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**K. K. RAVINDRAN**  
Managing Editor

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## **EDITORIAL**

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Section 80(P) of Income Tax Act 1961 gives income tax exemption to cooperatives. In 2008 Government amended this section by adding subsection 4 to it. The new subsection states that provisions in section 80(P) shall not apply to a 'cooperative bank' within its meaning as given in the BR Act 1949 except in the case of a Primary Agricultural Credit Society and a Primary Cooperative Agriculture & Rural Development Bank with jurisdiction not more than one taluk. Obvious purpose of subsection 4 is to exclude cooperative banks from the benefit of tax exemption as provided under section 80(P). However, when this subsection states that cooperative banks except a Primary ARDB with jurisdiction not more than one taluk, it implies that a Primary ARDB is also a cooperative bank coming under BR Act which is not correct. It appears that those who drafted this provision committed the mistake of presuming that ARDB is also a bank like a State Cooperative Bank, District Cooperative Bank or an Urban Cooperative Bank and therefore made an exception in the case of Primary ARDB only. It is an error of giving exception from a sector to an entity which does not belong to that sector. In other words, when subsection 4 deals with cooperative banks, an exception to this provision can be given only to an entity which is part of cooperative banks. BR Act defines a cooperative bank either as a State Cooperative Bank, District Central Cooperative Bank or a Primary Cooperative Bank (Urban Cooperative Banks). Moreover, BR Act itself makes a distinction between a Cooperative Bank and a Land Mortgage Bank (by which name ARDBs were known at the time of enacting BR Act). Section 56(c) of BR Act says that cooperative credit societies also include land mortgage banks. This implies that every Land Mortgage Bank irrespective of primary or apex is a cooperative credit society as defined

in section 5 (cci) of BR Act. Though the Federation had pointed out the drafting error in subsection 4 giving exception to Primary ARDB from cooperative banks as defined in BR Act to which a Primary ARDB does not belong, soon after the Budget, no action was taken by the Government to rectify the error. This has led to a large number of disputes between Income Tax Department and ARDBs across the nation. Income Tax Department started sending assessment notice to SCARDBs taking a view that all types of ARDBs except Primary ARDBs with jurisdiction not more than one taluk belong to the category of cooperative banks as per subsection 4 and therefore are excluded from tax exemption under section 80(P). SCARDBs in most of the States could convince income tax department of their status as cooperative credit society as per the definition of the cooperative credit society given in BR Act. However, in Kerala the matter could not be settled at the level of Department or Tribunal and went to the High Court which equated Kerala SCARDB with State Cooperative Bank for the purpose of applicability of subsection 4 in its final judgement. It is seen that the decision of High Court equating Kerala SCARDB with a State Cooperative Bank as defined in BR Act was the result of inept handling of the case by Bank's counsels right from the appellate level of income tax department. On Bank's appeal against the order of High Court, the Supreme Court of India has now given an interim order restraining income tax department from any action to recover tax from the bank till final decision on the appeal petition.

**K. K. Ravindran**  
**Managing Editor**

# **Innovative banking model of Primary Agricultural Credit Society (PACS) in Malappuram District, Kerala.**

Dr P Selvaraj\*

## **Introduction**

Banks play a crucial role in the socio economic development of any country. Though the Koudilya Arthasastra speaks about existence of banking practises in India, the first bank, namely Bank of Bengal was established in 1706. The sector has become more dynamic in recent years. "India's banking sector is set to transformative changes in the coming future accompanied by a pulsating derivatives market and IT-induced banking" says RBI Governor Dr. Raghuram Rajan. We are seeing emergence of new institutions like payments banks, small finance banks etc., making the environment. Now, every branch of the banks has to prove their worth through fast and quality services to retain the customers and have an eye on their profitability also for survival. Technological innovations has made life of customers easier and hence faster and comfortable services become order of the day. Customers especially young customers, today will walk into a bank only if there is ATM Card, Internet Banking, mobile banking, Credit Card, Plastic money, e-money etc. These are comparatively easy for the newly started banks and even resource rich commercial banks and Regional

Rural Banks (RRBs) but is a herculean challenge for Cooperative Banks.

## **2. Grass root level Cooperative Institutions**

A co-operative institution which is an autonomous democratic association, is based on the self-help responsibility, equity and solidarity and believes in the ethical values, social commitment of caring for others. They are more than 100 years old in our country. As can be seen from Annexure-1 the co-operative Credit structure comprises of urban co-operative banks and rural co-operative Banks. Urban co-operative banks consist of a single tier, namely Urban Co-operative Banks (UCBs). The rural co-operative credit structure has traditionally been bifurcated in to 2 parallel wings, ie., short-term and long-term structures. Short-term co-operative credit institutions have a federal 3-tier structure consisting of a large number of Primary Agricultural Credit Societies (PACS) at the grass-root level, District Central Co-operative Banks (DCCBs) at the district level and State Co-operative Banks (StCBs) at the state/apex level. The long-term rural co-operative structure has 2 tiers,

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namely State Co-operative Agriculture and Rural Development Banks (SCARDBs) at the state level and Primary Co-operative Agriculture and Rural Development Banks (PCARDBs) at the taluka/tehsil level.

### **3. PACSs in Kerala**

In Kerala, where the cooperatives are very strong and vibrant, the PACS are also called as Banks. During the year 2002 as many as .....banks (PACSs) were started in the name of Service Cooperative banks / Cooperative Rural Banks as per registered rules 15(11(A) 3(a), by the Kerala State government. One such bank is Thenhipalam Cooperative Rural Bank called TCR Bank located at Kohinoor village, Thenhipalam panchayat of Malappuram district of Kerala. The bank was with 100 members and a share capital of ₹75,000. Parallely there were other age old PACSs functioning in the State.

TCR bank was continuously incurring loss till 2009, due to various problems like low customer base, continuous loss in business, poor confidence by the public, inadequate staff and severe financial crunches. The bank conducted panchayat survey covering 220 samples and found that 89% of the respondents were unaware about all banking activities of a Cooperative Bank; 93% were depending on Commercial banks especially New generation banks for their personal

Loans; 96% preferring NBFCs for Gold Loans; 97% had seriously concern about safety and security in a Cooperative Bank and 95% had reservations on technology banking by Cooperative Bank. But today, due to the innovative business approach adopted, by designing products based on customer demand, the face of the bank has changed to as a profit-making, popular and technology bank in the State. This PACS has become a successful replicable model for similar institutions in the country, proving the fact that new business approach and changed mindset is the need of the hour for all banks and more particularly for cooperative banks.

### **4. NABARD's Farmers Club**

Farmers club, a concept introduced by NABARD on 5<sup>th</sup> November 1982, is a grass root level informal forum, with principles of "development through Credit, technology transfer, awareness and capacity building". Every village can promote such club through Banks/ NGOs, with non default customers. They have to be registered with NABARD and can conduct farm and non-farm promotional programme which are beneficial to bank and the entire village community. Farmers Club is a non for profit, social organisation and they can receive donations, financial assistance from anybody for their activities. For initial period of three years NABARD extends support and financial assistance and later clubs should

sustain themselves. TCR Bank promoted Green Earth farmers Club in Feb 2011 (Regn No. UID:0983131/MLP.134) with 15 members. During this period, RBI, as a financial Inclusion imitative, permitted banks to use the services of NGOs/ NBFCs as Business Correspondents / Business Facilitators (vide circular DBOD. No. BLBC.58/22.01.001/ 2005-06 dated 25 Jan 2006) and NABARD was also suggesting PACSs to function as BCs to DCCBs, diversifying their activities so as to become Multi Service credit Societies.

TCR bank conceived the novel idea of utilising the services of Green Earth farmers Club, as Business Correspondent, since the club had the recognition by NABARD, popularity among the press, and local public at large. Leveraging the brand image of farmers club, the bank planned to expand the customer base. This was the turning point for the bank. Necessity is a mother of invention. Business Correspondent is an intermediary non profitable organization (Farmers Club) between Bank and beneficiaries, which provides financial services to the end customers (members) on behalf of the Bank.

### **5. 1. Green Earth farmers Club as Business Correspondent**

Green Earth Farmers Club started functioning as Business Correspondent (BC) to TCR Bank from August 2011. The following are

the major milestones achieved so far.

- ▶ The BC addressed the major problems of the bank i.e., poor customer base, lesser staff and lesser volume of business, effectively.
- ▶ BC appointed agents, who reported to them and the wages were fixed by BC. The banks had no role in these affairs.
- ▶ Housewives, anganwadi teachers, health workers, Panchayat workers and educated unemployed girls joined as agents. Agents are mostly girls from the same panchayat and have advantages of “known person” tag and with age group of 18 to 40 years. Today there are 96 agents and 12 full time employees with BC.
- ▶ The incentive system conceived by the bank, motivated the BC for their full involvement for promoting the image of the bank and market their products. BC/ FC acted as ambassadors of TCR Bank.
- ▶ The commission was mutually fixed for all types of transactions. The bank gives a commission of 2.5 to 4.0% of the amount collected under various schemes like savings A/c, pigmy deposit, Micro savings scheme, loan repayment etc., and ₹2 per transaction of credit & deposit in micro ATM. Bank gives commission to BC and BC pays the incentive to their agents.
- ▶ The whole responsibility of



collection by agents and remittance thereafter was with the BC. Further, BC was responsible for defaults if any.

- ▶ The Bank had entered an agreement with BC with suitable terms & conditions.
- ▶ All the transactions of the BC were transparent through the electronic systems, such as ICT, Smart Card, ATM, SMS Alert, E pass book etc.
- ▶ The bank had invested about ₹30 lakh for IT infrastructure and charged ₹2500 per month as user charges from the BC.
- ▶ The ICT helped the bank for the proper and timely monitoring of the activities of BC, ensuring no mis-utilisation, till date.
- ▶ On an average the BC collected about ₹1.00 lakh per day during first week and ₹3.00 lakh per day, during third week of every month. The monthly collection was about ₹50 to 60 lakh. Bank pays about ₹2.50 lakh per month as commission to the BC. TDS is effected for this payment.
- ▶ All the staff of BC wear the similar uniform like that of Bank staff. This helps them to have the feeling of oneness and sense of belonging to the bank.

## 5.2 Customer Service points

Keeping the convenience of customers and the agents the farmers Club established three Business centres called “Customer Service Points” at Komarappadi,

Chenakkalangi and Parambilpeedika villages. Both walk in customers and agents visit these centre for daily transactions. Two agents (one lady and one man) are working in these Centres from 0930 hrs to 1700 Hrs daily. Daily about 25 to 30 customers visit and enjoy the benefits.

Collection of new SB account opening forms, KYC, loan applications, documentation and disbursements are dealt with in these centres. PC, Scanner, Printer, micro ATM, CC TV, Safety locker, Wi-Fi facility etc have been provided in these centres, giving a corporate ambiance. Solar panel helps during power cut. In addition to banking, these centre also book train ticket, arrange PAN card, receive electricity and phone bills, recharge mobiles and make payments through Western Union. All these utility services are also linked to the respective bank accounts.

The agents working with the BC are attached to these centres based on their location. Maintenance of these points is with the BC. Bank does not interfere with these. About ₹50,000 cash is given by the bank to each of these centres every morning and the cash & details of transactions are collected back by the bank staff in the evening. Bank provides additional cash also as and when required. The functioning of the BC does not impose any financial liability on the bank and this is an added advantage for the bank. The BC has an account in the bank.

During a credit transaction, when the customer is paying the cash to the agent,

- ▶ CBS debit the same amount from the BC's account and give credit to the customer.
- ▶ BC software will mark the credit against agent/CSP.
- ▶ Thus the real time transaction is happening and the customer gets the message alert from the bank.
- ▶ By the end of the day, BC will collect the money from agent and credit to BC's account.

The reverse is the case with debit transaction. The customer will get the amount from BC and the same will be credited to the BC's account and give debit to the customer by CBS

### **5.3 Technology banking by PACS**

In order to attract more customers and compete with other banks, TCR Bank invested in software and hardware infrastructure. The TCR Bank has installed software's like Core banking software, BC software, ATM switch and Micro ATM switch and hardware like ATM Machine. Server machine, Micro ATMs, UPS (for server & ATM), Firewall & IT rack and 2 PCs (for ATM switch and Backup). All transactions are done online only. They collect user charges from BC.

There are 2 softwares i.e., Core banking Solution for the bank (Becon-pro) and BC software ((Becon-orbit). Both are with interface, in message format ISO 8583. Every account is mapped with

one agent working under BC. Mapping and remapping are done at BC level. Mapping is mainly for fixing responsibility. All customers are provided with ATM cards. The round the clock service through micro ATM is an added attraction for new customers. Micro ATM is the minute form of ATM. This constitutes of a tablet, Bluetooth printer and card swiping slot. Transactions are fully electronic. Cash dispensing is completely done manually. Portable micro ATM can work at homes of the customers as well, i.e., door step banking.

The transactions of the customers with the micro ATM are recorded in the CBS of the bank through BC software by online. Maximum limit through micro ATM is ₹30,000 per day. The customer gets the confirmation through the SMS in his/her mobile. The Bank has implemented a "clear debit and credit transaction system".

### **5.4 Green Earth Self Employment Training Institute (GSETI)**

With grant assistance of ₹8.00 lakh from NABARD, Green Earth Farmers Club established GSETI in 2011. In the same centre Financial Literacy Credit Counselling Centre (FLC) and Village Knowledge Centre are functioning. The centre has full-fledged class room and a conference hall, beside an office. GSETI has conducted entrepreneurship development training programmes on coconut climbing, Saree designing, Garment Making, Flower

Bouquet making and Metal Embossing. The trainees have been financed by the TCR bank. Monthly review meetings and motivational training programmes for staff & agents are also conducted in this centre.

### 5.5 Other activities of the farmers Club

During 2011-14 Green Earth Farmers club has conducted various programmes like exposure visit to JLGs to Allepy district, Bramagiri project of Wayanad district and agriculture projects in Anakayam and Trichur. They have participated with 2 stalls in Agro food festival conducted by Calicut University during Feb 2013 and sold products made by JLGs for ₹57,000. Seminars on entrepreneurship, mushroom cultivation, organ donation, plastic waste disposal etc., have also been organised. The club availed maintenance grant assistance from NABARD for only initial 2 years. The Farmers club got best farmers Club award from NABARD for the years 2012-13 and 2013-14.

### 5.6 Future Strategies

Green Earth farmers Club propose to expand in the following areas:-

- ▶ consultancy services to the interested banks on the replication of BC model, for a fee.
- ▶ work with Calicut University for a mega forest based tourism Project.
- ▶ arrange Inputs supply as well as promote organic farming.

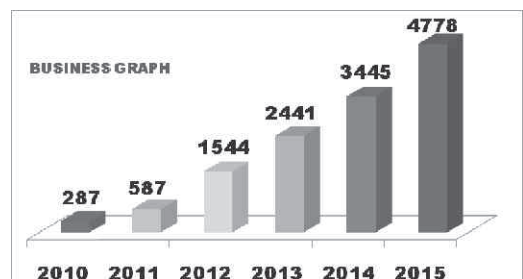
- ▶ promote and market by products of jack fruits
- ▶ arrange marketing for eggs of “Mattupavil Muttakrishi” scheme.

### 6.1. Achievements by TCR Bank

This model of farmers club as BC has done wonders for the turnaround exercise of the bank. The bank started earning profit from 2010 onwards. The operational area for the bank was three Panchayats namely Thenhipalam, Peruvallur and A R Nagar. The bank got ISO 9001:2008 certification in 2011. The total business of the bank was enhanced from ₹2.86 cr to ₹47.63 cr in just 5 years. The customer base also increased from 2514 (2010) to 27,931 (2015). The overdue loan balance was reduced from 88% to 1.5% through the dedicated work of the BC.

The following graph explains the road of success over the past 5 years.

**Progress of Business Turnover in ₹ lakhs over years**



The bank has only 6 staff i.e., Secretary, Asst. Secretary, Accountant, Clerk, Attendant and Peon. President is honorary position. They do cash management, processing of applications, Business

rules, Admin controls, data storage/uploading to central location, Remuneration management and Performance tracking while the field works are outsourced to BC. It is highly economical. The promotional works done by the staff are also suitably rewarded.

The working hours of the bank is from 8 am to 8 pm, with two shifts. The first shift is from 0800 to 1500 Hrs and the second shift is from 1300 to 2000 Hrs. The second shift officers come for the first shift of next day, so that there is continuity in cash handling. The bank extend maximum of ₹25 lakh per customer. The bank has started financing JLGs in 2012 and till date it has financed 36 JLGs formed by Farmers Clubs, with grant assistance from NABARD.

