of information everyone would like to be associated with. Though, chemical pesticides still dominate the overall pesticide usage in India, a simple trend line based projection indicates that by 2020 biopesticide will account for about 37 percent of the pesticide consumption in India

In India, so far only 12 types of biopesticides have been registered under the Insecticide Act, 1968 (www.nicm.org.in/biopesticides/registered.htm). Neem based pesticides, *Bacillus thuringensis*, NPV and *Trichoderma* are the major biopesticides produced and used in India (http://

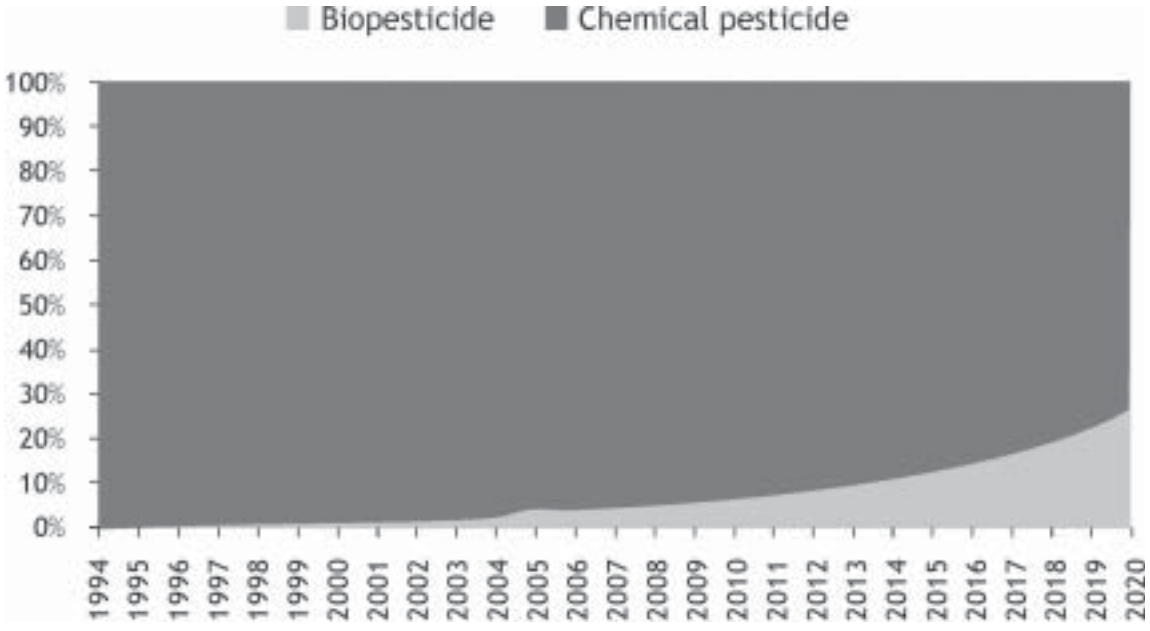

Figure. Projected percentage consumption of biopesticide in India by 2020

coe.mse.ac.in/taxproj.asp). Whereas more than 190 synthetics are registered for use as chemical pesticides. Most of the biopesticides find use in public health, except a few that are used in agriculture. Besides, i) transgenic plants and ii) beneficial organisms called bio-agents are also used for pest management in India.

Table 1: **Annual availability of biopesticide in India** (*Source: **Kalra & Khanuja 2007***)

Biopesticides/ Bioagents	Quantity/annum (approx.)
Neem 300 PPM	1,000,000 L
Neem 1500 PPM	250,000 L
Bt	50,000 kg
NPV (liquid)	500,000 Le
Beauveria	Meager
Pheromone traps	500,000 nos.
Lures	2 million
Trichogramma	1 million
Chrysoperla & other biocontrol insects	Meager
Trichoderma	500 T

Some success stories about successful utilization of biopesticides and bio-control agents in Indian agriculture include (Kalra & Khanuja, 2007, Directorate of plant quarantine, Government of India):

- Control of diamondback moths by *Bacillus thuringiensis.*
- Control of mango hoppers and mealy bugs and coffee pod borer by *Beauveria.*
- Control of *Helicoverpa* on cotton, pigeon-pea, and tomato by *Bacillus thuringiensis.*
- Control of white fly on cotton by neem products.
- Control of *Helicoverpa* on gram by N.P.V.
- Control of sugarcane borers by Trichogramma.
- Control of rots and wilts in various crops by Trichoderma-based products.

Biopesticides represents about 2.89 percent (as on 2005) of the overall pesticide market in India (valued at Rs.74 billion, including exports of Rs.29 billion.) and is expected to exhibit an annual growth rate of about 2.3 percent in the coming years (Thakore, 2006).

State Support

The Government of India is promoting research, production, registration and adoption of biopesticides with open hands, through various rules, regulations, policies and schemes. The Department of Biotechnology (DBT) spearheads the promotion of biopesticides, especially research funding and production.

The Indian Council of Agricultural Research (ICAR) has 31 bio-control production facilities while DBT supports another 22. The National Agriculture Technology Project (NATP) led IPM project during 1998 to 2005 also enhanced the use of biopesticides. States like Tamil Nadu and Andhra Pradesh already have 200 laboratories producing biopesticides.

The National Centre for Integrated Pest Management (NCIPM) looks after plant protection needs in various agro-climatic zones of the country. Besides, it oversees the setting up and running of State Bio-control Labs (SBCLs). There are around 38 such SBCLs across the country, which are engaged in production and distribution of natural predators and parasites to farmers.

The Insecticide Act of 1968 has been amended accordingly to simplify the process of registration to allow speedier development and production of biopesticides. The National Farmer Policy 2007 has strongly recommended the promotion of biopesticides for increasing agricultural production, sustaining the health of farmers and environment. It also includes the clause that biopesticides would be treated at par with chemical pesticides in terms of support and promotion.

Rural Development

Growth of the agriculture sector is a prerequisite for economic development

Table 2: Acts and policies for regulation and promotion of biopesticides in India

Acts/Policies	Objective
The Insecticide Act, 1968 *[Act]*	To regulate the import, manufacture, sale, transport, distribution and use of insecticides with a view to prevent risk to human beings or animals, and for matters connected therewith
Insecticides (Amendment) Act, 2000	
Notifications issued recently under the Insecticide Act, 1968	
The Insecticide Rules, 1971 *[Rule]*	Functioning of CIB, licensing, registration, production, packaging and transport of insecticides
The Destructive Insects and Pests Act, 1914 *[Act]*	To prevent the introduction into and the transport from one state to another in India of any insects, fungus or other pest which or may be destructive to crops
The Destructive Insects and Pests (Amendments and validation) Act, 1992	
The Plants, Fruits and Seeds Order, 1989 *[Act]*	Regarding regulation of import into India
Recent Amendments to PFS Order, 1989	
Promotion of Integrated Pest Management, 1991 *[Scheme]*	To promote use of biopesticides: neem based pesticides, bacillus based biopesticides, insect pathogen as alternative to chemical pesticides
National Agriculture Policy 2000 *[Policy]*	Recommends use of biotechnology for evolving pest-resistant crop plants
National Farmer Policy 2007 *[Policy]*	Recommended support and promotion of biopesticides as par with chemical pesticides

in general and rural development in particular. And this growth must be both pro-poor and environmentally sustainable to reduce poverty and improve the quality of life in rural areas.