The other business parameters over years are shown in the following Table-1.

## 6.2 New Initiatives by the Bank

► Due to the penetration of post office, RD account of the bank not popular. The bank designed a new product called “Micro

savings scheme (MSS)” through which a customer can save varying amount of money in a month in his SB, with a standard instruction for debiting for RD account. This becomes very popular. As on 31 March 2015 the bank has 6856 accounts with ₹6.75 crores.

- The small traders, petty shop owners, Tea masters, street vendors and even Doctors felt difficult to visit the bank for depositing their daily savings. The bank started a new product called “Pigmy deposit” in which 5 male agents visit these people on daily basis, at a regular time of the day, collect their savings and give them printed receipts from hand machine. The entire savings could be withdrawn at the end of 6 months. The “purpose oriented saving” became a very popular product.
- Bank encouraged group deposit scheme locally called Chit fund. All the members operate the chit through the bank account.

**Table-1**

(₹ in Lakh.. as on 31 March)

Parameters	2010	2011	2012	2013	2014	2015
Share capital	1.45	2.47	6.11	9.95	20.22	38.50
Deposits	168.65	317.58	906.38	1433.82	2068.00	2665.92
Loans	118.11	269.40	637.38	1007.33	1377.00	1897.14
Profit	NA	(-) 8.69	(-) 2.73	1.43	4.04	Yet to be audited
Turnover(₹ crore)	2.86	5.86	15.43	24.41	34.46	47.63
Increase with respect to year 2011 (in %)	-	-	26.30	416	587	811.45
No of accounts	2,514	7,581	14,930	20,364	23,948	27,931
No of Staff	03	03	03	04	06	06

- ▶ An innovative scheme called Rural Mahila Credit Card (RMCC) was introduced to cover women folk. Under this scheme any lady member could avail of over draft facility of ₹5000 without security, withdrawable through agents/ micro ATMs. Many women got the benefits, when there was delay in getting money from the husband working abroad as well as for emergencies. Otherwise they had to wait at the doorstep of money lenders.
- ▶ Two Milk producers Cooperative Societies in the operational area of the bank, have been revived by the dairy farmers financed by TCR Bank. Now they are running successfully with profit. TCR bank is planning to make them as BCs for expanding business.
- ▶ Efforts are being made to link interested customers SB accounts with the SB accounts of Service providers like milk vendors, news paper agents, cable operators, Mobile company electricity board etc, so that the monthly payment to these service providers could be done through the bank. The bank will transfer the amount after getting a simple SMS from the Customer and send SMS confirmation to both the parties. This would be a great relief both customers and service providers and the customer base and transaction will improve the business for the bank.
- ▶ Shortly a new scheme is being introduced for terrace cultivation of poultry layers namely “Mattupavil Muttakrishi”. The loan amount of ₹5000 would be given in kind component i.e., a cage and 10 numbers of 50 days old layer birds of Gramashree or Gramalakshmi breeds. The supply will be through Green earth farmers club. About 1000 units would be sanctioned by the year end.
- ▶ BC maintain agent wise customer wise case history i.e., “Customer Register” indicating the past history of repayment by the customer. If there is delay/default, the cells in Excel sheet are coloured red. The President of the bank while sanctioning loans, pursue case to get registered, along with application form, appraisal report, recommendatory notes by agent, bank and the Secretary of Bank. The loans are sanctioned based on social structure/customer appraisal than the value of assets owned by customer.

### **6.3 Instrumental for Policy changes**

As this “farmers Club as BC” business model has yielded success and more suitable for replication, the Registrar of Cooperative Societies has issued a circular to all PACSs/ Rural Banks to adopt this innovative model for increasing their business



volume and quality of services in Kerala. Similarly after seeing the successful implementation of Rural Mahila Credit Card scheme, State Govt replicated the scheme to all banks under their “Operation Kubera” scheme which is also called “Rin mukthi yojana”. In Kerala, the rate of interest changed by cooperative banks are regulated by “Central Bank Conference” conducted annually. TCR bank made a presentation on their success story in the conference conducted on 12 Sept. 2014.

The bank received best performance award from NABARD for the years 2012-13 and 2013-14. They also got bank frontier award 2015. Many banks including RRBs, Commercial banks, PACSs and other Service Cooperative Banks are visiting TCR Bank for the guidance.

#### **6.4 The benefits of BC model can be explained as given below**

To Government	To Bank	To BC	To Customers
<ul style="list-style-type: none"> <li>Reaching out to unbanked population.</li> <li>Inculcating saving/banking habits.</li> <li>Reducing migration to urban centres.</li> <li>Speeding up economic development.</li> </ul>	<ul style="list-style-type: none"> <li>Increase outreach.</li> <li>Increase customers base.</li> <li>Improving market share.</li> <li>Potential business.</li> <li>Low investment outlets/ low transaction cost.</li> <li>Social responsibility.</li> <li>No need for more staff and branch network.</li> </ul>	<ul style="list-style-type: none"> <li>Income to Agents / volunteers.</li> <li>Opportunity to expand existing business.</li> <li>Ride on the brand name of the bank.</li> <li>Respectable image in society.</li> <li>Customer base for its own activities other than banking activities.</li> <li>Empowerment of women.</li> </ul>	<ul style="list-style-type: none"> <li>Affordable access to banking services practically at the doorstep.</li> <li>Loans and remittance facility.</li> <li>Surplus income saving / safety.</li> <li>Release from the clutches of local money lenders.</li> <li>Improvement in economic status.</li> <li>Availability of govt. benefits.</li> <li>Improved financial literacy.</li> </ul>

## **7. Conclusion**

Banks have reservation on the BC model, due to the fear of private people invading into the business of the bank. When the farmers club promoted by the bank did the job with fully committed heart, it has become a grand success. If banking is add on activity then the success is a casualty. In the present case, the farmers club played role of ambassador of the bank and the fruits of cooperation could be enjoyed by bank, farmers club, local people, customers, government and everyone, proving the cooperative principle of “each for all and all for each”.

Among all, cooperative banks are the banks that are close to public. But during recent years the public are attracted towards modern technology linked banking products offered by other banks. Cooperative banks may loose the opportunity if



they are immune to changes. The success stories of their counterparts should motivate them for adopting the changes for better survival, as everyone understands the survival of

the fittest. With changed mindset, cooperative banks can make the rural prosperity a reality as they also belong to the rural areas.

### **Annexure-1 VOICE OF PEOPLE ....**

“We all are leading a decent life, earning our livelihood only because of the assistance given by Thenhippalam Cooperative Rural Bank” says Smt. Jalajaa member of Soorya JLG in Devathiyal village. This 5 member JLG is a part of Kairali SHG and is engaged in stitching of readymade garments, procuring cloth from Erode Tamil Nadu. They got a loan of ₹1.00 lakh without security and promptly repaying the loan. “Our husbands also got employment in marketing as well as cutting & designing in our tailoring units only because of JLG” says Smt. Sumitha another member from the same JLG.

“I was working part time in Sales Tax department getting a meagre salary and joined as collection agent in TCRB in 2007 for a salary of ₹3000 per month. There were only 3 employees and no computers. My husband who was a porter and had health issues saw my development in getting more income through salary and commission over years, got motivated and joined as Agent in the Bank in 2013. Today we are happy with two storied house, two wheeler and three children going to good schools” says Smt. Anitha and her

Husband Shri Subramanian. She is the team leader now earning ₹15,000 per month and her husband ₹25,000.

Shri Haridasan is the best performing agent, earning ₹50,000 per month. He says, “though I worked for 18 hours a day in a Super Market, in Saudi for 13 years, I could not save more money and after returning back to the country, I was earning my livelihood by selling news papers and pappads. I love to work with people in field and hence, I joined the bank as agent in July 2011. Today I own a good house and a car. I am taking care of my family including my aged mother very well”. His wife Smt. Sheeba who was helping him, has also become an agent earning ₹9,000 per month.

“Our bank not only takes care of the customers but also make employees and agents working with BC happy and prosperous. The fruits of cooperation should be shared by all and we takes care of local population as well. Every bank in our country should be updated with technology to retain good customers and serve them with quick and quality services” says Shri P K Pradeep Menon, President of TCRB,

representing the voice of many. The President of Kadukattupara Milk cooperative Society Shri. Imbich iKoya says “our society was loss making and almost closed. It was revived in 2014 with the involvement of TCR bank, which deputed Smt. Vinitha who is the Secretary now.. We are collecting about 300 litres of milk per day and people stand in queue to purchase our fresh milk from our outlets. We pay more to milk producers than any other society and that too only to their bank account. The society is running profitably today and now planning to expand for milk processing and bye products. After seeing the progress, the local Panchayat is now extending grant assistance @ ₹3 per litre produced, through this Society.

Smt. V. Anua beneficiary of RMCC says with gratitude “Whenever there was delay in getting money from my husband from abroad, I used to avail loan from money lenders, who

charges exorbitant interest and sometime I had to undergo humiliation also. Today with dignity I swipe the card for getting assistance through Rural Mahila Credit card. We are grateful to the bank and Green Earth club” Smt. Girija, a tailor, when met in Komarappadi Customer Service point said “I feel at home here, for meeting all my credit needs and I have just got a loan of ₹25000 for repairing my house. As my shop is close by I will make timely repayment and I do have other accounts like Pigmy deposit, SB account etc.” Shri. Abdulvahab, a painter, when met in Chenakkalangadi Customer Service point said “I came here as the services are very fast, technology based, no need for waiting in queue and above all I know all of them personally and it gives me confidence in financial dealings” highlighting the feel good character of the cooperatives.

### Abbreviations

BC	Business Correspondent
BF	Business facilitator
GEFC	Green Earth Farmers Club
GSETI	Green Earth Self Employment Training Institute
JLG	Joint Liability Group
MSS	Micro Savings Scheme
NBFC	Non-Banking Financial Company
RRB	Regional Rural Bank
TCRB	Thenhipalam Cooperative Rural Bank Ltd



**THE HARYANA STATE COOPERATIVE AGRICULTURE  
AND RURAL DEVELOPMENT BANK LTD.**  
Sahakarita Bhawan, Bay No. 31-34, Sector - 2, Panchkula

The Haryana State Cooperative Agriculture and Rural Development Bank Ltd., is the specialised institution in the State, which caters to the Long Term credit needs of the farmers for the upliftment of the economic position of the agriculturists and allied fields.

The bank advances Long Term loans to the farmers for the following purposes :-

**Scale of finance and periodicity of Major Sectors**

**Farm Sector**

Sr.No.	Name of the Scheme & Purpose	Period	Scale of finance
1.	Minor Irrigation	9 Years	₹75,000 to ₹4,00,000
2.	Land Development	-do-	90% of the project cost
3.	Farm Mechanisation	5-9 Years	85% of the cost of Machinery
4.	Purchase of Agriculture Land	10 Years	Upto ₹12.00 Lacs
5.	Horticulture/Plantation	5-10 Years	₹25,000 to ₹3,55,000 per Hectare
	Medicinal & Aromatic Plants	-do-	90% of the project cost
6.	Animal Husbandary	5-7 Years	90% of the project cost
7.	Construction of Rural Godowns	Upto 9 Years	90% of the project cost

**Non Farm Sector**

Sr.No.	Name of the Scheme/Purpose	Period	Scale of finance
1.	Rural Housing	Upto 10 years	Upto ₹6.00 lacs
2.	Marriage Palaces	Upto 10 years	90% of the project Cost
3.	Community Halls	Upto 10 years	90% of the project Cost
4.	Village Cottage Industry	Upto 10 years	90% of the project Cost
5.	Public Transport Vehicles	Upto 5 years	85% of the project Cost
6.	Rural Educational Infrastructure	Upto 10 years	90% of the project Cost
7.	Other SSI units	Upto 10 years	90% of the project Cost

**Rate of Interest**

The rate of interest to be charged from the ultimate borrowers has been reduced to 13.25% P.A. w.e.f. 01.04.2015 for all type of loans advanced by the DPCARDBs in the state of Haryana.

**Note:-**

For further details, kindly contact The Haryana State Coop. Agri. & Rural Dev. Bank Ltd., Panchkula or the District Coop. Agri and Rural Dev. Banks at District level and its branches at Tehsil & Sub-Tehsil level in the State.

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## Feasibility analysis of areca nut + pepper mixed cropping system in Karnataka

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### ABSTRACT

*The per hectare total initial cost incurred by organic orchard growers was 6,42,676.48 of which investment cost constituted 21.46% and maintenance constituted 78.54%. Similarly, the per hectare total establishment cost incurred by inorganic orchard growers was 7,02,508.36 of which investment cost constituted 20.84% and maintenance constituted 79.16%. The average per ha maintenance cost incurred by respondents in arecanut + pepper mixed cropping orchards under organic methods was 1, 27,135.05 during the bearing period. The labour, material and fixed costs accounted for 26.58, 32.83, and 36.75 %, respectively. While the cost was 1,45,031.52 under inorganic methods where labour, material and fixed cost accounted for about 29.77,34.90 and 35.33 %, respectively. The average per ha yield of arecanut and pepper from arecanut + pepper mixed cropping orchards under organic methods was 19.94 and 2.08 quintals, respectively and the net returns obtained were ₹4,93,460.71. Similarly the average yield arecanut and pepper from arecanut + pepper mixed cropping orchards under inorganic methods was 21.96 quintals per ha and 2.31 quintals per ha, and the net returns were ₹4,86,943.93. The investment appraisal analysis revealed that the payback period was found to be 7.80 years in organic orchards and 8.02 years in inorganic orchards. The net present value of investment for the orchards under organic and inorganic methods were ₹6,67,552.02 per ha and ₹5,59,219.08 per hectare respectively at 12.00% discount rate for arecanut + pepper mixed cropping orchards. The discounted benefit cost ratio were 1.74 in organic orchards and 1.56 in inorganic orchards and the internal rate of return was found to be 23% and 21% respectively.*

*Key words: cropping system, organic agriculture, productivity, payback period, internal rate of return.*

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## **INTRODUCTION**

Pepper (*Piper nigrum* L.) is one of the most important and earliest known spices in the world. It plays a significant role in Indian economy. Based on international trade, it is called “King of Spices” and “Black Gold”. The whole dried fruit of the plant is black pepper while white pepper is the dried seed after removing the fruit wall. About 90% of the produce is traded in the form of black pepper and the rest is used as a white pepper (Tamil Selvan, 2009). Pepper is a native of Western Ghats of India and is an important crop commercially grown in India. It is mainly cultivated in India, Indonesia, Vietnam, Malaysia, Brazil, Thailand, Srilanka and in some other tropical countries. Pepper is cultivated over an area of 2, 46,000 ha in India with a production of 69,000 tonnes.

Areca nut or Betelnut or Supari is one of the important commercial crops of India. Though the production of areca nut is locations specific, its consumption is widespread among all sections of the population, cutting across caste, religion, age and gender in India. Areca nut is chewed in various forms by both the poor and the rich alike. It forms the main ingredient of thambula (pan) whose use in India dates back to pre-vedic times.

Today organic mixed cropping research with a farmer’s perspective occupies a pride of place in India’s agricultural research agenda. Organic mixed cropping systems

concept as a system referring to crop combination. Organic agriculture aims at reducing the cost of production and helps the farmers to get reasonable returns (Suresh, 2001). Organic agriculture is today's answer not only to sustained productivity, but also to safe and nutritious food, which is increasingly demanded by conscious consumers within and outside India. Organic products also promise better prospects for Market and Trade (Inder Pal Singh 2011). There is an ever growing export market for organic products and also the domestic market in India is emerging. Products that are certified and sold as ‘organic’ can fetch a premium price compared with conventional products if there is proper marketing facility. Keeping all these aspects in view, the present study has been undertaken to analyse the financial feasibility of investment in areca nut + pepper mixed cropping orchards under organic and inorganic methods.