This growth can be accelerated in part through recognition and capitalization of the rich traditional knowledge base of India especially in areas like eco-friendly pest management. Let us have a look at the gamut of information already available from the traditional wisdom. As many as 2,121 plant species are documented to possess pest management properties, 1,005 species of plants exhibiting insecticide properties, 384 with anti-feedant properties, 297 with repellant properties, 27 with attractant properties and 31 with growth-inhabiting properties. Some plants like *Azadirachta*, *Cymbopogon* have already been exploited for commercial production of biopesticides. Hundreds of such plants like Mahua, Tagetes, and *Chenopodium* etc. await serious attention.

Institutional Support

Institutes like Centre for Indian Knowledge Systems, National Innovation Foundation and others are involved in exploring and promoting traditional pesticides. A lot more needs to be done for optimum utilization of the traditional wisdom for sustainable rural development.

In this regard the recommendation by the National Farmer Commission is praiseworthy. It says that the government should provide incentive/support measures for promoting the purchase of products developed through indigenous technologies in areas including biopesticides. This is indeed a very concrete approach to boost rural livelihood and though the National Farmers Policy, 2007 recommended support and promotion of biopesticides as per with chemical pesticides, it did not spell out any specific mechanism of support like the one being mentioned here.

Another approach to promote biopesticide use vis-à-vis rural development is to work out a mechanism to certify traditional biopesticides in the line of Public Guarantee System (PGS) of organic products which is still under discussion. This certification system should be started and integrated with the Panchayat System for administrative control. The universities and research organizations can contribute to the certification process by providing empirical scientific efficacy of the traditional practices.

Biopesticide has the potential to be developed into a rural industry like many other sectors. For instance 'Natural dye' has successfully emerged as a rural household industry in the villages adopted by Gandhigram in Tamil Nadu. Likewise, the production of biopesticides can be a decentralized activity under the Ministry of Rural development. But to create such an industry a lot of ground work needs to be done such as appropriate mechanism of production (including selection of products and processes, beneficiaries, technical know-how) and marketing and such others.

Opportunities

- As reported, India's total pesticide consumption stands at 1,00,000 tonnes. The area under organic cultivation (crops) in India is estimated to be around 1,00,000 hectare. Besides, there are lakhs of hectares of forest area being certified as organic. States like Uttaranchal and Sikkim have declared their states as organic. Moreover, the area under organic crop cultivation is going to increase substantially because of the growing demand of organic food, as a result of increasing health consciousness among the people. This indicates that there is huge scope for growth of the biopesticide sector in India.
- Analysts believe that due to rising cost of developing new effective molecules and the non-capability of most Indian companies associated with the pesticide industry to invest such huge amount, there would be a greater development in the biopesticides sector (Desai, 1997).
- Due to its rich biodiversity India offers plenty of scope in terms of sources for natural biological control organisms as well as natural plant based pesticides.
- The rich traditional knowledge base available with the highly diverse indigenous communities in India may provide valuable clues for developing newer and effective biopesticide.
- There exist opportunities for identification of novel sources of biopesticides; for instance, exploration and utilization of nanosilica as a potential agent of biopesticide.
- The supply chain management needs to be strengthened in order to increase the usage of biopesticides. In this regard, an efficient delivery system from the place of production (factory) to place of utilization (farm) of biopesticides is quite essential.

** The writers are scientists with the National Institute of Science Technology and Development Studies (NISTADS), New Delhi attached to CSIR*

Industry, Technologists Gearing Up to Tap Opportunities

By **G. Kalyan Kumar** *

The Indian sugar industry enjoys a pivotal place in the global sugar industry as the second largest producer in the world. India is again a big consumer market in the world, in terms of high volumes. The Indian sugar market is now growing at a rate above the Asian and world consumption growth averages throwing up significant opportunities for all stakeholders.

Sugar is the main driver of India's rural economy. It supports 50 million farmers and their families, along with workers and entrepreneurs of almost 500 mills, apart from a host of wholesalers and distributors spread across the country. Besides sugar, the industry also supports diversified ancillary activities and skills in the local economy. The sugar industry is a green industry that is largely self-sufficient in its energy needs thanks to the utilisation of bagasse for generating electricity and steam.

Key States

Sugarcane, the primary raw material of the industry, is grown in nine states of India: Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Maharashtra, Punjab, Tamil Nadu and Uttar Pradesh. The sugar industry caters to an estimated 12 percent of rural population in these nine states through direct and indirect employment. Effectively, each farmer contributes to the production of 2.9 MT of sugar every year. The share of sugar production by private mills is increasing. Sugar production from the private mills accounts for more than 54 percent of the total production while the share of production from the cooperative mills is coming down to below 40 percent.

Indian sugar industry has grown horizontally with large number of small size sugar plants throughout the country as opposed to the consolidation of capacities in the rest of the important sugar producing countries where greater emphasis has been laid on the capacity of the sugar plants.

While in most other important countries the capacities of the sugar plants are hovering around an average daily crushing capacity of 10,000 tonnes of cane, in India the average capacity is less than 2,000 TCD. This has put the Indian sugar sector at a disadvantage vis-a-vis other producers in the world. On the demand side, besides household

consumption, industrial consumption for sugar is also growing rapidly after the de-regulation of the food processing sector came into effective.

Demand-Supply

One of the key characteristics of the sugar industry in India is the wide fluctuation in annual production. Though India's installed capacity is 28 million tones, the actual production varies between 20 million to 24 million tonnes. Obviously there is the issue of wide fluctuation in demand-supply adding uncertainty to sugarcane producers, sugar factories and sugar consumers. Often this unmet gap is filled through import of raw or white sugar from foreign countries such as Brazil and Thailand.

Sugarcane

Sugarcane can be called an energy crop. Just from one stick of cane come sugar, bagasse and molasses. In the West, it has already been recognised as an energy crop and is no longer a food crop. All three products are recession proof.

The average yield of sugarcane is not uniform at all parts of India; it varies from region to region. The average yield has come down from 70 MT per hectare to 60 MT per hectare. In Tamil Nadu, average production is 135 MT per hectare, whereas in Madhya Pradesh it is less than 40 MT per hectare. The reasons for low yield in India are as follow:

- Non-availability of high-yielding varieties;
- Dearth of good-quality seed or saplings;
- Improper water management;
- Use of imbalanced fertilizer doses;
- Lack of plant protection; and,
- Non-implementation of improved cultivation practices.

The sugar industry in India is in the cusp of high growth. To sustain the growth and achieve effective diversification and revenue maximization, the professional community of Sugar Technologists is playing a key role in energizing the industry through partnerships with agricultural scientists, farmers and technocrats in enhancing productivity, inducing innovations, adding efficiency and higher yields. Industrial partnerships with the sugarcane farming sector is one of the new trends in augmenting per hectare yield of sugarcane in select regions.

Improved Technology

In India, if 100 tonnes of sugarcane is crushed, only 10 tonnes of processed sugar is generated, whereas in other countries the recovery rate is huge; for instance 14.6 (Brazil), Australia 13.5 and Mexico12.2. This low recovery rate is a big challenge before for the sugar technologists; India has to improve the sugar recovery from 10 to15 in stages through appropriate technology and adoption of latest techniques in milling, juice clarification, evaporation, crystallisation, centrifugation and overall process optimisation, leading to enhanced results.

The Sugar Technology Mission undertaken by Technology Information Forecasting and Assessment Council (TIFAC) for technical upgrading of Indian sugar industries led to 20 percent reduction in sugar losses in certain demonstration cases. These techniques and other lessons can be applied to the sugar factories to raise the sugar recovery content to a higher level.

In India, when 100 tonnes of sugarcane is crushed, 38 tonnes of by products are generated which include 4 tonnes of molasses, 4 tonnes of filter cake and 30 tonnes of bagasse. With continuous adaptation of economy measures and installation of planetary gears and variable frequency drives, the steam and

Sugar Producer Partners with UP Farmers

DCM Shriram Consolidated Ltd, a New Delhi-based producer of sugar buys cane from about 200,000 farmers in Uttar Pradesh. The company launched a programme last year to help 5,000 sugarcane farmers in Uttar Pradesh increase yields by 25 percent over three years. According to Ajay S. Shriram, chairman of the company, "The best way for farmers to adopt improved technology is through demonstrations. Unless farmers see a change, they find it hard to believe. We want these 5,000 to be convinced so that they become the ambassadors."

In Brazil and Thailand, the cost of cane accounts for about 65 percent of the sugar price, while in India the ratio fluctuated between 50 percent and 75 percent last year, Shriram said. Cane costs accounted for 90 percent of the Indian sugar price in 2008, he added.

installed requirement that is around 40 percent on cane and 25 kW per tonne of cane per hour can be reduced to 30 percent on cane and 20 kW per tonne cane per hour.

The processing system, in addition to producing 10 tonnes of sugar and 38 tonnes of by products, generates 87 tonnes of liquid effluents, which include 35 tonnes of water supply externally. This surplus water can be treated to remove injurious elements for plant life and can be recycled and supplied to the farmers for cultivation purposes.

Diversification

Similar to the Amul success story in milk which was all about diversified milk products; The sugar industry also carries the potential to build an eco system and climate to enhance the volume and market of by products and provide revenue maximization to the producers. The ideal product mix could be raw sugar, white sugar, ethanol and alcohol. Ethanol has multiple industrial and pharmaceutical applications besides use in blending with petrol for automotive fuel applications. This is despite interstate controls in the movement of molasses needed for making ethanol and alcohol. By reinforcing the total sugar and by products the fluctuation seen in this industry on a cyclical basis can be curtailed.

Challenges

The loosening of controls on sugar industry started in 2003 after the then Government accepted some of the recommendations made by the Mahajan Committee. In the past, the Rule book was stringent; there were draconian stipulations as to how much a trader can keep in his go-down and mandates on assorted stock limits. Only traders with a sugar license could buy sugar. Those days the levy quota (Govt: Quota from sugar mills) was 40 percent, now the same is 10 percent. Stocks limits are gone. But the industry faces controls on the finished products and levy quota on the finished product.

The lack of alignment between sugarcane and sugar prices is a big problem. As a result, it leads to cane payment arrears. The arrears typically result in the eventual need for government support packages, and the pronounced cyclicality destabilizes the sector revenues. The average sugarcane yields have also, at best, stagnated and the average recovery is amongst the lowest in comparison with key sugar producing nations. Large sugar inventory exposure and sugar price volatility result in high sugar price risk for the sector. In the past ten years, on an average, even the large listed sugar firms have struggled to generate return on invested capital (ROIC) over and above their cost of capital. This is primarily due to high mandated fixed cane prices and volatile sugar prices.

Decontrol

The industry sees salvation in total decontrol to expand production and profits. They want the government to take care of the levy system. The practice of government taking sugar at a lesser price from the mills (10 percent of the total output) leads to the destabilization of sugar prices. If the government can pay the market price and distribute it in whatever manner, the producers say they will get a fair return.

Cross Roads

Clearly the Indian sugar industry is at the crossroads today. It needs the confidence to leverage opportunities created by global shifts in sugar trade and emergence of sugarcane as a source of renewable energy, through ethanol and cogeneration. While some of these opportunities have been well-researched in the past, there is a need to assess the potential for India and to develop a comprehensive and actionable roadmap that would enable the Indian industry to take its rightful place as a food and energy producer for one of the world's leading economies.

Vision for Indian Sugar 2020

1. Indian sugar industry to be fully liberated from all controls both by the state and central governments and is market-driven.
2. National average production of sugar in India rises to 120 tonnes per hectare.
3. Average sugar recovery from Indian sugar factories is above 13 percent.
4. Water consumption by sugarcane producers reduces by 50 percent through the use of micro and irrigation.
5. Sugarcane farmers adopt eco-farming and bio fertilisers and pesticides leading to better environment.
6. Indian sugar factories achieve global standards on environment compliance and plant safety.
7. Indian white sugar fully meets the international standard of 40I CUMSA and 20 percent output of sugar factories is exported.
8. Ethanol production from molasses and also directly from cane supplemented with other biomass leading to an energy-independent rural sector.

** The writer is Editor of Financing Agriculture*

Kenya Expo will open up Global opportunities: Rao

The Indian Sugar Expo being held in the Kenyan Capital Nairobi is going to become a landmark event for the industry.

In an interview with Financing Agriculture, ***Dr. G.S.C. Rao****, President of the Sugar Technologist Association of India (STAI) looks at the opportunities from the expo including the exports of Indian sugar companies to the international market.*

Excerpts

Q. Idea behind organizing the India Sugar Expo - 2010?

India is one of the largest producer and consumer of sugar in the world with around 615 installed sugar mills. Pursuant to the size of industry, there are about 5000 SME's catering to the technological needs of sugar & allied industries. These SME's are low cost and high quality technology developers and serve as the backbone to the Indian Sugar Industry. However, despite being the quality product producers many of them are unable to make a beginning in the international arena due to lack of right contacts. This is how the idea to hold the Expo in Kenya was mooted to give our SME's an international exposure.

Q. Why did you select Kenya as the venue for the event?

Our SME's have huge opportunity to expand and develop their business in developing and under-developed countries for sugar process technology, cogeneration and alcohol industries. The best opportunities are available in African continent – South East Asia and South Asia. Among these, Africa offers huge potential. Apart from this, the Indian Sugar Industry has the best pool of technocrats in the world.

Q. How many exhibitors are participating in this event and what products, processes and technologies they are going to display?