## **METHODOLOGY**

Organic farming is an emerging trend and practiced throughout the Uttara Kannada district of Karnataka state. In cultivation areca nut and pepper are used as mixed crops. Three predominantly areca nut and pepper growing taluks in the district were selected. Sirsi, Yellapur and Siddapur were having highest area under areca nut and pepper. Totally 12 villages at the rate of four from each selected taluks having maximum areca nut + pepper

**Table 1: Investment pattern in Arecanut + Pepper mixed cropping orchards under organic and inorganic methods**

(₹/ha)

Sl. No.	Particulars	Organic			Inorganic		
		Qty	Value	%	Qty	Value	%
<b>A</b>	<b>Initial investment</b>						
<b>I</b>	<b>Material Cost</b>						
1	FYM (tonnes)	12.25	21,745.36	3.38	10.56	18,754.87	2.67
2	Red earth (tonne)	21.00	11,243.73	1.75	22.30	12,657.31	1.80
3	Planting materials	2010	16,087.12	2.50	2100	18,475.95	2.63
4	Sprayer	1.25	9,754.36	1.52	1.38	10,742.79	1.53
5	Others	-	4,055.74	0.63	-	6,452.14	0.92
	Total Material cost	-	62,886.31	9.79	-	67,083.06	9.55
<b>II</b>	<b>Labour Cost</b>						
1	Cleaning	206.25	41,250.00	6.42	211.73	42,345.00	6.03
2	Nursery, pitting	108.78	21,755.00	3.39	112.26	22,451.36	3.20
3	FYM and red earth application	10.77	2,154.00	0.34	19.75	3,950.00	0.56
4	Planting	49.25	9,850.00	1.53	52.70	10,540.00	1.50
	Total labour cost	375.05	75,009.00	11.67	396.43	79,286.36	11.29
	Total Cost (I+II)		137,895.31	21.46		146,369.42	20.84
<b>B</b>	<b>Maintenance cost up to bearing period</b>						
	1st year		105,301.46	16.38		112,785.43	16.05
	2nd year		70,095.08	10.91		81,012.64	11.53
	3rd year		103,350.44	16.08		106,879.72	15.21
	4th year		72,003.83	11.20		80,928.00	11.52
	5th year		72,808.04	11.33		82,231.56	11.71
	6th year		81,222.32	12.64		92,301.59	13.14
	<b>Sub total (I+II+III+IV+V+VI)</b>		<b>504,781.17</b>	<b>78.54</b>		<b>556,138.94</b>	<b>79.16</b>
	<b>Total Establishment Cost (A+B)</b>		<b>642,676.48</b>	<b>100.00</b>		<b>702,508.36</b>	<b>100.00</b>



mixed farming area under organic and inorganic cultivation were selected. From each selected village five farmers growing arecanut + pepper mixed farming under organic method and another five farmers growing arecanut + pepper mixed farming under inorganic method were selected. Thus, the total sample size was 120.

**Financial analysis**

The techniques used for the financial analysis were: Pay Back Period (PBP), Net Present Value / worth (NPV or NPW), Benefit-Cost Ratio (B: C Ratio) and Internal Rate of Return (IRR).

**Pay Back Period**

Payback period represents the length of time required for the stream of cash proceeds produced by the investment to be equal to the original cash outlay i.e. the time required for the project to pay for itself. In the present study, payback period was calculated by following formula.

$$PBP = \frac{\text{Initial investment}}{\text{Net returns (average)}}$$

**Net Present Value**

The present value represents the discounted value of the net cash inflows to the project. In the present study, a discount factor of 12% was used to discount the net cash inflows representing the opportunity cost of capital. It can be represented by

$$NPV = \sum_{i=1}^n \frac{Y_i}{(1+r)^i} - I$$

Y<sub>i</sub> = the net cash inflows in the year 'i'

r = the rate of discount

i = Year of life period (1, 2, 3, n)

I = Initial investment

**Benefit-Cost Ratio**

The benefit cost ratio (BCR) was worked out by using following formula.

$$B:C \text{ ratio} = \frac{\text{Discounted net cash flows}}{\text{Initial investment}}$$

$$= \frac{\sum_{i=1}^n \frac{Y_i}{(1+r)^i}}{I}$$

**Internal rate of return**

The rate at which the net present value of project is equal to zero is internal rate of return (IRR) to the project. The net cash inflows were discounted to determine the present worth by the following interpolation technique.

$$IRR = \text{Lower Discount rate} + \frac{\text{Difference between the rate}}{\text{Two discount rates}}$$

Present worth of cash flows at lower discount rate  
 .....  
 Absolute difference between present worth of cash flows stream at the two discount rates

**RESULTS AND DISCUSSION**

**Establishment cost of arecanut + pepper mixed cropping orchard**

It is revealed from the Table 1 that the initial investment was higher in case of inorganic orchards (702,509.36 per hectare) than the organic orchards (642,676.48). The higher initial investment in case of inorganic orchards was due to higher plant population, high valued

**Table 2: Maintenance cost of Arecanut + Pepper mixed cropping orchards during gestation period under organic method**

(₹/ha)

Sl. No.	Particulars	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	6 <sup>th</sup> year	Total cost	%
<b>I</b>	<b>Variable cost</b>								
<b>A</b>	<b>Material Cost</b>								
1	Seedling for gap filling	-	450.00	8,500.00	565.00	450.00	450.00	10,415.00	2.06
2	FYM	-	9,250.00	18,250.00	9,250.00	9,250.00	12,500.00	58,500.00	11.59
3	Green manure & vermicompost	4,500.00	3,250.00	6,500.00	3,250.00	3,250.00	3,250.00	24,000.00	4.75
4	Bio-fertilizers	650.00	675.00	1,250.00	650.00	650.00	650.00	4,525.00	0.90
5	Bio-pesticides	-	250.00	525.00	450.00	450.00	650.00	2,325.00	0.46
6	Fencing materials	28,423.00	-	-	-	-	-	28,423.00	5.63
7	Others	4,562.00	3,256.00	3,125.00	3,125.00	3,125.00	3,125.00	20,318.00	4.03
	<b>Total Material cost (A)</b>	<b>38,135.00</b>	<b>17,131.00</b>	<b>38,150.00</b>	<b>17,290.00</b>	<b>17,175.00</b>	<b>20,625.00</b>	<b>148,506.00</b>	<b>29.42</b>
<b>B</b>	<b>Labour cost</b>								
1	Gap filling	-	1,250.00	6,750.00	1,350.00	1,350.00	1,350.00	12,050.00	2.39
2	Training	-	-	875.00	1,500.36	2,542.00	2,654.00	7,571.36	1.50
3	FYM, green manure & vermicompost application	-	5,650.00	7,800.00	5,650.00	5,650.00	5,650.00	30,400.00	6.02
4	Weeding and mulching	6,501.00	8,452.00	8,500.00	8,500.00	8,542.00	12,502.00	52,997.00	10.50
5	Bio-pesticide application	0.00	650.00	1,450.00	750.00	750.00	750.00	4,350.00	0.86
6	Fencing	21,236.00	325.00	950.00	452.00	450.00	450.00	23,863.00	4.73
7	Watch and ward	3,376.50	2,925.00	3,750.00	2,925.00	2,703.00	2,703.00	18,382.50	3.64
8	Miscellaneous	6,235.00	6,502.00	5,452.00	6,235.00	6,235.00	6,504.00	37,163.00	7.36
	<b>Total labour cost (B)</b>	<b>37,348.50</b>	<b>25,754.00</b>	<b>35,527.00</b>	<b>27,362.36</b>	<b>28,222.00</b>	<b>32,563.00</b>	<b>186,776.86</b>	<b>37.00</b>
<b>C</b>	<b>Interest on working capital @8%</b>	<b>6,038.68</b>	<b>3,430.80</b>	<b>5,894.16</b>	<b>3,572.19</b>	<b>3,631.76</b>	<b>4,255.04</b>	<b>26,822.63</b>	<b>5.31</b>
	<b>Total variable cost (A+B+C)</b>	<b>81,522.18</b>	<b>46,315.80</b>	<b>79,571.16</b>	<b>48,224.55</b>	<b>49,028.76</b>	<b>57,443.04</b>	<b>362,105.49</b>	<b>71.74</b>
<b>II</b>	<b>Fixed cost</b>								
1	Rental value of land	10,600.00	10,600.00	10,600.00	10,600.00	10,600.00	10,600.00	63,600.00	12.60
2	Land revenue	134.00	134.00	134.00	134.00	134.00	134.00	804.00	0.16
3	Depreciation	10,497.50	10,497.50	10,497.50	10,497.50	10,497.50	10,497.50	62,985.00	12.48
4	Interest on fixed capital @12%	2,547.78	2,547.78	2,547.78	2,547.78	2,547.78	2,547.78	15,286.68	3.03
	<b>Total fixed cost (II)</b>	<b>23,779.28</b>	<b>23,779.28</b>	<b>23,779.28</b>	<b>23,779.28</b>	<b>23,779.28</b>	<b>23,779.28</b>	<b>142,675.68</b>	<b>28.26</b>
	<b>Total cost (I+II)</b>	<b>105,301.46</b>	<b>70,095.08</b>	<b>103,350.44</b>	<b>72,003.83</b>	<b>72,808.04</b>	<b>81,222.32</b>	<b>504,781.17</b>	<b>100.00</b>

**Table 3: Maintenance cost of Arcanaut + Pepper mixed cropping orchards during gestation period under inorganic method**

(₹/ha)

Sl. No.	Particulars	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year	5 <sup>th</sup> year	6 <sup>th</sup> year	Total cost	%
<b>I</b>	<b>Variable cost</b>								
<b>A</b>	<b>Material Cost</b>								
1	Seedling for gap filling	-	575.00	9,250.00	750.00	750.00	750.00	12,075.00	2.17
2	FYM	-	10,250.00	12,550.00	10,250.00	10,250.00	10,250.00	53,550.00	9.63
3	Fertilizers	5,250.00	6,500.00	7,500.00	3,150.00	2,845.63	5,200.00	30,445.63	5.47
4	PPC	1,800.00	1,225.00	2,252.00	1,225.00	1,225.00	1,850.00	9,577.00	1.72
5	Fencing materials	28,654.00	869.00	1,252.00	869.00	869.00	869.00	33,382.00	6.00
6	Others	5,360.00	5,250.00	5,250.00	5,250.00	5,250.00	5,250.00	31,610.00	5.68
	<b>Total Material cost (A)</b>	<b>41,064.00</b>	<b>24,669.00</b>	<b>38,054.00</b>	<b>21,494.00</b>	<b>21,189.63</b>	<b>24,169.00</b>	<b>170,639.63</b>	<b>30.68</b>
<b>B</b>	<b>Labour cost</b>								
1	Gap filling	-	1,755.00	8,250.00	1,250.00	1,250.00	2,450.00	14,955.00	2.69
2	Training	-	-	925.00	2,513.63	3,125.00	3,125.00	9,688.63	1.74
3	FYMs and Fertilizers application	-	4,256.00	5,123.00	4,502.00	4,502.00	4,502.00	22,885.00	4.11
4	Weeding and mulching	7,500.00	9,504.00	9,564.00	9,252.00	9,252.00	13,496.73	58,568.73	10.53
5	PPC spraying	0.00	706.00	1,250.00	1,850.00	2,750.00	3,650.00	10,206.00	1.84
6	Fencing	22,345.25	1,725.00	1,725.00	1,725.00	1,725.00	1,725.00	30,970.25	5.57
7	Watch and ward	3,750.00	2,575.00	4,250.00	2,525.00	2,525.00	2,525.00	18,150.00	3.26
8	Miscellaneous	7,800.00	7,850.00	7,850.00	7,850.00	7,850.00	7,850.00	47,060.00	8.46
	<b>Total labour cost (B)</b>	<b>41,395.25</b>	<b>28,371.00</b>	<b>38,937.00</b>	<b>31,467.63</b>	<b>32,979.00</b>	<b>39,323.73</b>	<b>212,473.61</b>	<b>38.21</b>
<b>C</b>	<b>Interest on working capital @ 8%</b>	<b>6,596.74</b>	<b>4,243.20</b>	<b>6,159.28</b>	<b>4,236.93</b>	<b>4,333.49</b>	<b>5,079.42</b>	<b>30,649.06</b>	<b>5.51</b>
	Total variable cost (A+B+C)	89,055.99	57,283.20	83,150.28	57,198.56	58,502.12	68,572.15	413,762.30	74.40
<b>II</b>	<b>Fixed cost</b>								
1	Rental value of land	10,600.00	10,600.00	10,600.00	10,600.00	10,600.00	10,600.00	63,600.00	11.44
2	Land revenue	134.00	134.00	134.00	134.00	134.00	134.00	804.00	0.14
3	Depreciation	10,453.00	10,453.00	10,453.00	10,453.00	10,453.00	10,453.00	62,718.00	11.28
4	Interest on fixed capital @ 12%	2,542.44	2,542.44	2,542.44	2,542.44	2,542.44	2,542.44	15,254.64	2.74
	<b>Total fixed cost (II)</b>	<b>23,729.44</b>	<b>23,729.44</b>	<b>23,729.44</b>	<b>23,729.44</b>	<b>23,729.44</b>	<b>23,729.44</b>	<b>142,376.64</b>	<b>25.60</b>
	<b>Total cost (I+II)</b>	<b>112,785.43</b>	<b>81,012.64</b>	<b>106,879.72</b>	<b>80,928.00</b>	<b>82,231.56</b>	<b>92,301.59</b>	<b>556,138.94</b>	<b>100.00</b>

**Table 4: Maintenance cost of Arecanut + Pepper mixed cropping orchards during bearing period under organic and inorganic methods**

(₹/ha)

Sl. No.	Particulars	Organic		Inorganic	
		Value	%	Value	%
<b>I</b>	<b>Variable Cost</b>				
<b>A</b>	<b>Material Cost</b>				
1	Seedling for gap filling	835.42	0.66	1,725.95	1.19
2	FYM	21,452.00	16.87	8,452.65	5.83
3	Red earth	9,521.00	7.49	12,531.00	8.64
4	Fertilizers	-	-	12,837.64	8.85
5	Bio-fertilizers & jeevamrut	2,350.00	1.85	-	-
6	Green manure & vermi compost	1,750.00	1.38	-	-
7	PPC / bio-pesticide	1,577.91	1.24	7,542.00	5.20
8	Miscellaneous	4,250.00	3.34	7,525.00	5.19
	<b>Total Material cost (A)</b>	<b>41,736.33</b>	<b>32.83</b>	<b>50,614.24</b>	<b>34.90</b>
<b>B</b>	<b>Labour cost</b>				
1	Gap filling	1,425.00	1.12	1,768.27	1.22
2	Training	3,265.00	2.57	3,754.97	2.59
3	FYM and Fertilizers application	2,561.36	2.01	3,765.00	2.60
4	Weeding and mulching	10,365.00	8.15	13,752.00	9.48
5	PPC / bio-pesticide application	1,750.27	1.38	3,625.79	2.50
6	Watch and ward	3,150.00	2.48	3,250.00	2.24
7	Harvesting	6,375.15	5.01	7,564.25	5.22
8	Miscellaneous	4,521.30	3.56	5,697.00	3.93
	<b>Total Labour cost (B)</b>	<b>33,413.08</b>	<b>26.28</b>	<b>43,177.28</b>	<b>29.77</b>
	<b>Interest on working capital @ 8%</b>	<b>5,260.46</b>	<b>4.14</b>	<b>6,565.41</b>	<b>4.53</b>
	<b>Total Variable Cost (A+B)</b>	<b>80,409.87</b>	<b>63.25</b>	<b>93,791.52</b>	<b>64.67</b>
<b>II</b>	<b>Fixed cost</b>				
1	Amortized establishment cost	32,133.82	25.28	35,125.42	24.22
2	Rental value of land	10,600.00	8.34	10,600.00	7.31
3	Land revenue	134.00	0.11	134.00	0.09
4	Depreciation	2,294.00	1.80	3,654.02	2.52
5	Interest on fixed capital	1,563.36	1.23	1,726.56	1.19
	<b>Total fixed cost (II)</b>	<b>46,725.18</b>	<b>36.75</b>	<b>51,240.00</b>	<b>35.33</b>
	<b>Grand Total</b>	<b>127,135.05</b>	<b>100.00</b>	<b>145,031.52</b>	<b>100.00</b>

fertilizer, PPC application, as in case of organic orchards no fertilizers, PPC were applied instead of which the organic inputs (like FYM, green manures, vermi compost, bio-fertilizers, bio-pesticides) were used (Thankamani, 2010). The higher initial investment on cleaning, pitting was due to presence of dense forest and slope of land. It was also observed from Table 2 and 3 that the maintenance cost during gestation period both for organic and inorganic orchards was decreased from 1<sup>st</sup> year to 2<sup>nd</sup> year. This was due to more care taken to establishment orchards during the initial investment period of establishment of arecanut + pepper mixed cropping orchards i.e., gap filling, weeding and mulching, fencing, application of PPC, watch and ward etc. such operations were carried out during initial period and which gradually decreased in next years. The maintenance cost was high in 3<sup>rd</sup> year, because pepper planting will be taken up in this period as mixed crop in arecanut orchard. Pepper needs standard for its growth and development. Here, arecanut is used as live standard for the growth of pepper (Balachandra K. Naik, 1987).

#### **Maintenance cost of arecanut + pepper mixed cropping orchards under organic and inorganic methods during bearing period**

The maintenance cost of arecanut + pepper mixed cropping orchards under organic and inorganic methods during bearing period i.e.,

from seventh year onwards assumed to be same in each year as mentioned in Table 4. In organic orchards, the total annual maintenance cost of arecanut + pepper mixed cropping orchards under organic and inorganic methods was ₹127,135.05 and ₹145,031.52, respectively of which labour component constituted 26.28 and 29.77% respectively in that order. Of the total labour cost incurred per hectare, weeding and mulching and harvesting accounted around 50% in case of both the methods of organic and inorganic. This clearly shows that arecanut + pepper mixed cropping orchards under organic and inorganic methods is a labour intensive operation.

It was found that the inorganic farmers employed marginally more labours for harvesting and weeding and mulching. It was also observed that the organic farmers applied more FYM, bio-fertilizers, jeevamruta, green manure and vermi compost than that of inorganic farmers. Moreover, the employment of family labour was more in case of organic than inorganic. It was observed that a mortized establishment cost was more in case of inorganic than organic due to higher establishment cost. The result of the present study corroborates with the findings of Gangadhar (2012) who has reported that the per hectare maintenance cost was higher on inorganic banana cultivation (₹56,300) than inorganic banana cultivation (₹39,750).

### **Yield and return structure of arecanut and pepper under organic and inorganic methods**

It was observed from the Table 5 that in the study area the average yield of arecanut and pepper from arecanut + pepper mixed cropping orchards obtained per hectare was more in case of inorganic orchards (arecanut – 21.96 qtls/ha, pepper – 2.31qtls/ha) than organic orchards (arecanut – 19.94 qtls/ha, pepper – 2.08 qtls/ha). It might be due to higher fertilizer and PPC application by inorganic orchard farmers. The gross returns realized per hectare in case of organic orchard was found to be higher than inorganic orchards. This marginal difference in returns could be accounted to the higher price obtained for organic pepper by selling to the organic agencies. It was also found that the average annual maintenance cost per hectare incurred by organic farmers was lower. The lower cost coupled with higher returns realized by the organic farmers resulted higher net returns for organic orchards than inorganic. The study by Ganesh (2010) in arecanut cultivation in North Karnataka also revealed that the per hectare net returns obtained by organic farm was corporately more than that of inorganic farms.

### **Financial feasibility of investments in arecanut + pepper mixed cropping orchards under organic and inorganic methods**

The analysis of financial feasibility

of long-term investments in arecanut + pepper mixed cropping orchards is essential to evaluate whether the heavy investments made in the initial period of the project would yield sufficient returns to cover the cost and recover the investment in a reasonable time period. In this regard, the use of discounted cash flow techniques was found to be more appropriate (Malave, 2012). Financial feasibility of investment in arecanut + pepper mixed cropping orchards in the study area was analysed using the project evaluation technique such as Net Present Value (NPV), Benefit-Cost Ratio (B:C ratio), Pay Back Period and Internal Rate of Return and results are presented in Table 6.

### **Net Present Value (NPV)**

The formal selection criterion of NPV is to accept all the projects with positive values. In the study area, the NPV was found to be positive and higher in organic orchards (₹667,552.02) than inorganic orchards (₹559,219.08) counterparts. It could be concluded that investment in arecanut + pepper mixed cropping orchards is financially feasible and financially sound. The higher magnitude of net present value may be attributed realization of continuous high returns during the economic life of both organic and inorganic orchards. Investment in organic orchards was found to be more feasible financially as compared to inorganic orchards.



Table 5: Yield and returns structure of arecanut and pepper

Sl. No.	Particulars	Organic						Inorganic					
		Yield			Total Value			Yield			Total Value (₹)		
		Arecanut (Qt/ha)	Pepper (Qt/ha)	Grand Total	Arecanut (₹)	Pepper (₹)	Arecanut + Pepper (₹)	Arecanut (Qt/ha)	Pepper (Qt/ha)	Grand Total	Arecanut (₹)	Pepper (₹)	Arecanut + Pepper (₹)
1	7	16.50	0.77	351,150.00	45,900.00	351,150.00	18.36	0.85	339,660.00	29,750.00	369,410.00		
2	8	16.85	0.95	368,425.00	56,700.00	368,425.00	18.95	1.05	350,575.00	36,750.00	387,325.00		
3	9	18.92	1.23	423,820.00	73,800.00	423,820.00	20.75	1.25	383,875.00	43,750.00	427,625.00		
4	10	19.36	1.49	447,260.00	89,100.00	447,260.00	21.93	1.65	405,705.00	57,750.00	463,455.00		
5	11	21.45	1.58	491,325.00	94,500.00	491,325.00	22.45	1.75	415,325.00	61,250.00	476,575.00		
6	12	21.05	1.62	486,625.00	97,200.00	486,625.00	22.36	2.20	413,660.00	77,000.00	490,660.00		
7	13	21.54	2.25	533,490.00	135,000.00	533,490.00	22.75	2.50	420,875.00	87,500.00	508,375.00		
8	14	20.14	2.85	543,590.00	171,000.00	543,590.00	23.45	2.75	433,825.00	96,250.00	530,075.00		
9	15	21.65	2.95	577,645.00	177,120.00	577,645.00	24.15	3.28	446,775.00	114,800.00	561,575.00		
10	16	22.75	3.11	607,175.00	186,300.00	607,175.00	23.29	3.45	430,865.00	120,750.00	551,615.00		
11	17	21.25	3.17	583,205.00	190,080.00	583,205.00	23.00	3.52	425,500.00	123,200.00	548,700.00		
12	18	20.78	2.79	551,830.00	167,400.00	551,830.00	22.45	3.10	415,325.00	108,500.00	523,825.00		
13	19	19.35	2.25	492,975.00	135,000.00	492,975.00	22.50	2.50	416,250.00	87,500.00	503,750.00		
14	20	17.51	2.10	449,935.00	126,000.00	449,935.00	21.00	2.45	388,500.00	85,750.00	474,250.00		
	Total	279.10	29.09	6,908,450.00	1,745,100.00	6,908,450.00	307.39	32.30	5,686,715.00	1,130,500.00	6,817,215.00		
	Average	19.94	2.08	368,810.71	124,650.00	493,460.71	21.96	2.31	406,193.93	80,750.00	486,943.93		

**Table 6: Financial feasibility of investment in arecanut + pepper mixed cropping orchards under organic and inorganic methods**

Sl. No.	Particulars	Units	Organic	Inorganic
1	Net Present Value	₹/ha	667,552.02	559,219.08
2	Internal Rate of Return	Percent	23	21
3	B:C Ratio		1.74	1.56
4	Pay Back Period	Years	7.80	8.02

Note: Discount rate @ 12 %

### **Internal Rate of Return (IRR)**

The formal criterion of IRR is to accept the projects with IRR value more than the opportunity cost of capital. The IRR worked out for organic orchards was higher (23%) as compared to inorganic orchards (21%) in the study area. Both the IRR values were found to be higher than the opportunity cost of capital i.e., the lending rate (12% at present rate of interest) of commercial banks for long term loans, indicating a higher average earning power of money invested in arecanut + pepper mixed orchards. Hence, investment in organic orchards is more feasible and sound as compared to inorganic orchards (Rajesh Chauhan, 2005).

### **Benefit Cost Ratio (BCR)**

The decision in B: C ratio frame work is to select the projects where the ratio is more than unity. The BCR at 12% discount rate was found to be 1.74 and 1.56 for organic and inorganic orchards, respectively in the study area. Both these values were above unity and the investment in both organic and inorganic orchards in the study area

considered to be a profitable venture. Thus, it could be concluded that investment in arecanut + pepper mixed cropping orchard was found to be financially feasible and economically viable. Moreover, the BCR of organic orchards was relatively more attracting than the inorganic orchards counterparts. The study conducted by Ganesh (2010) was in conformity with the result of the present study.

### **Pay Back Period (PBP)**

The PBP is the length of time taken to recover the investment made in the project. The PBP in establishing arecanut + pepper mixed cropping orchards was found to be less in organic orchards (7.80 years) as compared to inorganic orchards (8.02 years). Thus, the period of recovery of investment would be within 8 years in consideration of long economic period of 25 years during which the farmer would earn sufficient income from the arecanut + pepper mixed cropping orchards. The payback period of organic orchards was found to be more attractive as compared to

the inorganic orchards.

## CONCLUSION

The per hectare total initial cost incurred by organic orchard growers was ₹6,42,676.48 of which investment cost constituted 21.46% and maintenance constituted 78.54%. Similarly, the per hectare total establishment cost incurred by inorganic orchard growers was ₹7,02,508.36 of which investment cost constituted 20.84% and maintenance constituted 79.16%. The average per ha maintenance cost incurred by respondents in arecanut + pepper mixed cropping orchards under organic methods was ₹1,27,135.05 during the bearing period. The labour, material and fixed costs accounted for 26.58, 32.83, and 36.75%, respectively. While the cost was ₹1,45,031.52 under inorganic methods where labour, material and fixed cost accounted for about 29.77, 34.90 and 35.33%, respectively. The average per ha yield of arecanut and pepper from arecanut + pepper

mixed cropping orchards under organic methods was 19.94 and 2.08 quintals, respectively and the net returns obtained were ₹4,93,460.71. Similarly the average yield arecanut and pepper from arecanut + pepper mixed cropping orchards under inorganic methods was 21.96 quintals per ha and 2.31 quintals per ha, and the net returns were ₹4,86,943.93.

The investment appraisal analysis revealed that the payback period was found to be 7.80 years in organic orchards and 8.02 years in inorganic orchards. The net present value of investment for the orchards under organic and inorganic methods were ₹6,67,552.02 per ha and ₹5,59,219.08 per hectare respectively at 12.00 % discount rate for arecanut + pepper mixed cropping orchards. The discounted benefit cost ratio were 1.74 in organic orchards and 1.56 in inorganic orchards and the internal rate of return was found to be 23% and 21% respectively.

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## **Influence of phosphorus and mycorrhizae on root colonization And spore count at different stages of sugarcane crop**

T. Usha Rani\*  
D. Balaguravaiah\*  
M. Bharata Laxmi\*

### **ABSTRACT**

*The field experiment was conducted at RARS, Anakapalle on the effect of different levels of phosphorus on yield and quality of sugarcane (two plant crops and one ratoon crop) in presence and absence of cane trash and mycorrhizae. The experiment was laid out in split plot design with four main levels and four sub levels. The main levels consists of control (M1), mycorrhizae alone (M2), cane trash and mycorrhizae (M3) and cane trash alone (M4). The four sub levels consists of 0, 50, 100 and 150 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>. The fertilizers for the plant crop were 112 kg N, 75 kg P<sub>2</sub>O<sub>5</sub> and 100 kg K<sub>2</sub>O ha<sup>-1</sup> for plant crop and 224 kg N, 75 kg P<sub>2</sub>O<sub>5</sub> and 100 kg K<sub>2</sub>O ha<sup>-1</sup> for ratoon crop. Significantly higher colonization was made possible by inorganic P application at 50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, which later showed a decrease with increase in inorganic P levels. With advancement in age, the root colonization increased upto grand growth stage. During all the years of study, significantly higher root colonization was observed with the application of cane trash and mycorrhizae (M3) in plant and in ratoon crop. The highest mycorrhizal spore count was observed with the application of 50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>. Further increase in phosphorus levels depressed the spore count of mycorrhizae. Significantly lowest mycorrhizal spore count was recorded with the control (M1). Significantly more spore count noticed in plant and ratoon crop at formative, grand growth and at maturity stages respectively with application of 50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> along with cane trash plus mycorrhizae.*

*Key words : Mycorrhizae, cane trash, plant and ratoon crop, root colonization, spore count.*

### **INTRODUCTION**

Sugarcane is one of the important cash crops in India and plays pivotal role in both agricultural and industrial economy of the country. India the largest producer of sugar cultivating sugarcane in an area of 5.04

million hectares with a production of 338.168 million tonnes and productivity of 70 tonnes per hectare (2010-2011). Sugarcane is an exhaustive crop and depletes soil nutrients heavily. India ranks second in the world contributing to 22 % of world's

\*Regional Agricultural Research Station, Anakappali.



production. Andhra Pradesh ranks fifth in sugarcane crop area of the country with a share of 4.83% (0.22 M.ha) with an average production of 20.30 Mt contributing to 5.83% of the total production of the country. Phosphorous is one of the essential elements required in optimum amounts for the growth and development of the plants. About 98% soils have inadequate supply of available phosphorous and likely to induce deficiency of this mineral. Application of 100 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> through SSP or DAP along with 112 kg nitrogen ha<sup>-1</sup> was found optimum for sugarcane in sandy loam soils (Devi et al., 2005).

The plants which are deficient in P, show retarded growth and cause dark green colouration due to enhancement of anthocyanin formation (Khan et al., 2009). Phosphorous is the important nutrient for plant growth and root development in crops. Application of phosphorus increases the dry matter yield, internodal length and quality parameters in sugarcane (Tilib et al., 2004). Earlier, sugarcane crop was not responding to P application in A.P. With the advent of physiologically active improved sugarcane variety, P nutrition to sugarcane crop played a vital role in yield and quality improvement.

Application of phosphate fertilizer increased the average shoot dry weight. The highest SDW was with 40 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>. However response of sugarcane to P application is varying, probably due to variation in

the fraction of P contributing towards P uptake. It has been observed that the colonization of plant roots with VAM improves the activity of enzyme phosphatase (Dodd, 1987). Since the world resources of P are limited and they can be depleted in a few decades, the contribution of VAM to P fertilizer management is of increasing interest.

Vesicular arbuscular mycorrhizae (VAM) fungi commonly infect plant roots, including those of sugarcane, forming beneficial symbiotic relationships (Kelly et al., 1997). The primary benefit to the plant of this symbiosis is enhanced acquisition of water, phosphorous and other minerals. VAM fungal hyphae provide a greater effective absorptive root surface able to explore larger volumes of soil, thus overcoming nutrient and water depletion zones (Clark and Zeto, 1996; Hetrick et al., 1988).

In low input agricultural systems, cultural practices such as organic amendments are known to enhance Arbuscular mycorrhizae formulation and fungal propagules (Darzi et al., 2007). These changes in crop growth and yield produced by various organic amendments are ascribed to changes in the physical, chemical and biological properties of the soils. The response of crop growth and yield to different organic amendments may be related to changes in population of VAM fungi, as in conventional high input farming systems.

It is well established that (i) improvements in plant growth are attributed to an enhanced access of mycorrhizal root to soil P located beyond the rhizosphere (Sanders and Tinker, 1973) and (ii) infection by mycorrhizal fungi is significantly reduced at high soil phosphorus levels (Amijee et al., 1989; Koide and Li, 1990). Although information on the acquisition of minerals by plants is available, information on the P is limited. Phosphorus is generally available in small quantities in soil solution because most of inorganic phosphate ions are bound to soil colloids or fixed as iron aluminium PO<sub>4</sub> (Larsen et al., 2007).

Moreover, less than 15-25% of P from PO<sub>4</sub> fertilizer applied to soil is normally available to plants and a large quantity of P remains unavailable due to its fixation (Singh and Singh, 2007). Under such circumstances VAM fungi can be effectively utilized to enhance the P mobilization. Sugarcane production requires high water availability at various growth stages. Since ground water table is getting reduced, new technique should be incorporated to sustain sugarcane productivity and it includes use of VAM fungi as bioinoculant to tolerate drought stress, use of genetically modified sugarcane variety which requires less water for growth etc.

## **MATERIALS AND METHODS**

The experiment was laid out in split plot design with four main treatments and four sub levels with a

early maturing variety 93 A 145. The sets were selected from the short crop. The seed rate per hectare was 16,000 ha<sup>-1</sup>.