About 55 exhibitors from India will be participating in this expo ranging from turn-key sugar plant manufacturers to small and medium machinery, chemical and agri-rnachinery manufacturers. They will be showcasing all the products that can be made from sugarcane viz. raw sugar, refined sugar, speciality sugar, cogeneration of power, anhydrous bioethanol, biomass and or biogas based cogeneration, biomanure etc.

Q. How is the African sugar industry going to gain out of this Expo in term of technology, processes investment etc?

Sugar industry is an agro based industry and is a key driver for the development of the rural industry. The industry has the potential to transform the rural sector into massive revenue generator besides providing livelihood to millions of skilled, semi-skilled & other workers employed in ancillary activities mostly from rural areas. The sugar industry in African Continent has huge potential for development of the sugar industry.

The expo offers immense opportunities for the development, rehabilitation, modernization of sugar factories in Kenya through understanding, acquiring latest cost effective technologies for improving productivity, operational efficiencies both for field and factories. Given the working environment and cost considerations, Indian technology and machinery is most suitable for them.

Q. How good is the sugar industry in the African continent vis-a-vis compared to Indian sugar industry?

The sugar industry in African Continent is in the process of upgrading its technology & improving its operational

Sugarcane crop is an energy crop and it has the potential for production of sugar, power and ethanol. Now the industry world over is transforming from food to energy. India has developed adequate expertise in all the aspects of sugar, power and alcohol besides huge talent pool to extend it to the world.

efficiencies. Whereas the technical efficiency of the Indian sugar mills are at par or even better than the most developed countries in the respect of energy conservation, sugar losses and the cost of conversion. A number of sugar factories in India are now producing sugar quality of global standards.

Q. What will the Indian Sugar Industry and particularly the Indian Sugar Machinery Manufacturers going to gain from the event?

This is an important event for the Indian Sugar machinery manufacturers particularly for the SME's as many of them for the first would get an opportunity to meet the sugar professionals from the African continent at one place in such large numbers. This interaction would enable them to understand the African Sugar Industry and its requirements. I am sure that this would later translate into bigger business opportunities for them.

Apart from this, there is huge potential for bilateral cooperation among the Indian and African sugar industry for mutual benefit & to build a platform for the two sides to meet and establish contacts for long term business relations.

Q. Who is your target audience?

Our main target audience is the sugar industry and allied industries connected with it. In order to have larger participation and to take advantage from the event, we have extended invitation to attend India Sugar Expo - 2010 to virtually every sugar mill, trade associations, National Chamber of Commerce in the African Sub-Continent.

Q. Is there any presence of Indian sugar companies, sugar technocrats or sugar consultants in Africa?

Yes the Indian sugar technocrats, sugar technologists, consultants, professionals and even a few sugar turn-key-plant manufacturers have their presence in most of the Afro-Asian countries. The products, technologies, processes and services rendered by the Indian sugar companies are considered to be the most cost effective and efficient in the world.

Q. Is there any Govt. support to the event?

Yes the event is being supported by the Government and a few important sugar organizations both from India and Kenya:

- Ministry of Consumer Affairs, Food & Public Distribution, Govt. of India
- Ministry of Commerce & Industry, Dept. of Commerce, Govt. of India
- The Kenya National Chamber of Commerce & Industry, Kenya
- Joint Kenya Arab Chamber of Commerce & Industry
- Kenya Sugar Board, Govt. of Kenya
- Kenya Association of Manufacturers, Kenya
- Indian Sugar Mills Association (ISMA)
- National Federation of Cooperative of Sugar Mills Ltd. (NFCSF)
- South Indian Sugarcane & Sugar Technologists Association (SISSTA)

Apart from the above, we have received valuable support, assistance and guidance from the Ministry of Eternal Affairs at New Delhi India, Indian High Commission at Nairobi, Kenya. Without their guidance and support we would not have been able to organize the event of this magnitude.

Q. Will there be any merger or acquisitions during this event?

Possibility of this cannot be ruled out.

Q. When and where will you organize the next event?

This shall be considered after the event.

Q. Finally, what is your message to the industry and to our readers?

Sugarcane crop is an energy crop and it has the potential for production of sugar, power and ethanol. Now the industry world over is transforming from food to energy. India has developed adequate expertise in all the aspects of sugar, power and alcohol besides huge talent pool to extend it to the world. Africa is the next destination of growth in this field because of its agro-climatic conditions and availability of vast cultivable land tracks.

The exhibition offers a good opportunity for interaction between Indian experts and African continent professionals to take advantage from the event.

MEDICINAL PLANT KALMEGH (ANDROGRAPHIS PANICULATA)

A Case for Raising its Supply and Marketing in Tamil Nadu

By **N.Ajjan, N.Raveendaran, K.Rajamani, V.M.Indumathi and A.R.Vennila***

Kalmegh is found throughout India in the plains and hills. This is a small herb growing upto 2-3 ft height and tastes bitter. The common names are Bhoo Nimba in Sanskrit, Nilavembu in Tamil and Telugu and Kalmegh in Hindi. The crude drug consists of dried or fresh leaves or the aerial portions of the plant. Sometimes, the whole plant, including the roots, is used.

The drug is sometimes mixed with the genuine chirata (Swertia chirayita Karst) but can be distinguished from the latter easily by the green colour of its stems, numerous erect, slender, opposite branches and its lanceolate, green leaves. It is also adulterated with Andrographis echioides found in Rajasthan, Maharashtra and Tamil Nadu.

However, Andrographis echioides and Swertia chirayita are devoid of andrographolide, which is the major bioactive constituent of Kalmegh. Whole plant mainly leaf and roots are used for medicinal purposes. Active ingredients such as kalmeghin and andrographolide have been isolated from the plant. Plant is astringent, anodyne, tonic and alexipharmic.

Roots and leaves are used as a febrifuge, cholagogue and anthelmintic. It is used in dysentery, cholera, diabetics, influenza, bronchitis, itches and piles. Siomethionine, Hepatone, Surakta, Hepachal, Livobin, Bylogen, Indised sarsa and Kalmegh Pills are some of the major medicinal preparations from the plant. The major source of supply is from forests and hilly areas. The demand for the year 2005 – 2006 was 2197 tonnes and the average growth rate of demand was 3.1 percent per annum. Mode of propagation is through seeds and it is used as an adulterant for chirata.

Tamil Nadu is one of the important sources of medicinal plants either through natural collection or cultivated sources. Most of the medicinal plants in the State are being collected by the wild collectors due to their availability and only some of them are cultivated on a limited scale. The present study was attempted with the following objectives:

Objectives

i) Analysing mode, economics of collection of kalmegh and standardization ;
ii) Understanding the marketing of kalmegh; and
iii) Identify the various constraints involved in collection and marketing of Kalmegh.

Methodology

Main source of Andrographis supply is wild collection as it is not widely cultivated in Tamil Nadu. Around 50 wild collectors and 5 traders/exporters of hilly areas of Dindigul, Madurai, Rajapalayam were selected at random. The selected wild collectors and traders/exporters were contacted and interviewed

personally. Information on type, mode, post harvest method and economics of collection, marketing of collected materials, problems faced by the collectors etc., were collected. Field experiments of bio-stimulants involving foliar treatments and its effect on biometric observations were evaluated. The data were tabulated and subjected to further analysis. Percentage analysis was carried out to draw useful conclusions.