The main treatments consists of control (M1), mycorrhizae alone (M2), cane trash and mycorrhizae (M3) and cane trash alone (M4). The sub levels consists of 4 levels of phosphorus i.e., 0,50,100 and 150 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>. The fertilizers for the plant crop are 112 kg N, 75 kg P<sub>2</sub>O<sub>5</sub> and 100 kg K<sub>2</sub>O ha<sup>-1</sup> and 224 kg N, 75 kg P<sub>2</sub>O<sub>5</sub> and 100 kg K<sub>2</sub>O ha<sup>-1</sup> for ratoon crop. The phosphorus in the form of single super phosphate and potassium fertilisers in the form of muriate of potash were applied as per the treatments. The nitrogen was applied at 45 and 90 days after planting for plant crop and at stubble shaving and 45 days after planting for ratoon crop. The cane trash (pre decomposed) was applied @ 3t ha<sup>-1</sup> three days after planting. The mycorrhizae was applied @12.5 kg ha<sup>-1</sup> 24 hours after application of chemical fertilizers. The EM1 culture was applied on the trash @ 1kg ton<sup>-1</sup> after application of chemical fertilizers. Weeding and irrigation was done as and when required. Harvesting was done when the cane attains maturity. The C/N ratio was estimated at 15 days interval by comparing the conventional method and decomposition by EM1 culture.

## **RESULTS AND DISCUSSIONS**

Mycorrhizal root colonization (% infection) and spore count 50 g soil<sup>-1</sup>

Root colonization in percent root

infection was significantly influenced by inorganic P application at all the stages in all the three crops. Significantly higher colonization was made possible by inorganic P application at 50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, which later showed a decrease with increase in inorganic P levels, the mean root colonization being 35.0, 38.8 and 33.4 % in plant crop, while it was 31.2, 39.4 and 33.7% in ratoon crop. It was observed that with advancement in age, the root colonization increased upto grand growth stage due to higher root activity to supply carbonaceous substances to the growing VAM fungi. When the crop reached maturity stage again the root activity slowed down and hence colonization decreased. At higher levels of P the mycorrhizal colonization reduced due to reduced root membrane permeability resulting in decreased loss of metabolites and plant rich in P are poor in carbohydrate content which reduces AMF colonization (Mohan and Ponnusamy.,2011).

Application of 50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> helped the crop to put forth extensive root system thus increasing the secretion that favour mycorrhizal colonization. However, at higher levels of inorganic P antagonistic effect will be exerted for the growth of mycorrhizae.

During all the years of study, significantly higher root colonization was observed with the application of cane trash and mycorrhizae (M3) in plant crop (31.2, 37.1 and 28.1%) and in ratoon crop (29.9, 38.2 and

31.6%) at formative, grand growth and maturity stages respectively as against 16.0, 18.8 and 16.6 in plant and 13.2, 16.9 and 14.6 per cent in ratoon crop in the absence of both cane trash and mycorrhizae.

Cane trash and mycorrhizae with the inorganic P at 50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> found to increase the root colonization significantly at all stages of growth in all the three crops.

Significantly higher root colonization of 41.4, 49.6 and 41.3% in plant crop at formative, grand growth and maturity stages and 40.6 & 54.4% in ratoon crop at formative and grand growth stage were observed. However, at maturity stage ratoon crop, significantly higher root colonization was facilitated by the application of inorganic P at 50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> in presence of mycorrhizae alone. These results are in conformity with the findings of Aparna and Bhagyaraj., (2007) who stated that application of phosphorus @ 40 and 60kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> along with mycorrhizae in medium P soils not only recorded high spore count and root colonization of mycorrhizae but also increased growth and yield of the crop in addition to saving in 25% of phosphorus fertilizer application.

**Mycorrhizal spore count 50 g soil-1 :** The spore count in plant and ratoon crops was influenced by the application of phosphorus levels. The highest mycorrhizal spore count was observed with the application of 50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> showing 51.5, 113.4 and 90.9 per 50 g soil at formative, grand growth and maturity stages of

and 45.6, 106.3 and 81.1 per 50 g soil in ratoon crop at the respective stages. Further increase in phosphorus levels depressed the spore count of mycorrhizae. The significantly lower spore count was observed with the application of 150 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> in all the crops at all the stages, the respective values at formative, grand growth and maturity stage being 31.9, 80.9 and 63.1 per 50 g soil in plant crop and and 26.5, 76.8, 54.1 per 50 g-1 soil in ratoon crop respectively.

During both the years of study and all at the three stages under study, more spore count was recorded in plant crop i.e., 50.8, 117.4 and 100.2 per 50 g soil and 43.2, 114.5 and 86.8 per 50 g soil in ratoon crop with cane trash plus mycorrhizae (M3) at formative, grand growth and at maturity stages when compared to mycorrhizae alone (M2), cane trash alone (M4). Significantly lowest

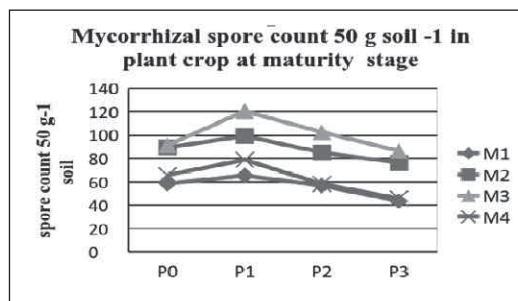
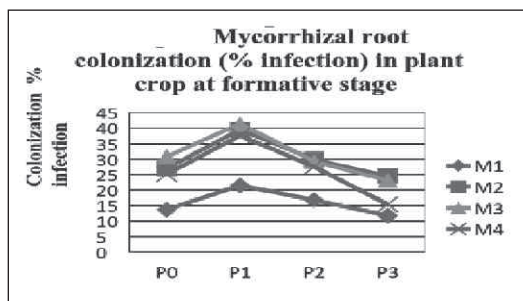
mycorrhizal spore count was recorded with the control (M1), in plant crop (29.6, 67.1 and 43.5 number 50 g-1 soil) and in ratoon crop (27.3, 66.4 and 49.1 no.50 g-1 soil) at formative, grand growth and maturity stages respectively.

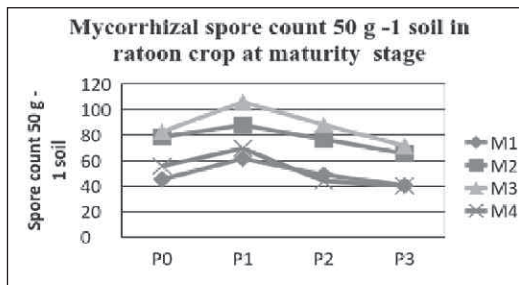
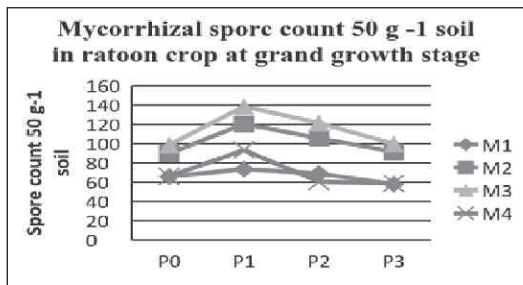
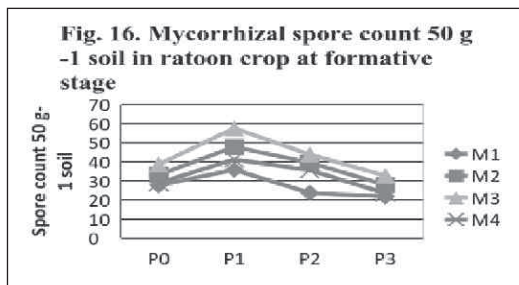
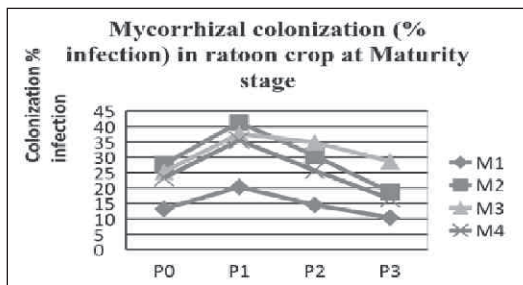
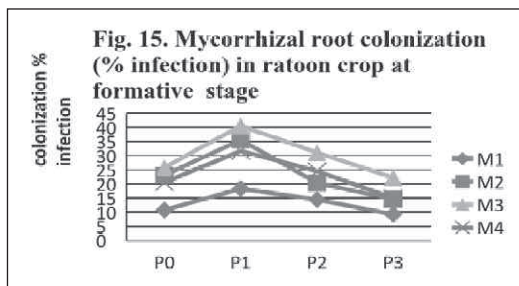
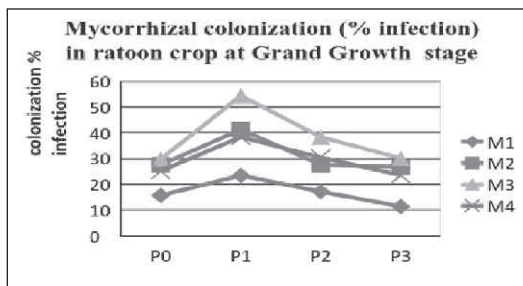
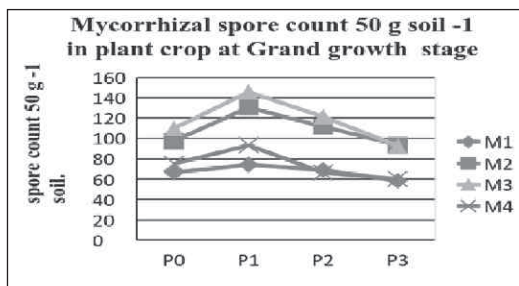
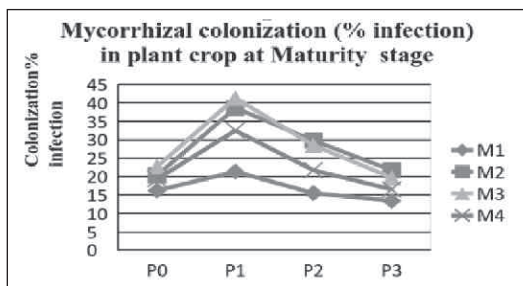
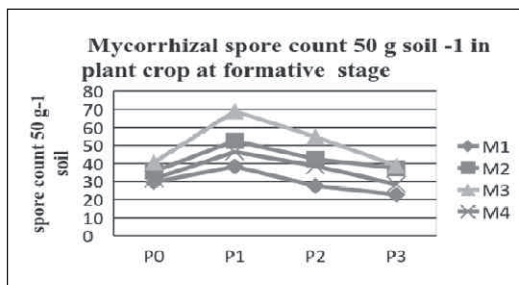
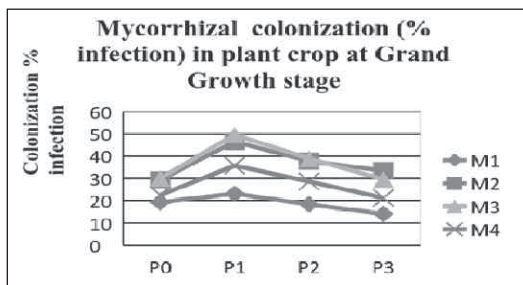
Significantly more spore count of 68.9, 145.7, 120.5 per 50 g-1 soil noticed in plant crop and 57.6, 138.5, 105.7 per 50 g soil in ratoon crop at formative, grand growth and at maturity stages respectively with application of 50 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> along with cane trash plus mycorrhizae. The decrease in spore density with an increase in soil available phosphorus may due to the fact that, available soil phosphorus inhibits AM root colonization as well as their density (Anderson, 1992). The root infection by mycorrhizal fungi was significantly reduced at high soil phosphorus levels (Amijee et al., 1989; Koide and Li, 1990).

**Root colonisation at P<sub>50</sub> level.**



**Root colonisation at P<sub>0</sub> level.**







**Table 1 Effect of different levels of phosphorus in presence and absence of cane trash and mycorrhizae on the content of Phosphorus (%) in sheath at different stages of plant crop (Pooled data)**

Treatments	Formative stage					Grand growth stage					Maturity stage				
	P0	P1	P2	P3	Mean	P0	P1	P2	P3	Mean	P0	P1	P2	P3	Mean
M1	13.7	21.5	16.8	11.8	16.0	19.4	23.2	18.4	14.1	18.8	16.2	21.3	15.5	13.4	16.6
M2	27.0	39.5	29.9	24.5	30.2	29.4	46.5	37.8	33.5	36.8	20.3	38.6	29.8	21.7	27.6
M3	30.8	41.4	29.3	23.2	31.2	30.1	49.6	38.9	29.7	37.1	22.7	41.3	28.5	19.7	28.1
M4	25.2	37.6	27.6	15.4	26.5	22.6	35.8	28.7	21.3	27.1	19.3	32.5	21.7	16.5	22.5
Mean	24.2	35.0	25.9	18.7	26.0	25.4	38.8	31.0	24.6	29.9	19.6	33.4	23.9	17.8	23.7
		S.Ed	CD at 0.05	CV%			SED	CD at 0.05	CV%			SED	CD at 0.05	CV%	
M		0.31	0.62	7.8			0.59	1.41	5.8			0.05	0.12	4.8	0.31
P		0.28	0.56				0.44	0.88				0.05	0.10		0.28
P x M		0.62	1.12				1.14	2.36				0.02	0.22		0.62
M x P		0.56	1.05	6.6			0.98	1.18	4.7			0.02	0.22	3.8	0.56

**Table 2. Effect of different levels of phosphorus in presence and absence of cane trash and mycorrhizae on the content of Phosphorus (%) in sheath at different stages of ratoon crop (Pooled data)**

Treatments	Formative stage					Grand growth stage					Maturity stage				
	P0	P1	P2	P3	Mean	P0	P1	P2	P3	Mean	P0	P1	P2	P3	Mean
M1	29.7	38.3	27.6	22.7	29.6	66.6	74.3	69.2	58.4	67.1	58.5	65.3	56.9	43.5	56.1
M2	35.6	52.5	42.4	37.4	42.0	97.4	130.4	111.5	93.5	108.2	89.4	99.2	85.1	76.3	87.5
M3	40.6	68.9	54.7	38.8	50.8	109.8	145.7	121.3	92.6	117.4	91.2	120.5	102.5	86.5	100.2
M4	31.5	46.4	38.6	28.5	36.3	75.2	93.4	66.5	60.3	73.8	65.8	78.8	58.2	45.8	62.2
Mean	34.4	51.5	40.8	31.9	39.7	88.7	113.4	95.9	80.9	94.8	76.2	90.9	75.7	63.1	76.5
		S.Ed	CD at 0.05	CV%			SED	CD at 0.05	CV%			SED	CD at 0.05	CV%	
M		1.47	3.60	7.4			0.43	0.89	8.9			0.59	1.44	6.7	1.47
P		1.41	2.90				0.38	0.68				0.59	1.22		1.41
P x M		2.85	6.16				1.12	2.34				1.18	2.55		2.85
M x P		2.81	5.80	6.8			1.10	2.20	7.6			1.18	2.43	5.8	2.81



**Table 3. Effect of different levels of phosphorus in presence and absence of cane trash and mycorrhizae on the content of Phosphorus (%) in leaf at different stages of plant crop (Pooled data)**

Treatments	Formative stage					Grand growth stage					Maturity stage				
	P0	P1	P2	P3	Mean	P0	P1	P2	P3	Mean	P0	P1	P2	P3	Mean
M1	10.8	18.4	14.5	9.3	13.2	15.7	23.5	17.2	11.4	16.9	13.2	20.3	14.5	10.4	14.6
M2	23.1	35.6	20.4	14.7	23.5	27.6	41.3	27.6	26.8	30.8	27.7	41.3	30.5	18.7	29.6
M3	25.8	40.6	31.1	22.3	29.9	29.8	54.4	38.4	30.1	38.2	25.3	37.6	34.8	28.7	31.6
M4	20.6	31.7	24.56	15.1	23.0	25.2	38.4	30.4	23.6	29.4	23.3	35.5	25.7	16.5	25.2
Mean	20.1	31.2	22.6	15.4	22.4	24.6	39.4	28.4	23.0	28.8	22.4	33.7	26.4	18.6	25.3
		S.Ed	CD	CV%			SED	CD at 0.05	CV%			SED	CD at 0.05	CV%	
M		0.17	0.35	6.7			0.16	0.32	7.9			0.18	0.36	4.8	
P		0.20	0.40				0.18	0.36				0.16	0.32		
P x M		0.34	0.68				0.32	0.64				0.35	0.70		
M x P		0.40	0.80	5.8			0.28	0.56	6.4			0.32	0.64	3.9	

**Table 4. Effect of different levels of phosphorus in presence and absence of cane trash and mycorrhizae on the content of phosphorus (%) in leaf at different stages of ratoon crop**

Treatments	Formative stage					Grand growth stage					Maturity stage				
	P0	P1	P2	P3	Mean	P0	P1	P2	P3	Mean	P0	P1	P2	P3	Mean
M1	27.7	35.8	23.7	21.8	27.3	65.7	73.4	68.9	57.7	66.4	45.3	61.5	48.9	40.5	49.1
M2	33.1	47.8	39.56	27.9	37.1	89.4	120.3	105.5	91.3	101.6	78.4	87.5	76.4	65.5	77.0
M3	38.6	57.6	43.8	32.7	43.2	98.5	138.5	121.3	99.6	114.5	82.3	105.7	87.8	71.3	86.8
M4	28.9	41.2	35.6	23.5	32.3	65.9	93.2	60.5	58.7	69.6	55.7	69.5	43.9	40.3	52.4
Mean	32.1	45.6	35.7	26.5	35.0	79.9	106.3	89.1	76.8	88.0	65.4	81.1	64.3	54.1	66.3
		S.Ed	CD	CV%			SED	CD at 0.05	CV%			SED	CD at 0.05	CV%	
M		0.32	0.65	8.7			0.02	0.04	7.8			0.06	0.14	8.2	
P		0.26	0.52				0.02	0.04				0.06	0.13		
P x M		0.67	1.13				0.04	0.08				0.12	0.26		
M x P		0.52	1.12	6.9			0.04	0.07	6.9			0.12	0.26	7.5	

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## Biofertilizers: An eco-friendly fertilizer for agriculture

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### Introduction

Biofertilizers are the source of microbial inoculants, which reveal hope for many countries both economically and environmentally. Therefore, in developing countries like India, biofertilizers can solve problems of high cost of fertilizers and thus can save the economy of the country. Bio-fertilizers, in strict sense, are not fertilizers which directly give nutrition to crop plants. These are cultures of microorganisms like bacteria, fungi, which are packed in a carrier material. Thus, the critical input in Biofertilizers is the microorganisms. They help to plants indirectly through better Nitrogen (N) fixation or improving the nutrient availability in the soil. In simple meaning, these are the substances which make use of microorganisms to fertilize the soil.