1. **Results and Discussion**
2. **Collection and Processing**
3. **Area of collection**

As the whole plant is having medicinal value the tribes residing nearby the forest area were found collecting these whole plants. They constituted 50 percent of the wild collection (Table 1.). Twenty percent of the collectors were collecting Andrographis from local area where the tribal people were residing.

Table 1. Area of Wild Collection

(n= 50)

Sl. No.	Particulars	Number	Percent
1.	Local Area	10	20
2.	Near by forest area	25	50
3.	Hilly areas	15	30
	Total	**50**	**100**

Most of the tribes were residing near forest and hilly areas and their major occupation was wild collection.

A. Frequency of Wild Collection

Table 2. Frequency of Collection

(n= 50)

Sl. No.	Particulars	Number	Percent
1.	Daily	30	60
2.	Two days once	14	28
3.	Weekly once	6	12
4.	Weekly	-	-
	Total	**50**	**100**

It was observed that 60 percent of the wild collectors were daily collecting Andrographis followed by more than one – fourth (26 percent) collecting once in two days. Since the peak season of collection is only for few months (September – December) the availability was more during this period and hence the wild collectors used to go daily for collecting the *Andrographis* plants during the season (Table.2.)

B. Collection type

Table 3. Type of Collection

(n= 50)

Sl. No.	Particulars	Number	Percent
1.	Single	32	64
2.	Group	18	36
	Total	**50**	**100**

Nearly two–third (64 percent) of the wild collectors was found collecting singly followed by collecting in groups (Table.3). In some places the wild collectors formed Self Help Groups (SHGs) and these group members were collecting Andrographis. The SHG members were collecting the Andrographis and they were selling to the wholesale traders and some of the tribal collectors were making powder from Andrographis leaves for their own use for fever, cold and other common health problems (Mishra et al, 2008).

C. Mode of reaching the sale point

Table 4. Mode of reaching the collection point

(n= 50)

Sl. No.	Particulars	Number	Percent
1.	Buses	22	44
2.	Others (By walk)	28	56
	Total	**50**	**1 00**

Majority (56 percent) of the wild collectors were reaching the collection point by walk (Table.4). Rest of them was reaching the places by bus. Hence frequent bus facilities have to be made available to the tribal areas as most of the tribal people were engaged in wild collection of Andrographis.

Time spent in collection

Nearly two third of the wild collectors were collecting the Andrographis plants for 5- 10 hrs and only 32 percent of them were collecting less than 5 hours as could be observed from Table.5.

Table 5. Time spent in collection (hrs/ day)

(n= 50)

Sl. No.	Particulars	Number	Percent
1.	< 5 hrs	16	32
2.	5 – 10 hrs	34	68
3.	> 10 hrs	-	-
	Total	**50**	**100**

The wild collectors used to collect from morning to evening and majority of them were spending 6 -7 hrs and collect about 7-10 kgs of Andrographis/ day. For most of the tribes, their main occupation was wild collection hence they used to spend much of their time in this activity.

Reasons

About 44 percent of the wild collectors expressed that the major reason for opting wild collection was, ready market for the produce (Table.6). The other reasons were absence of other productive employment opportunities (30 percent), immediate return (16 percent) and no initial investment (10 percent). As majority of the wild collectors were living in the tribal areas employment opportunities were limited for them. Hence majority of them were dependent on the wild collection of different medicinal plants.

Table 6. Reasons for wild collection

(n= 50)

Sl. No.	Particulars	Number	Percent
1.	Ready market for the produce	22	44
2.	No other productive employment	15	30
3.	Immediate return	8	16
4.	No initial investment	5	10
	Total	**50**	**100**

Post Harvest activities

After collection, the plants are cleaned, washed and shade dried. The dried material is packed and sold. While all the wild

collectors were found cleaning the collected materials only 56 percent of them washed the same before drying (Table.7).

Table 7. Post Harvest activities

(n= 50)

Sl. No.	Particulars	Number	Percent
1.	Cleaning	50	100
2.	Washing	28	56
3.	Packing	50	100
4.	Processing	-	-
	Total	**50**	**100**

Economics of Wild Collection

Since there is no cultivation in Tamil Nadu, the main source of supply of Andrographis is from wild collection only. The wild collectors used to collect on an average 7-8 kgs of whole plants per day and the whole plant and roots are used for medicinal purposes. After collecting the plant materials the collectors used to dry it under shade and during drying the loss in quantity will be 200 gm/ kg of plant material. They got 6 - 6 ½ kgs of dried plant material. The price prevailed ranged from Rs. 20 to 25/ kg of dry product. The collectors brought the dried material to the market by bus by spending Rs. 15 towards transport cost. There is a good market for Andrographis and there is no problem in sale of the product and some of the traders have tie–up arrangements with collectors group. The cost of collection is detailed below.

Cost of Collection

Particulars	
Total quantity of green leaves collected / day	7 - 8 Kgs
Loss during drying	200 g/ kg
Quantity of dry leaves obtained	6 ½ kgs
Mode of transport for collection	by walk
For selling	By Bus
Method of drying	Drying under shade
Transport cost	Rs.15
Transport cost/ Kg	Rs. 2.50
Entry fees	Rs. 10
Total Expenditure	Rs.25

Table 8. Effect of bio stimulants on biometric characters at 45 DAP

Treatments	Plant height (cm)	Mean No. of branches	Mean No. of leaves per plant	Mean Fresh weight (gram per plant)	Mean Dry weight (gram per plant)
T_1-2% Panchakavya	13.4	2.1	13.4	8.2	3.28
T_2-0.2% Humic Acid	24.1	8.5	31.7	15.5	2.88
T_3-2% Moringa Leaf Extract	22.2	5.2	28.1	15.0	2.76
T_4-4% Panchagavya	22.7	8.4	29.8	15.0	2.72
$T_{50.}$- 0.4% Humic Acid	21.6	7.5	24.4	15.7	2.90
T_6-4% Moringa Leaf Extract	22.1	6.4	24.4	14.5	2.84
T_7- T_1 + T_2+ T_3	**28.1**	**8.3**	**27.3**	**17.9**	**3.64**
T_8- T_4 + T_5 + T_6	17.1	7.3	30.6	17.2	3.44
T_9-Control	23.7	7.6	31.2	12.1	2.44
Mean	21.7	6.8	26.8	14.6	2.98

Table 9. Effect of bio stimulants on biometric characters at 90 DAP

Treatments	Plant height (cm)	Mean Number of branches	Mean Fresh weight (gram per plant)	Mean Dry weight (g/plant)	Mean Estimated dry herbage yield (kg/ha)	BC ratio
T_1-2% Panchakavya	27.8	7.3	16.5	3.8	1688.88	1.52
T_2-0.2% Humic Acid	24.1	8.5	15.5	3.4	1511.11	1.38
T_3-2% Moringa Leaf Extract	22.2	5.2	15.0	3.2	1422.22	1.42
T_4-4% Panchagavya	22.7	8.4	15.0	3.3	1466.67	1.28
T_5-0.4% Humic Acid	21.6	7.5	15.7	3.5	1555.55	1.19
T_6-4% Moringa Leaf Extract	22.1	6.4	14.5	3.0	1333.33	1.38
T_7- T_1 + T_2+ T_3	**28.1**	**8.3**	**17.9**	**4.4**	**1955.55**	**1.43**
T_8- T_4 + T_5 + T_6	17.1	7.3	17.2	4.1	1822.22	1.18
T_9-Control	23.7	7.6	12.1	2.1	933.33	1.27
Mean	23.6	7.4	15.5	3.4	1520.98	

Cost and Returns of Andrographis Collection

Wild collectors got on an average of 6– 6 ½ kgs of dried material. Price is fixed by the trader based on the quality of the material considering market price. The Net returns of Rs.125/ day was realized and this will continue for the peak season i.e. for four months (September– December).

Net Return/ day

Gross return / day	Rs. 150
Cost of collection and marketing	Rs.25/ Kg
Net Income/ day	Rs. 125

Effect of foliar treatments on biomass and yield

The bio - stimulant trial involving foliar treatments (Panchakavya (2% and 4%), humic acid (0.2% and 0.4%), moringa leaf extract (2% and 4%) were sprayed at 30, 60 and 90 days after planting. Biometric observations like plant height, number of branches per plant, number of pods per plant and fresh weight were recorded. First season crop was raised during June 2005. The experimental results revealed that combination of 0.2 percent humic acid, 2 percent panchakavya and 2 percent moringa leaf

Table 10. Effect of bio stimulants on biometric characters at 45 DAP

Treatments	Plant height (cm)	Mean Number of branches	Mean Number of leaves per plant	Mean Fresh weight (gram per plant)	Mean Dry weight (gram per plant)
T_1-2% Panchakavya	12.9	6.1	12.9	7.9	3.1
T_2-0.2% Humic Acid	23.6	8.4	31.2	15.2	2.7
T_3-2% Moringa Leaf Extract	21.7	5.0	27.6	14.7	2.6
T_4-4% Panchagavya	22.2	8.2	29.3	14.7	2.5
T_5-0.4% Humic Acid	21.1	7.3	23.9	15.4	2.7
T_6-4% Moringa Leaf Extract	21.6	6.2	23.9	14.2	2.6
T_7- T_1 + T_2+ T_3	**27.6**	**8.1**	**26.8**	**17.6**	**3.4**
T_8- T_4 + T_5 + T_6	16.5	7.1	30.1	16.9	3.2
T_9-Control	23.2	7.4	30.7	11.8	2.2
Mean	21.2	6.6	26.3	14.3	2.8

Table 11. Effect of bio stimulants on biometric characters at 90 DAP

Treatments	Mean Plant height (cm)	Mean Number of branches	Mean Fresh weight (gram per plant)	Mean Dry weight (g/plant)	Mean Estimated dry herbage yield (kg/ha)	BC ratio
T_1-2% Panchakavya	27.4	7.1	16.0	3.6	1598.40	1.41
T_2-0.2% Humic Acid	23.7	8.1	15.0	3.2	1420.80	1.27
T_3-2% Moringa Leaf Extract	21.8	4.8	14.5	3.0	1332.00	1.31
T_4-4% Panchagavya	22.3	8.0	14.5	3.1	1376.40	1.17
T_5-0.4% Humic Acid	21.2	7.1	15.2	3.3	1465.20	1.08
T_6-4% Moringa Leaf Extract	21.7	6.0	14.0	2.8	1243.20	1.27
T_7- T_1 + T_2+ T_3	27.7	7.9	17.4	4.2	1864.80	1.32
T_8- T_4 + T_5 + T_6	16.7	6.9	16.7	3.9	1731.60	1.07
T_9-Control	23.3	7.2	11.6	1.9	843.60	1.16
Mean	22.9	7.0	15.0	3.2	1420.80	

extract recorded highest biomass (17.9 g/plant) at 90 days after planting (Table 9). The second season crop was raised during July 2006. The same treatments were imposed at 30, 60 and 90 days after planting to confirm the previous season results. Same treatment recorded highest biomass (17.4 g/plant) at 90 days after planting (Table 11). The third crop was raised during June 07. Similar results were obtained during third season also (Table 12).

Thus a combination of 0.2 percent humic acid, 2 percent panchakavya and 2 percent moringa leaf extract recorded highest biomass of more than 19 gm/ plant with dry herbage of 2 tons/hactare.

Marketing of *kalmegh*

Selling behavior

About 42 percent of the wild collectors sold the collected material to the local traders who were available locally followed by wholesalers (24 percent), processors (18 percent) and direct sales to pharmaceutical companies (16 percent). In turn the local traders were found selling to wholesalers and the wholesalers sell it to pharmaceutical companies for medicines and various types of product preparation (Table.15.)

Table 15. Selling behaviour of Collectors

(n= 50)

Sl. No.	Particulars	Number	Percent
1.	Local traders	21	42
2.	Wholesalers	12	24
3.	Processors	9	18
4.	Direct sales to pharmaceutical companies	8	16
	Total	**50**	**100**

Average price of the product

Majority (72 percent) of the wild collectors indicated that they got Rs. 22/ kg of dried plant material and the remaining 28 percent of wild collectors got more than 25 rupees/kg as price of the collected product (Table.16). The traders used to give lesser price to the wild collectors as the price information was not known to the wild collectors. Whatever the prices are offered by the traders the wild collectors are forced to sell for that price only. When the materials are sold to wholesalers and companies directly they were able to get better prices.

Table 16. Average Price of the Product (in Rs. / kg)

(n= 50)

Sl. No.	Particulars	Number	Percent
1.	< 10	-	-
2.	10 - 15	-	-
3.	15 - 20	-	-
4.	20 – 25	36	72
5.	> 25	14	28
	Total	**50**	**100**

5.3. Marketing Channel for kalmegh

Andrographis is being sold to local traders or whole sale traders by the wild collectors through five major channels as depicted in Fig 1. The cost of marketing and other details are discussed hereunder.

I. Wild Collectors ⟶ Local traders ⟶ Wholesale Traders ⟶ Exporters

In this channel, the wild collectors sell their produce collected from the nearby hilly and forest areas to the traders available locally, he sells to the next level trader (Wholesale traders) who handles in bulk. The wholesale trader sells to the exporters and pharmaceutical companies. The exporters are exporting the material to countries like Japan, U.S., Malaysia and Italy.

Since, more than three intermediaries are involved in the business; the price received by the collector is comparatively less. For example, while tracing the channels for marketing of dried and cleaned kalmegh plants it was found that it was sold by the collector at Rs. 25/ kg to the local trader in his premise, in turn the local trader sold that produce to the wholesale trader at the rate of Rs.46/ kg and the wholesale trader sold to the exporter at a rate of Rs.70/kg and further the export price realized by the exporter is about Rs.120 -130/kg. Thus the collector's share in exporter price is 21 percent only with less value addition by other intermediaries having higher margin.