The commercial history of biofertilizers began with the launch of 'Nitragin' by Nobbe and Hiltner, a laboratory culture of Rhizobia in 1895 and followed by the discovery of Azotobacter and then the blue green algae and a host of other microorganisms. Azospirillum and Vesicular Arbuscular Mycorrhizae (VAM) are fairly recent discoveries. In India the first study on legume

Rhizobium symbiosis was conducted by N.V.Joshi and the first commercial production was started as early as 1956.

### Disadvantages of Chemical Fertilizers and advantages of Biofertilizers

During the last 30 years or so, there was a quantitative shift in favour of using chemical fertilizers by the farming community. Repeated and extensive use of these chemical fertilizers has deteriorated soil quality, resulting in progressively diminishing crop yield. Vast tracts of agricultural land have turned barren and unproductive. The use of chemical fertilizers and pesticides has caused tremendous harm to the environment. Three vital natural resources namely, soil, water and air are liable to be affected by excessive use of chemical fertilizer. The disadvantages of using chemical fertilizer are as follows:

#### Water Pollution

The main problem associated with excessive use of fertilizers is the eutrophication of surface water. Arable soils leak considerable amount of nutrients which enrich the water body resulting in more growth of algae and other organisms

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and thus impair the quality of water and limits its use. Application of nitrogen fertilizers also results in increasing the concentration of nitrate in ground water. Two main alleged health hazards are blue baby diseases of young babies and cancer due to nitrate ingestion in food and water.

### **Damage to crops and soils**

Evidences showed that excessive use of fertilizers particularly nitrogen, cause lodging of crops, low sugar content in sugar crops, acidifying action and increased incidence of weed and pest attacks. At the same time heavy use of N fertilizers is also inimical to *Rhizobium*, the microbe responsible for symbiotic nitrogen fixation. It has also been said that the population of earthworms is limited in nitrogen applied fields.

### **Heavy metal contamination**

There is an increasing concern about occurrence of trace elements in the environment in concentrations which can be harmful for animal health. Many fertilizers contain varying amounts of trace elements such as F, As, Cd, Co, Cr, Hg, Mo, Ni, Pb etc. Incidental addition of these elements may lead to their accumulation in soils and ground water aquifers. The judicious use of nature's own biofertilizers by their biotechnological applications appears to be a suitable answer to this problem. Biofertilizers can be used to overcome the problems of chemical fertilizers.

There are several advantages in

using biofertilizer: They have high nitrogen-fixing capabilities. They can solubilize phosphates. They can also supply Vitamin B12, Auxin and Ascorbic acid. They involve less energy, low cost and less effort in their production whereas chemical fertilizers are expensive and involve higher energy in their production e.g., the Haber process of ammonia synthesis requires temperature up to 800°F, a catalyst and high pressures, yet the same synthesis by nitrogen and hydrogen is accompanied by a nitrogen fixing microbes of the soil at ordinary pressure and temperature by the mediation of enzyme. Microbial processes are quick. No pollution hazards by using biofertilizers whereas application of chemical fertilizers causes pollution. They save non-renewable form of energy. They can be stored for long duration. They need little space for storage. They have less chance of getting damaged.

### **Types of Biofertilizers**

**(a) Nitrogen-fixing biofertilizers** - *Rhizobium*, *Azotobacter*, *Azospirillum*, *Blue-green algae*, *Azolla*.

**(b) Phosphorus mobilising biofertilizers:** i) *Phosphate solubilizer Bacillus*, *Pseudomonas*, *Aspergillus nige*.

ii) *Phosphate absorber- VAM fungi* - e.g., *Glomus*, *Gigaspora*

**(c) Organic matter decomposer biofertilizers**

i) *Cellulolytic-Cellulomonas*, *Trichoderma*.

ii) *Lignolytic-Arthrobacter, Agaricus.*

**Details of some important biofertilizers are discussed below:**

***Rhizobium spp:*** These are gram negative soil bacteria. They form a symbiotic association with leguminous plants to form nodules in the roots of host plant. These nodules are the sites of nitrogen fixation. Active nodules contain a red pigment called leghaemoglobin. This leghaemoglobin pigment regulates the oxygen diffusion within the nodule. Intensities of nitrogen fixation are directly proportional to the amount of haemoglobin present in nodules. They fix atmospheric nitrogen and thus not only increase the production of the inoculated crops, but also leave a fair amount of nitrogen in the soil, which benefits the subsequent crops. *Rhizobium spp.* are the best biofertilizers for legumes. Inoculums of *Rhizobium* can add 50-230 Kg N/ha. Although *Rhizobium* is abundant in soil, all of them are not able to nodulate all types of legumes. Because of their specificity, for each legume, effective inoculum is to be developed for each crop.

***Azotobacter and Azospirillum (Asymbiotic nitrogen fixers):*** They are bacteria which reduce nitrogen to ammonia in soil which is acceptable by plants. They are also helpful in synthesizing phytohormones and vitamins by plants. In the presence of these bacteria, plants become less susceptible to some fungal diseases. They are widely used for cereals like

maize, millet and sorghum, *Azotobacter* can fix up to 30 kg of nitrogen from 1000 kg of organic matter and hence save 10-30 kg/ha of N<sub>2</sub>. Similarly, *Azospirillum* led to saving of 15-25 kg equivalent of N<sub>2</sub> per hectare.

***Blue-Green Algae (BGA):*** Dominant nitrogen-fixer blue-green algae are *Anabaena*, *Nostoc*, *Aulosira*, *Calothrix*, *Plectonema* etc. Blue green algae have the abilities of photosynthesis as well as biological nitrogen fixation. Like in many other biological systems, nitrogen fixation in Cyanobacteria is brought about by an enzyme known as nitrogenase (Mishra & Pabbi, 2004).

***Azolla:*** *Azolla* is an aquatic fern occurring in ditches and stagnant water. It harbours an algal endosymbiont *Anabaena azollae* which fixes atmospheric nitrogen. The *Azolla Anabaena* symbiosis has attracted attention as a biofertilizer worldwide, especially in South East Asia. It is widely used in rice cultivated areas and fish culture ponds. It can fix upto 900 kg N/ha/year.

***Vesicular-Arbuscular Mycorrhiza (VAM) fungi:*** The roots of most plant species form symbiotic association with specialized fungi (e.g., *Glomus*, *Gigaspora* etc.) called mycorrhiza. Vesicular Arbuscular Mycorrhiza (VAM) is the most abundant kind of mycorrhizal described as 'a universal plant symbiosis'. Studies on VAM fungi conducted during last few decades envisaged their occurrence in a wide variety of hosts, different

habitats and variability in quality and quantity.

**Critical factors responsible for the effectiveness of biofertilizers**

The critical factors which are responsible for the effectiveness of a particular biofertilizer are

- ▶ Suitability of the species to the target crop.
- ▶ Suitability of the strain: There are specific strains of Rhizobium for different leguminous species like Cowpea, Red gram, Soybean, Alfalfa etc. Biofertilizer of specific culture should be used for specific crop.
- ▶ Identification of strains as suited to the agro-eco system, particularly the soil pH and moisture conditions. Through research, specific strains as suited to a particular soil and environmental conditions are usually identified and pure mother cultures are maintained in research labs for supply to the commercial manufacturers.
- ▶ The aseptic conditions of manufacturing, the cell count of living organism present in the carrier material, purity and level of contamination.
- ▶ The conditions of carrier mate-

rial in which the culture is packed and the quality of the packing material, which determine the shelf life.

- ▶ The conditions in which the packed materials are stored, distributed and kept with the farmers before it is applied.
- ▶ Soil conditions particularly pH, organic matter content, moisture level and agronomic practices.

**Method and Area of Application of Biofertilizers**

Different methods are available for applications of various biofertilizers which are outlined below.

- ▶ As seed inoculant - e.g., Rhizobium. Seed treatment is a most common method adopted for all types of inoculant. The seed treatment is effective and economic.
- ▶ As soil inoculant - e.g., carrier based blue-green algae, Azotobacter.
- ▶ As seed & soil inoculant - VAM fungi. Carrier materials for BGA inoculum are straw, rice bran, polyurethane foam and sugarcane waste.

**Biofertilizers can be applied for variety of crops such as:**

Biofertilizer	Beneficiary Crops
Rhizobium	Crop specific biofertilizers for legume like Groundnut, Soybean, Redgram, Green-gram, Black-gram, Lentil, Cowpea, Bengal-gram and Fodder legumes
Azotobacter	Cotton, Vegetables, Mulberry, Plantation Crop, Rice, Wheat, Barley, Ragi, Jowar, Mustard, Safflower, Niger, Sunflower, Tobacco, Fruit, Spices, Condiment, Ornamental Flower



Biofertilizer	Beneficiary Crops
Azospirillum	Sugarcane, Vegetables, Maize, Pearl millet, Rice, Wheat, Fodders, Oil seeds, Fruit and Flower
Blue Green Algae	Rice, banana
Azolla	Rice
Phosphate Solubilizing Microorganisms (PSM)	All Crops (non specific)
VAM fungi	for variety of plant

## Simple Steps to prepare Biofertilizers in Five Months

### Step 1 (Day 1) –

Required ingredients:

- ✓ 1 kg of bamboo leaves
- ✓ 5 kg of husk
- ✓ 2 kg of bran
- ✓ 1 kg of undisturbed soil collected from 5 cm under the surface near a tree



**Step 2 (Day 1)**- Mix the ingredients on the ground for approximately 30 minutes or until the mixture is consistent.



**Add** water while mixing to moisten the blend.

**Step 3 (Day 1)** - Move the mixture into a shallow bucket with a 50 cm diameter. Distribute the mixture in the bucket and create a depression in the center to promote heat ventilation.

**Step 4 (Day 1-31)** -Cover the bucket and move it to a shady area to create a dried sample. Mix on every 4 days for a period of 30 days to maintain consistency.

**Step 5 (Day 31)** -Place the dried sample from Step 4 into a net bag once a layer of white hypha has formed on the top of it.

**Step 6 (Day 31)** - Making the liquid micro-organisms:

- ✓ Prepare 75 L of clean water in a 100 L barrel.
- ✓ Add 15 kg of brown sugar or 15 L of molasses.



✓ Add 0.5 kg net bag from Step 5.

✓ Stir in one direction for around 10 minutes, or until evenly mixed.

**Step 7 (Day 31-61)** - Seal the barrel tightly and leave it alone. This allows the mixture to ferment and form a liquid called micro-organisms. After 30 days, a white layer will form.



**Step 8 (Day 61)** - Prepare the following ingredients to make biofertilizers:

- ✓ 1 part micro-organism that was prepared in Step 7.

- ✓ 1 part sugar or molasses.

✓10 parts water.

✓100 L barrel that is 1/3 full of chopped leftover vegetables, herbs or fruits.

**Step 9 (Day 61-76) - Make the biofertilizers:**

✓Mix the water, sugar or molasses, and micro-organism together.

✓Add the chopped vegetables and continue to stir.

✓Tightly seal the barrel and let it sit for approximately 15 days.

**Step 10 (Day 76)** - Dilute 30ml with 20L of water. Spray the biofertilizers on the root of the plants to enhance their growth.

**Limitations and Constraints**

Narrow genetic base of mother cultures and lack of efficient and virulent strains suitable to various agro-environments. Unsatisfactory carrier material with uniform and consistent good quality comparable to imported peat material.

Contamination in broth mixing and packing stages, not using completely closed system of production. Unsatisfactory packing material which reduces shelf life. Unsatisfactory storing conditions, particularly during the distribution period. Exposure to high temperatures and sunlight destroy the microbial culture. They should be preferably kept in cold storage conditions. Not employing properly trained microbiologist. Lack of quality controls and certification procedures.

**Conclusions**

Despite having certain limitations, Biofertilizers are potential alternative to chemical fertilizers for improvement of soil fertility for sustainable crop productivity and revegetating the mine spoils in cost effective and eco-friendly manner.



# THE GUJARAT STATE COOP. AGRICULTURE AND RURAL DEVELOPMENT BANK LTD.

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The Bank was established in 1951 to extend long term and medium term loans to farmers for agriculture and allied agricultural activities through 176 branches and 17 district offices located at each taluka places and district places respectively in the State of Gujarat.

## THE BANK FINANCES FOR :

- Farm Mechanisation:** Tractor, Thresher set and other implements etc.
- Horticulture / Plantation:** Mango, Chickoo Plantation, Green House etc.
- Animal Husbandry :** Dairy development, Cattle rearing, Cattle sheds, Bullock cart, Sheep & Goat rearing, Poultry, Sericulture, Fisheries etc.
- Land Development :** Land levelling, Land reclamation etc.
- Non Farm Sector:** Small scale industries, Cottage industries including service sector, Rural housing, SRTOs, Rural godowns, APMCs, Cold storage, Consumer loan, Gold Loan etc.
- Minor Irrigation:** Construction/repairs of irrigation well, Shallow tube well, Deep tube well, Installation of pumpsets, Pipelines, Lift irrigation, Drip irrigation, Check dams, Sprinkler irrigation, Solar Pumps etc.
- Kissan Credit Card:** KCC for Purchase of Fertilizers, pesticides, equipments and maintenance, and payment of electricity bills etc. It is a medium term credit requirement of its borrowers who are regular in their repayment obligation to the Bank.
- Rural Housing:** Construction of new houses, repairing and renovation of old houses.

Financial Details of the Bank (₹ in Crores)			
Sr. No.	Details	31.03.2013	31.03.2014
1	Owned Funds	511.94	542.90
2	Loans Disbursed	190.09	177.50
3	Fixed Deposit Outstanding	205.59	215.06
4	Profit	37.52	23.50
5	Dividend	12%	12%

### Bank accepts Fix Deposit at following rate of interest.

1 year and above 8% p.a. Double 108 months  
0.25% additional interest for senior citizens, Bank's employees and Share Holders  
Double 105 months

### Bank accepts Thrift Deposit at 5%

### Salient Features

- Interest payable: Quarterly/half yearly and yearly as per demand
- Monthly Income Scheme is available
- TDS is not deducted on maturity of FDs
- FD outstanding as on 31.3.14 is within the own fund limit.
- All the loans issued by the Bank are theoretically recoverable since they are secured by registered mortgage of land and as such FDs mobilized by the Bank are fully secured.
- Loan against FD to the extent of 75% of FD is available.
- Thrift Deposit Scheme, 3 months and 6 months Fixed Deposit Scheme is introduced from November 2011.