II. Wild Collectors' Groups ⟶ Wholesale Traders ⟶ Pharmaceutical Companies

In this type of channel, wild collectors were formed into groups and the groups sell their produce to the wholesale traders available in nearby areas, in turn they sell the produce to the Pharmaceutical companies manufacturing Siddha, Ayurvedic and Homeopathy medicines. Benefits obtained by the collector members from these types of groups/ organizations are more. The collectors groups or associations are present in some areas only and price received by the collector is Rs.35/ Kg

III. Wild Collectors ⟶ Wholesale Traders ⟶ Exporters

In this type of channel, the wild collectors sell their produce to the wholesale traders and in turn they sell to the exporters. The exporters are exporting the material to countries like Japan, U.S., Malaysia, Singapore and Italy. Some of the

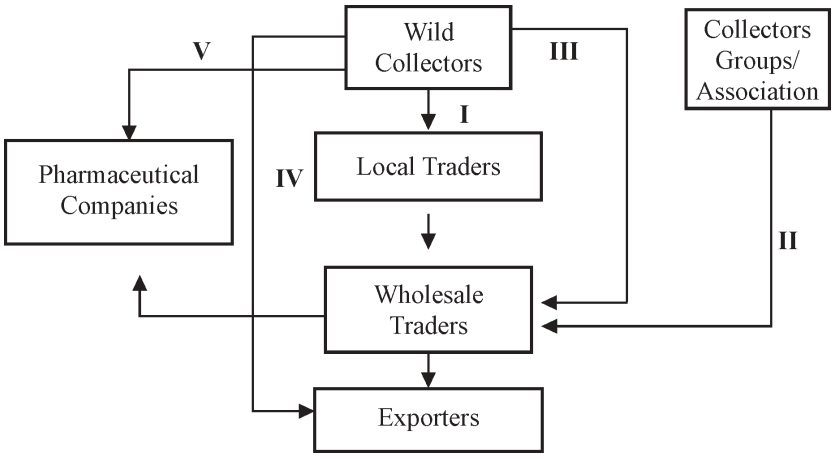

Fig 1. Marketing Channel for kalmegh

Table 12. Effect of bio stimulants on biometric characters at 45 DAP

Treatments	Mean Plant height (cm)	Mean Number of branches	Mean Number of leaves per plant	Mean Fresh weight (gram per plant)	Mean Dry weight (gram per plant)
T_1-2% Panchakavya	14.2	6.7	14.2	8.7	3.4
T_2-0.2% Humic Acid	26.0	9.2	34.3	16.7	3.0
T_3-2% Moringa Leaf Extract	23.9	5.5	30.4	16.2	2.9
T_4-4% Panchagavya	24.4	9.0	32.2	16.2	2.8
T_5-0.4% Humic Acid	23.2	8.0	26.3	16.9	3.0
T_6-4% Moringa Leaf Extract	23.8	6.8	26.3	15.6	2.9
T_7- T_{1+} T_{2+} T_3	**30.4**	**8.9**	**29.5**	**19.4**	**3.7**
T_8- T_{4+} T_{5+} T_6	18.2	7.8	33.1	18.6	3.5
T_9-Control	25.5	8.1	33.8	13.0	2.4
Mean	23.3	7.3	28.9	15.7	3.1

Table 13. Effect of bio stimulants on biometric characters at 90 DAP

Treatments	Mean Plant height (cm)	Mean Number of branches	Mean Fresh weight (gram per plant)	Mean Dry weight (g/plant)	Mean Estimated dry herbage yield (kg/ha)	BC ratio
T_1-2% Panchakavya	30.1	7.8	17.6	4.0	1758.2	1.6
T_2-0.2% Humic Acid	26.1	8.9	16.5	3.5	1562.9	1.4
T_3-2% Moringa Leaf Extract	24.0	5.3	16.0	3.3	1465.2	1.4
T_4-4% Panchagavya	24.5	8.8	16.0	3.4	1514.0	1.3
T_5-0.4% Humic Acid	23.3	7.8	16.7	3.6	1611.7	1.2
T_6-4% Moringa Leaf Extract	23.9	6.6	15.4	3.1	1367.5	1.4
T_7- T_{1+} T_{2+} T_3	**30.5**	**8.7**	**19.1**	**4.6**	**2051.3**	**1.5**
T_8- T_{4+} T_{5+} T_6	18.4	7.6	18.4	4.3	1904.8	1.2
T_9-Control	25.6	7.9	12.8	2.1	928.0	1.3
Mean	25.2	7.7	16.5	3.5	1562.9	

wholesale traders were doing export also. Price received by the collectors was Rs. 25 only.

Andrographis is being exported in raw form from Dindigul area while it is exported in powder and other forms from the companies manufacturing Siddha medicines in Rajapalayam and Madurai areas of Tamil Nadu. The preparations like capsules, syrup and powder are being exported to Malaysia, Japan and Hongkong and these preparations are useful in controlling fever, cough and for improving general body health.

IV. Wild Collectors ⟶ Exporters

The exporters directly buy kalmegh from the wild collectors. In this type of channel the intermediaries are not involved and the exporters are directly getting the products from wild collectors and price received by the wild collectors was Rs. 32 on an average.

V. Wild Collectors ⟶ Pharmaceutical Companies

Some of the pharmaceutical companies were buying the dried and cleaned kalmegh plants from the wild collectors. After getting it, they grade the produce and used for various medicinal preparations.

Scope for increasing Area, Production and Productivity

Since *kalmegh* is not cultivated in Tamil Nadu the main source of supply is wild collection only. Hence the supply of kalmegh is under serious threat; more than 70 percent of the plant collection involves destructive harvestings because

Andrographis is being exported in raw form from Dindigul area while it is exported in powder and other forms from the companies manufacturing Siddha medicines in Rajapalayam and Madurai areas of Tamil Nadu

Table 17. Problems faced by the Collectors

(n= 50)

Sl. No.	Particulars	Number	Percent
1.	Restrictions by the forest officials	22	44
2.	Transport problem	12	24
3.	Price is not transparent	11	22
4.	Not available through out the year	8	16
5.	Fear of wild animals	5	10
	Total	**50**	**100**

of the use of parts like roots and the whole plant. This poses a definite threat to the genetic stocks and the diversity of medicinal plants and cultivation of kalmegh is the only solution to mitigate the above problem. Hence possibilities for cultivation could be analysed since cultivation techniques are being standardized.

Problems faced by the collectors

Forty four percent of the wild collectors expressed that the restrictions by the forest officials as the major problem in wild collection (Table.17). The forest officials are charging Rs. 10 as entry fee to enter into the forest for collecting the medicinal plants from the forest area and in some places they used to collect Rs. 15 – 20 also. The other major problem was lack of adequate transportation facilities as expressed by 24 percent of the wild collectors. Non-availability of price information leading to non-transparency in marketing and price formation was reported by 10 percent of the collectors.

Conclusions and Suggestions

Conclusions

- Kalmegh is not under cultivation and the main source is wild collection only.
- One third of wild collectors has formed groups and collects the material.
- Economics of wild collection revealed that during peak seasons the collectors could get a net income of Rs.125/day.
- Local traders, wholesale traders and processors are the major source for selling the produce by the wild collectors
- Restrictions for collection and varying levies of entry fee by forest officials, lack of adequate transportation facilities and non-availability of price information were the major problems expressed by the collectors.

Suggestions

- The wild collection cannot be stopped all of a sudden but it can be regulated particularly for those species whose harvests inevitably involve destructive collection. Local communities can develop strategies in sustainable harvesting of medicinal plants from the forest and villages.
- Formations of more SHG groups by NGOs and training them for sustainable harvesting of the produce and tie-up with traders.
- Dissemination of price information on medicinal plants to the collectors by the NGOs
- Efforts are to be made to levy uniform entry fee for the collectors.

** The writers are —[1] Professor, Directorate of Research, TNAU, Coimbatore-3*
[2] Professor, Directorate of CARDS, TNAU, Coimbatore-3
[3] Professor & Head, Dept. of Spices & Plantation Crops, TNAU, Coimbatore-3
[4] Assistant Professor, Dept. of Agrl. & Rural Management, TNAU, Coimbatore-3
[5] Senior Research Fellow, TNAU, Coimbatore-3
Field view of the experiment.

AGRI NEWS

Organically Grown Cotton better than Bt Cotton: Report

A report "Picking Cotton - The choice between organic and genetically-engineered cotton for farmers in South India" made a comparative analysis of the two methods of agriculture among cotton farmers in Andhra Pradesh. The genetically engineered (GE) variety makes farmers more vulnerable to financial collapse due to high debts and increased costs of cultivation, it said. "In the year 2009-10, farmers cultivating cotton through organic practices earned 200 percent more net income than farmers who grew genetically engineered cotton (Bt cotton)," the report said.

"Our study illustrates how farmers growing GE cotton face high debts and high costs of cultivation, becoming more vulnerable to financial collapses," Greenpeace International scientist and study author Reyes Tirado said.

Bt cotton farmers not only use 26 different pesticides, including pesticides targeting pests that the GE cotton is supposed to control, but also lose financially due to their higher input costs, the report said. In Andhra Pradesh, the cost of cultivation is much higher for Bt cotton farmers.

"The Bt cotton farmers incurred 65 percent higher debt - accumulated during 2008-09 and 2009-10 - than the non-Bt organic cotton farmers," the report said.

The controversies around Bt cotton have finally forced the Genetic Engineering Approval Committee, the agency responsible for the commercial release of GE crops in the country, to review its performance since 2002, the year it was released.

Spanish Company looks at Olive Plantations in India

Spanish food major Borges has said it is aiming to set up olive plantations in India, following the setting up of its 100 percent subsidiary here and the launch of its range of healthy oils and even microwave popcorn.

"We have been talking to the governments of Rajasthan, Himachal Pradesh and Punjab for plantations. The feedback has been positive," said Rajneesh Bhasin, Managing Director, Borges India.

"Plantation of olives in India will reduce the comparative cost price. It will result in a huge employment opportunity. It will contribute to the society and help us to partner with various people in the value chain," Bhasin said.

According to Borges, the size of the market for Olive oil in India is pegged at Rs.400 crore over the next three years, with some 70 brands that are mainly imported. But the company, with a 100-percent arm in India, hopes an 18-percent market share soon.

Speaking about existing products, Bhasin said their extra light olive oil was conceived primarily for the Indian consumer, since it will not interfere with the flavours and the aroma of the domestic cuisine and yet remain a healthy cooking medium.

The group was founded in 1896 and has plantations in Spain and California, besides sourcing from other countries.

AGRI NEWS

Haryana to give 8-hour supply to agricultural tubewells

In view of start of paddy sowing, the Haryana Power Utilities have decided to supply electricity for 8 hours daily from June with immediate effect to agricultural tubewells in the state which would continue till the requirement of farmers.

A spokesman for the Haryana Power Utilities said here today that the state had made banking arrangement of short term power supply under which 300 MW from Tamil Nadu Electricity Board, 60 MW from Himachal Pradesh State Electricity Board, 40 MW from NVVN, Assam, 100 MW from NVVN, Orissa and 100 MW through Power Trading Corporation (PTC), Orissa would be available. The State had also arranged 116.4 MW power from Himachal Pradesh through PTC for the month of June.

The power availability and supply position would be monitored on day to day basis and the state would also procure electricity on daily basis, if required. He said the arrangement of power supply had been made keeping in view annual load growth and an expected 10 percent less rainfall in monsoon this year.

HAU develops technique to identify sex of date-palm plants

In a landmark achievement, CCS Haryana agricultural University, Hissar has developed a technique to identify sex of date-palm plants at the nursery stage. Vice-Chancellor K S Khokhar pointed out that in date-palm there were separate male and female plants. Since fruit was borne by female plants only which could not be identified upto 4-5 years till the trees bloom for the first time. But with this technique, the sex of date-palm plants was possible to identify at the seedling stage, he said.

Dr Khokhar said that this diagnostic technique had been developed by Ms Charu Mishra, a Ph D scholar of the Department of Biotechnology and Molecular Biology (BMB) of the university under a project sponsored by Department of Science and technology.

He said a polymerase chain reaction based SCAR marker developed by her could identify sex of date-palm even when the plants were in nursery stage. Dr Pushpa Kharab, a senior scientist of BMB Department and guide of Ms Charu, said the ratio of male and female plants of date-palm which emerged after seedling was almost equal. She said that identification of sex at seedling stage would help date-palm growers to remove unwanted male plants as one male plant was sufficient to pollinate 50-60 female plants in the orchard.

B.F.Tech Course in Tamil Nadu Agricultural University

Tamil Nadu Agricultural University (TNAU) has introduced degree programme for farming community Bachelor of Farm Technology (B.F.Tech)—under open and distance learning programme to impart technical knowledge and skills regarding farming and allied activities from the current academic year 2010-2011, announced Vice Chancellor P Murugesa Boopathy.

Dr Boopathy said the course duration would be of three years with six semesters and the medium of instruction would be Tamil. The eligibility criteria would expect the applicant to have passed tenth standard and should have attained the age of 30 years.

The course would help the farmers realize their dream of becoming a graduate, he said.

He said the TNAU will also offer 21 certificate courses from the current academic year. The eligibility criteria would be the same. He said the varsity was planning to offer new courses like M.SC (Food Science and Technology) and Post Graduate Diploma in Plant Quarantine besides a variety of certificate programmes in the future.

A mushroom production course is being discussed which will be useful for the women self-help groups and the district administration will consider providing grant for the course, depending upon the response.

The Editor
Financing Agriculture
Agricultural Finance Corporation Ltd.
Dhanraj Mahal, 1st floor
Chhattrapati Shivaji Maharaj Marg
Mumbai 400 001

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