**DIVIDEND ON SHARE IS REGULARLY PAID TO SHARE HOLDERS.**

**FOR FURTHER DETAILS, PLEASE CONTACT US OR THE BRANCHES OF OUR BANK IN THE STATE.**

**Shri Dhirenghai B. Chaudhari**  
Chairman

**Shri Dolarbhai V. Kotecha**  
Vice Chairman

**Shri D. B. Trivedi**  
Managing Director

## Social inclusion for rediscovery to new social order

Brij Pal

The cooperatives have to evolve a social culture to grow, survive and prosper. Social inclusion means cause to effect these change-conservative social ideology of individual. The social inclusion by cooperative societies at lowest rung of ladders would introduce the values of generosity, love, benevolence and compassion in people. Socio-economic structure of Israil is built on formation of these values. Individual ownership of resources in economic system has developed adverse social ethos.

The non-professional and political bodies like Panchayat, implement the National Rural Employment and Guarantee Scheme at grass-root level were not meant for arrangement of activities to workers. The production relation denounce the dignity of human being. The labour contract and construction cooperative with an infra-structure and professional acumanship are overshooted by the law. The cooperative sector of the economy is in a course of rediscovery of their identity to introduce new social values. The mobility of labour do not keep pace with rising technology. The cooperatives are the force to introduce those values in gradual manner. The exploitation of natural resources with capital intensity, using the advanced technology reduced the employment opportunities and access of income to people.

The Social Inclusion is an instrument of social transformation to a new socio-economic meliu whose values may be pledged to socio-economic democracy. The social inclusion is indispensable to the promotion of socio-economic institutions like cooperative. The social inclusion can be defined as formal relation of an institution with a man. The ultimate objective of this relation is to change the perception, behaviour and attitude to suit the requirement of contemporary socio-economic needs. Individual are brought up, live and survive under different micro-environment, so their perception, behaviour and attitudes are bound to differ from each other, unsuitable to collective efforts as a member of a group or community. Individual gains, individual losses, greed, to love to store money, resources, and power to recur a prosperous life for their own generation alone to come, are the factors making the human civilisation more complex-than ever before. The objective of institutions which are fashioned to promote the socio-economic democracy shall serve the purpose of new orientation, suiting to the requirement of prosperity without poverty. So the cooperative shall embrace the people under the social inclusion. 6000 big and small cities of the economy provides 38% of employment out of total available

employment of the economy. Decentralisation of employment opportunities is the concept of Rural Development. The cooperatives have the nature of micro social and economic business units are suited to provide decentralised economy. In addition to a new social change, the social inclusion would introduced to:-

1. Impure the organisational effectiveness to control the crop fluctuation in terms of acreage and balance the production-mix.
2. Improve the equity participation to enhance risk ability, solvency and a sound financial structure.
3. Create a managerial grid for higher values and deeper change of perception.
4. Socialise the individual gains and losses to overt the socio-economic melieu of inclusive growth and equitable distribution to change, re-establish, and redefine the concept of social justice and social utility.
5. Promote organised sector in rural economy through cooperative republic for value additions to make agriculture occupation gainful.
6. Provide an infrastructure, mobilise deposits and generate domestic investment to bring up the self-generating economy.

Social inclusion by grass root cooperatives is a paradigm of a decentralise economy to 6 lacs villages. The cooperatives are the tools of Rural Development. Hence

the stock taking of human resources to formulate the strategies, for their value addition, investment of democratic values in the member of these informal groups and the classification in consonance with the resources and occupational pattern with the arrangement of activities for them. Social inclusion opens up a new social vista and provides:-

1. To decide the appropriate business mix to a cooperative society in agrarian economy, the consumer business, agricultural inputs including insecticide and pesticide, cattle drugs etc.
2. To enable to determine the economic scene of the society and capital adequacy.
3. To enable the forecasting of demands and rotation of stock.
4. To determine viability norms under the specific conditions of the local scenario.
5. To educate the members in matters of input, technology and economic viability.

The agriculture credit cooperative societies have hitherto been functioning as a tool of dispensation of credit for crop loan without any recourse to strategies for improvement of the community of farmers. The cooperatives have to change the perception of their members. Cooperatives are the primary stakeholder in the welfare of the people. The concept of the cooperative needs to be rediscovered and the objectives have also to be rediscovered. The concept of democratic control means to perform with discipline, the given

objective under the control of elected leaders. The government shall enable the credit cooperatives to avail the services of soil conservator, agronomist, plant protection and family planning either as nominal member or nomination of these functionaries on the Board of the society. Moreover, this is constitutional obligation of the government. The cooperatives shall function as an agent of change and resource centre for rural development.

The agriculture credit cooperatives have acute dearth of equity base with impaired capital structure of agriculture credit societies. 60% of credit cooperatives eroded their equity capital. The local traders and merchants get the advantage of low expenses on establishment under the accounting head of wages and salaries over the cooperative credit societies who all had to pay the wages and salaries under the obligation of law. These societies suffer from non-repayment of loans and advances. More than 50% loans and advances sunk into bad debts. In fact only 5 to 6% farmers get marketable surplus. Thus the 4 to 6% farmers get advantage of MSP.

These Credit Societies are expected to function as recourse centre to bring a social change suiting to the requirements for achievement of latest available science and technology, owning the collective liability for individual loans and advances, provide a gainful occupational-mix for individual member, and to function as

incorporated body for embodiment for dispensation of social justice. The leadership of cooperatives is over laden with political echelons. Love for private sector of political echelons has deprived these primary institution from their legitimate share of subsidies to meet out managerial and working losses. Our own empirical study reveals that all primary credit cooperatives need one lakh crores managerial subsidy and two lacs crores subsidy to meet out interest margin due on dispensed with or waved on crop loans which became bad debts.

The loans were waved by respective state government and credit cooperatives did not get the accrued interest. The social inclusion would be of a different paradigm than those efforts of universal membership campaign buried into the papers of history of cooperative movement. The paradigms of social inclusion would carry the following elements:-

1. To diversify the occupational pattern to meet out equity erosion.
2. To dispense with the procedure of down payment of loans in terms of allotment of shares subject to adjustment at the time of final instalment of loan.
3. To make a paradigm shift in leadership by the empowerment of common people. This will purify the cooperative credit societies. These forces of change can lead to a new social order.
4. To provide a decentralise economy for cooperative republic.



The lack of investment has created death of capital. The government and private sector are not willing to make further investment. The specific body viz. National Agriculture and Rural Development Bank do not invest more than 28% of their total lending's.

The credit structure would harden their capacity to evolve and diversify the occupational pattern, influence the people to undertake cooperative farming to make the economic size of holdings and work with joint initiative and common pool of resources. The loans and advances to one of the members would be guaranteed by remaining members of the society. The prosperity without poverty must form the soul of our economic development.

The cooperatives and the public sector possess the necessary impetus to control the market. This is another factor of social inclusion by cooperatives. There are number of agricultural produce where price are influenced by international market such as cotton. However cooperative credit societies functioning in paradise areas of cotton growing suffer from poor financial structure for want of default, these societies could not develop human resources for spinning and weaving with small technology for easy recovery of their

credit. So social inclusion for such improvement is necessary.

The human endeavour has not been able to evolve a new concept, philosophy and synergy of cooperatives to face the social reality. Cooperatives are the association of people with a different method of production, rendering services and to avert the concentration of economic power. Simultaneously there is a need to provide an investment of economic decentralisation, utilisation of material and immaterial resources with joint initiative of people in accordance with the principle of social justice. World economy has to face the deters of 10 billion population in year 2050 to come. There is a quest of a section of people to redefine and rediscover a new concept, philosophy and synergy beyond the year 2050. So a new civilisation may grow up to peace, security and prosperity.

The future destiny of our economy would be either decided by community of corporate kings or the cooperatives would be accorded a future to grow a decentralised economy for prosperity. To rediscover the identity of cooperative philosophy for rapid economic growth with social justice is long overdue.

## NEWS & NOTES

### **Nabard launched initiative to digitise SHGs**

Nabard has launched a project — “Eshakti” — for digitisation of all SHGs (Self Help Groups) in the country. The bank has, in the pilot phase, taken up two districts – Dhule in Maharashtra and Ramgarh in Jharkhand for digitisation of SHG data. R Amalorpavanathan, Deputy Managing Director, Nabard, said the project, which was initiated in April, 2015 is nearing completion. “We will have collated the data of around 6,000 groups in these two districts alone. The database has been created; individual data linking their Aadhar and mobile number have been mapped. Banks are being given viewing rights of the activities of each of the groups. This will help banks to view the group activities and sanction loans from the comfort of the branch itself,” he said.

Nabard is now planning to escalate the pilot phase to cover 10 districts (one each in Tamil Nadu, Karnataka, Gujarat, Orissa, Madhya Pradesh, Haryana, Assam) before the

close of this fiscal. “After the first round of pilot, we will be able to sort out the technical issues,” the Nabard DMD said. According to him, there are around 74 lakh SHGs in the country. “Though SHGs per se appear to be organised, they are largely unorganised when it comes to specifics. There are issues of multiple financing, inadequacies in account keeping and so on.” To tackle such issues, Eshakti has been mooted in sync with Prime Minister’s Digital India Initiative, he said, and explained that volunteers trained by the Application Service Providers (ASPs) capture the data of the SHG and its members and upload the same in a web-based server. Nabard has given a tablet PC for the volunteer group. It is loaded with cloud-based apps, delivered front-end in regional languages. Nabard has estimated the investment for extension of this exercise at ₹1,200 crore.

### **Cabinet extends recapitalisation of Regional Rural Banks**

The Union Cabinet has extended the validity of the recapitalisation scheme for weak regional rural banks (RRBs) by three years. The scheme, which was earlier valid up to March 31, 2014, has been extended up to 2016-17 to help RRBs improve their capital-to-risk-weighted assets ratio (CRAR). The minimum CRAR

stipulated for RRBs stood at 9% and several of these banks are unable to maintain this level. With a view to bringing the CRAR to at least 9%, the KC Chakrabarty Committee has recommended recapitalisation support to the extent of ₹2,200 crore to 40 RRBs across 21 States.

The recapitalisation process had

started in 2010-11. The share of the Centre in respect of some RRBs could not be released in the absence of the release of the share of State Governments. Therefore, the scheme was extended to March 31, 2014. A total of ₹1,087 crore had been

released as on March 31, 2014, to 39 RRBs, including Central Madhya Pradesh Gramin Bank. The Centre is now widely expected to go in for Supplementary Demand for Grants to provide further funds to the RRBs that require capital support.

### **RBI allows banks to recast crop loans**

The RBI has decided to allow State Level Bankers' Committees/District Level Consultative Committees / banks to take a view on rescheduling of loans if the crop loss is 33% or more. This move follows the government reducing the criteria for crop loss from 50% to 33% for providing input subsidy (compensation) to the farmers. The

RBI said banks may now permit a maximum period of repayment of up to two years (including the moratorium period of one year) if the loss is between 33% and 50%. If the crop loss is 50% or more, the period for repayment may be extended to a maximum of five years (including the moratorium of one year).

### **RBI asks government to amend co-operative bank laws**

In a move to bring urban co-operative banks into the mainstream, the Reserve Bank of India (RBI) has recommended the government amend the laws to allow grant of a commercial bank licence to these entities. RBI had set up a committee chaired by one of its deputy governors, R Gandhi, on the urban cooperative bank (UCB) system. The panel has suggested the law be so amended as to allow these to exit from the ambit of the Multi State Co-operative Societies Act and come under the Companies Act. All new banks in the private sector are governed by the latter law.

At present, the Banking Regulation Act that governs commercial banks does not apply fully on cooperative banks. As a result, all RBI norms are not

applicable to these entities. "Today, the Companies Act allows an entity to become a bank but that provision is not there in the laws that govern co-op banks. We have recommended to the government to accordingly amend the laws," Gandhi said. He added that UCBs were now functioning well and the sector as a whole had stabilised. "UCBs have gone through various ups and downs. The latest problem they had was in early 2000. We had to tighten the regulations and supervision. Now, they have reached a good position. Gross non-performing assets are around 5% (of the total) and net NPAs are 3%," he said.

These asset quality ratios are almost in line with the overall banking system numbers. Provisioning coverage ratio of UCBs

improved significantly to 59.7% as of March'15 from 52.4% in end-September 2014. "The number of negative net worth banks are constantly coming down," Gandhi added. According to latest RBI data, the capital adequacy ratio of UCBs at March-end 2015 was 12.6%, as compared to the regulatory requirement of 9%. Only five such banks have a CRAR below 9%. The move to grant commercial banking licences to UCBs comes as the central bank has decided to issue niche bank licences — as opposed to

universal bank licences — and has invited applicants in the payments bank and small finance bank segment. One issue that had been a hurdle for UCBs to become commercial banks was their governance practices. "They still have some issues. This is being accepted by bringing in the concept of a board for management, as was recommended by the YH Malegam committee. We have also insisted for professional directors on the board," Gandhi said.

### **RBI clears the way for 10 Small Finance Banks**

Taking the financial inclusion agenda forward, the Reserve Bank of India (RBI) granted 'in principle' approval to 10 companies to set up small finance banks aimed at giving loans to farmers and small businesses. The selected applicants are: Au Financiers (Jaipur), Capital Local Area Bank (Jalandhar), Disha Microfin (Ahmedabad), Equitas Holdings (Chennai), ESAF Microfinance and Investments (Chennai), Janalakshmi Financial Services (Bengaluru), RGVN (North-east) Microfinance (Guwahati), Suryoday Micro Finance (Navi Mumbai), Ujjivan Financial Services (Bengaluru) and Utkarsh Micro Finance (Varanasi).

The RBI considered existing microfinance companies and small finance companies for granting small finance bank licences. The small finance bank will primarily undertake basic banking activities of

acceptance of deposits and lending to unserved and underserved sections including small business units, small and marginal farmers, micro and small industries and unorganised sector entities. There won't be any restrictions in the area of operations of small finance banks. The minimum paid-up equity capital for small finance banks shall be ₹100 crore. The promoter's minimum initial contribution to the paid-up equity capital of such a small finance bank should at least be 40% and gradually brought down to 26% within 12 years from the date of commencement of business of the bank.

The "in-principle" approval granted to the ten small banks will be valid for 18 months to enable the applicants to comply with the requirements under the guidelines and fulfil other conditions as may be stipulated by the RBI. On being

satisfied that the applicants have complied with the requisite conditions, the RBI would consider granting them a licence for commencement of banking business under the Banking Regulation Act, 1949. The RBI selected these ten applicants after three different committees contributing to the final decision, backed by detailed case study for each applicant. A preliminary scrutiny of all the applications involving prima facie eligibility including the ability to raise the minimum initial capital and the status of ownership and control by residents as per the guidelines was carried out by the RBI team. The findings of the preliminary scrutiny were presented to an External Advisory Committee (EAC) constituted under the chairmanship of Usha Thorat, former deputy governor of the RBI. The EAC

recommended applications to be taken up for detailed examination based on prima facie eligibility vis-a-vis the guidelines. The detailed scrutiny involved assessment of financial soundness, proposed business plan, fit and proper status based on due diligence reports received from the regulators, investigative agencies and banks. An important factor was proposed reach into unbanked areas and underserved sections of the population. The EAC held detailed discussions in multiple sittings on the applications based on the information presented to it. The EAC then submitted its recommendations to the RBI. An Internal Screening Committee (ISC), consisting of the governor and the four deputy governors of the RBI thereafter examined the applications.

### **RBI gave ‘in principle’ approval to 11 payments banks**

Out of 41 applicants, the RBI cleared Aditya Birla Nuvo Ltd, Airtel M Commerce Services Ltd, Cholamandalam Distribution Services Ltd, Department of Posts, Fino Pay Tech Ltd, National Securities Depository Ltd, Reliance Industries Ltd, Dilip Shantilal Shanghvi, Vijay Shekhar Sharma, Tech Mahindra Ltd, Vodafone m-pesa Ltd. According to the RBI, the “in-principle” approval granted will be valid for a period of 18 months, during which time the applicants have to comply with the requirements under the guidelines and fulfil the other conditions as may

be stipulated by the Reserve Bank. “On being satisfied that the applicants have complied with the requisite conditions laid down by it as part of “in-principle” approval, the Reserve Bank would consider granting to them a licence for commencement of banking business under the Banking Regulation Act, 1949. Until a regular licence is issued, the applicants cannot undertake any banking business,” it said. On the process of selecting the applicants, the RBI said, “First, a scrutiny was undertaken by an External Advisory Committee (EAC) under the chairmanship of

Nachiket Mor, director, Central Board of the RBI. The recommendations of the EAC were an input to an Internal Screening Committee (ISC), consisting of the Governor and the four Deputy Governors. The ISC prepared a final list of recommendations for the Committee of the Central Board (CCB), after independently scrutinising all the applications.” At its meeting, the CCB went through the applications, informed by the recommendations of the EAC and the ISC, and approved the announced list of applicants. “It has selected entities with experience in different sectors and with different capabilities so that different models

could be tried. It did ensure that all the selected applicants have the reach and the technological and financial strength to service hitherto excluded customers across the country,” the RBI said. Nevertheless, the in-principle approvals are subject to certain guidelines, including any developments in on-going cases. Going forward, the RBI intends to use the learning from this licensing round to revise the norms and move to giving licences more regularly. “The Reserve Bank believes that some of the entities who did not qualify in this round, could well be successful in future rounds,” it said.

### **New and upcoming challenges for RRBs**

The Reserve Bank of India (RBI) is examining the efficacy of Regional Rural Banks (RRBs), which will be up against tough competition from 23 new banks — two new private sector banks, 11 payments banks and 10 small finance banks — in a year or two. Expecting competition in the banking space to intensify further, the RBI has asked RRBs 18 questions. They centre on the positive aspects and drawbacks of the RRB scheme, whether the scheme should continue as it is, and how the banks propose to compete with small finance banks and the rural branch network of commercial banks. Further, the central bank has sought feedback on the benefits/drawbacks of a possible amalgamation of RRBs. Currently,

there are 56 RRBs in the country and these will be directly pitted against the 23 new banks. Once the new banks get going, they will make a play for the rural and semi-urban customers that the RRBs currently serve.

RRBs were established in 1975 under the provisions of an ordinance promulgated in September 1975, followed by the Regional Rural Banks Act, 1976. The aim was to develop the rural economy and to create a supplementary channel to the “cooperative credit structure” with a view to enlarge institutional credit for the rural and agriculture sector. The Government of India has 50% shareholding in all RRBs. The government of the respective State where an RRB mainly operates, and



its sponsor bank, hold 35% and 15%, respectively. As of March-end 2014, RRBs had a network of 19,082 branches.

SK Bhattacharjee, General Secretary, All India Regional Rural Bank Officers' Federation, says a level playing field should be provided to RRBs vis-a-vis the new entrants in the banking space. While emphasising that RRBs are best suited to serve the banking needs of rural and semi-urban areas, Bhattacharjee said all government

deposits should be with RRBs instead of with SBI and other PSU banks. Besides, all banking transactions of State Governments should be solely with RRBs, he added. RRBs need to assume new avatars in the current banking landscape, he said. The federation is of the view that all 56 RRBs should be transformed into mini public sector banks, with the Centre holding 51%, sponsor banks 24% and with the balance offloaded to the public.

### **Maharashtra among states with highest loss of agricultural land, says IIM-A paper**

Seven states including Maharashtra have seen the highest loss in net sown area between 1991-92 and 2011-12, with the growing conversion of farm land for non-agricultural uses, according to recent data released by a faculty member of the Indian Institute of Management, Ahmedabad. The working paper by Prof Vijay Paul Sharma, Centre for Management in Agriculture, IIM Ahmedabad, says that evidence shows agricultural land conversion has become a serious issue in the country and net sown area in the country declined by about 1.8 million hectare during the study period.

The states, which have recorded the highest loss in net sown area besides Maharashtra (17.57 lakh hectare), include Odisha (17.1 lakh hectare), followed by Bihar (12.4 lakh hectare), Tamil Nadu (7.12 lakh hectare), Karnataka (3.1 lakh hectare), Andhra Pradesh (2.73 lakh

hectare) and West Bengal (2.63 lakh hectare). In all, says the paper, an estimated 1.59 million hectare of prime farmland was converted to non-agricultural uses during the 20-year period 1991-2011, translating into an average annual loss of over 75,000 ha of productive land. "The issue (diversion of agricultural land to non-agricultural uses) has become more complex and politicised in India due to widely varied perceptions about the extent of diversion of agricultural land and the causes and socio-economic consequences of loss of agricultural land. It is generally perceived that large-scale conversion of agricultural land to non-agricultural uses has occurred and the issue of acquisition of large tracts of fertile land by corporates and displacement of farmers, agricultural workers, and other rural communities has become a major political rather than socio-economic issue," says the paper.

The paper says that since economic reforms began in early-1990s, about three million hectare of arable land has been lost during the study period. For instance, while Maharashtra lost about 4.37 lakh hectare, Odisha lost about 1.2 million hectare of agricultural land. Other states, which registered a decline included Tamil Nadu, Bihar, West Bengal, Kerala, Rajasthan and Punjab. The paper further says while at the all India level, area under non-agricultural uses has increased by 2.36 lakh hectare per year or 646 hectare per day between TE (triennium ending) 1991-92 and TE 2011-12, states with high rate of addition to area under non-agricultural uses (over three lakh hectare) are Maharashtra, Uttar Pradesh, Andhra Pradesh, Odisha,

Madhya Pradesh, Bihar, Tamil Nadu, Rajasthan, and Assam.

“However, the pace of agricultural land conversion has marginally slowed during the last decade — arable land from about 3.13 lakh hectare per year in 1991-95 to 1.33 lakh hectare in 2006-10 and net sown area from about 1.72 lakh hectare in 1996-00 to net addition of about 79,000 hectare in 2006-10 — largely because of the introduction of land protection policies and pressure from civil society, farmers organisations and media,” the paper says. Sharma says the trend will continue if there is no intervention by the government. Efforts should be made to bring fallow lands and culturable wastelands under farming with proper safety nets, his paper says.

### **Government to transfer ownership in PSU banks to a new holding company**

The government announced a seven-point action plan, ‘Indradhanush’ to infuse professionalism and fresh capital in to public sector banks. As part of the plan, the government announced the setting up of Bank Board Bureau (BBB) that will give way to holding company to which the Centre will transfer its ownership of all these banks.

The BBB will be headed by a Chairman and will comprise six other members — three government officials and three experts, two of which will be from the private sector. It will make recommendations for senior appointments and also advise

banks on strategies for consolidation among them including mergers and acquisitions. “Banks are encouraged to come forward with proposals for consolidation strategies...this will be a bottoms up approach,” Minister of State for Finance, Jayant Sinha.

Financial Services Secretary Hasmukh Adhia said: “The Government has issued a circular that there will be no interference from it and banks are encouraged to take their decisions independently keeping commercial interests in mind a cleaner distinction between interference and intervention has been made. Banks have also been asked to build robust grievance

redressal mechanisms for customers and staff,” he said. “In addition, the KPIs will be linked to the performance bonus paid to the MDs and CEOs of PSU banks. ESOPs are also being considered for the top management of PSU banks,” Mr. Adhia added.

To de-stress the banks, the government stressed the need to develop a vibrant corporate debt market and strengthen existing asset reconstruction companies. The banks, Mr. Jaitley said, will need a total of ₹1,80,000 crore over the next four years to meet their capitalisation needs and said the

### **Agriculture scientists have a new mandate to work with farmers**

The new mandate has been extended to about 6,000 scientists functioning at the various centres and institutes of the Indian Council of Agriculture Research (ICAR) and over 15,000 scientists working with state agricultural universities under a programme called Mera Gaon Mera Gaurav (MGMG) launched on July 25, 2015. The scheme envisages scientists to “select villages as per their convenience and remain in touch with the selected villages and provide information to the farmers on technical and other related aspects in a time frame through personal visits or on telephone”. Groups of four multidisciplinary scientists each will be constituted at these institutes and universities. Each group will “adopt” five villages within a radius of maximum 100 km. A benchmark report will have to be

revamp plans announced will make raising the balance ₹1,10,000 crore from the markets easier. Significantly for banks, the government announced a new 100-point framework of Key Performance Indicators to measure the performance of PSU banks. Twenty five points each will be allocated to ‘Efficiency of capital use’ and ‘Growth processes’, while 15 points each will be allocated to ‘NPA management’ and ‘Financial Inclusion’. The remaining 20 points will be for qualitative parameters such as improvement of external credit rating.

prepared by them about farming, climate, and social and economic conditions of the selected villages.

The scheme says the scientists may perform the functions with the help of Krishi Vigyan Kendras (KVKs) and Agriculture Technology Management Agency (ATMA), both already mandated with extension of technology. At national level, assistant director general (agricultural extension)/principal scientist, Division of Agricultural Extension, ICAR, will be the nodal officer. The scheme, however, has disquieted the scientific community. “The ICAR scientists’ mandate is only to do fundamental research, inventions and discoveries, not extensions. If they are supposed to shoulder this additional responsibility, the first casualty will be research. So, even if the scheme

succeeds in extending the research to these 20,000 select villages, could we be having enough of research in our hands to extend for the future challenges in agriculture,” asked a senior scientist, adding, “the research activity will virtually come to a standstill.”

C D Mayee, a leading agricultural scientist and former Chairman of Central Agriculture Recruitment Board, said, “Though ICAR has about 6,000 scientists, only about 3,000 of them are actually available for research. And if they too are involved in extension work, who will do the research?” Mayee pointed out that of the 70-odd farm universities in the country, only 10-odd are in good shape. They are barely able to carry out education (teaching), part of their three-fold mandate that also

includes extension education. Instead of augmenting their research potential, if you are going to make them do what they are not supposed to, their condition will only worsen. And worldwide, research and extension are handled by two different set-ups. So let’s not try to do something like this presuming it to be some solution to our problems,” Mayee said. “As it is, these centres are already doing extension to the extent possible by organising farm f a r e s a n d u n d e r t a k i n g demonstration farms in the region of their activity,” he added. Mayee also pointed out that even the universities’ responsibility regarding extension was to train the extension workers of the state government’s extension department and not do extension themselves.

### **Goa to form Farmers’ Public Ltd Company**

To boost agriculture, the Goa government has decided to form Farmers’ Public Ltd Company that will provide linkage of national markets to the local produce. State Agriculture department, which is working on a modality to form the company, has initiated the liaisoning process with the industry to set up the structure. “The government is working on to form a Farmers’ Public Ltd Company. Right now, there are various ideas under it, including value addition to seasonal fruits like jackfruit, mangoes and cashew. There is also an idea of producing low-calorie sugar from the toddy of high-breed coconuts,” State

Agriculture Minister Ramesh Tawadkar, told.

He said the government will soon constitute a special expert committee in this regard to conduct field visits to various states and study the unique agricultural experiments which can be emulated in Goa. “All possible steps will be initiated in this regard. Formation of an expert committee will be the first step,” the minister said. He said a State such as Kerala has done number of researches with seasonal fruit jackfruit promoting it as a health medicinal fruit. Apprising on steps initiated for promotion of agriculture in Goa, Tawadkar said

government has adopted 58 villages under 'Model Village' concept, wherein special agricultural survey

will be undertaken to ascertain productivity of the villages.

### **RBI moots uniform methodology for calculating base rate**

Banks could soon lose some of their freedom to fix lending rates. To ensure that banks' lending rates are more sensitive to changes in the monetary policy rates, the Reserve Bank of India issued draft guidelines, prescribing a uniform method by which they have to arrive at the interest rates for providing loans. Though this could ring in transparency in the pricing of loans, banks are expected to oppose the proposed move. The central bank said it will encourage banks to move, in a time-bound manner, to the so-called marginal-cost-of-funds-based determination of their minimum lending rates. Using this methodology, the base rates of banks could soften a tad, going by the easy liquidity in the banking system currently. This could also reduce the lag between changes in deposit rates and lending rates.

The RBI has proposed to fix April 1, 2016, for implementing the new methodology. This will give sufficient time to all banks to adopt the new base rate methodology as well as the spread guidelines. Banks will have to submit a roadmap clearly indicating the time frame for adopting the new methodology within a period of two months from the date of the final circular. The RBI said the marginal cost of funds should be arrived at by taking into account all sources of funds other than equity. Cost of

deposits should be calculated using the latest interest rate payable on deposits (current, savings and term) of various maturities.

Further, the cost of borrowings should be arrived at using the average rates at which funds were raised in the last one month preceding the date of review. Each of these rates should be weighted by the proportionate balance outstanding on the date of review. Currently, banks, according to their convenience, are using three methods for calculating the cost of funds — average, blended, or marginal.

Banks, according to the RBI, should delineate the components of spread (charged over the base rate) with the approval of their boards. For the sake of uniformity in these components, broad components of the spread finalised by the Indian Banks' Association should be adopted by all banks. The RBI said it is expected that the new base rate guidelines would be helpful in the medium term goal of banks pricing their floating rate loans linked to an external benchmark. Once Financial Benchmarks India Pvt Ltd (FBIL) starts publishing various indices of market interest rates, banks will be encouraged to price their deposits as well as advances with reference to the external benchmarks published by the FBIL.

## **Set realistic repayment schedules, says RBI's Gandhi to banks**

Reserve Bank of India Deputy Governor R Gandhi asked banks to ensure proper structuring of credit facilities and beef up their credit appraisal skills for managing asset quality. Besides, they should give up the 'one size fits all' approach of extending loans to clients. He also emphasised that loan restructuring should be driven by banks' motivation to revive an account, rather than merely concentrating on asset classification and provisioning benefits. "While granting credit facilities, banks should set realistic repayment schedules on the basis of a proper analysis of cash flows of the borrowers. "This would go a long way in facilitating prompt repayment by the borrowers and thus improve the record of recovery in advances," said Gandhi at an Asset Reconstruction & Non-Performing Assets Management Summit.

He cautioned that a 'one size fits all' approach and providing plain vanilla loans to all clients may not be in the interest of banks as well as its customers. Considering the effect bad loans have on both capital and liquidity position of banks, Gandhi felt that there is an urgent need for banks to reduce their stressed assets and clean up their balance sheets lest they become a drag on the economy. He underscored that one of the fundamental issues that hampers bad loan management is the inadequacies in the credit appraisal capacity of banks, more specifically on project appraisal. The

Deputy Governor said, "As we know, there is just one technical consultancy firm, besides some specific desks in some banks. "With the requirement of independent evaluation for Joint Lenders Forums (JLFs) and the number of JLFs, there is a crying need for emergence of additional technical capabilities to undertake evaluation of projects, restructuring schemes, etc. Banks will have to strengthen their in-house desks as well. The RBI through the Centre for Advanced Financial Research and Learning has taken the initiative to organise capacity building programme for bankers.

Another suggestion that has come up for bad loans management relates to limiting the number of banks and financial institutions that should be permitted in a consortium or even in a multiple banking arrangement. "It is said that the banks with very meagre share (loan exposure in a consortium) neither have incentives nor inclination to independently assess the (loan) proposal and they typically and blindly go by the one that has the bigger share. Even if the bank has in-house technical capabilities, with a small share its voice is not strong enough," Gandhi said. Therefore, the suggestion is to have a regulatory limit on the number of members in a consortium or multiple banking arrangements so that every member has at least 10% of the exposure and therefore, will undertake serious independent



credit appraisal and credit monitoring.

However, there are counter views about this suggestion, especially with regard to the freedom available to banks and borrowers to take commercial decisions related to loans. Referring to the sudden drop in the assets being 'restructured', the Deputy Governor observed that it seems banks have become very choosy in restructuring loans to borrowers who are under stress. One of the reasons cited for the drop in restructuring of assets is that 'banks have no incentive in restructuring'. "We feel that the decision of banks in restructuring should be driven by their motivation to revive an account which is under temporary financial difficulty and preservation of the economic value of viable entities in the interest of both the creditors and the borrowers, rather than merely

concentrating on asset classification and provisioning benefits," explained Gandhi.

On the recovery side, Gandhi said the performance of ARCs is not very encouraging. As on March 31, 2015, the average recovery rate (assets resolved as a percentage to assets acquired) of ARCs was 31%. One of the reasons for the dip in the average recovery rate is the fact that a substantial part of the assets under management of ARCs is acquired recently. Further, wide variation in recovery rates among ARCs has also been observed for the same reason. Only a few of the 15 ARCs appear to have been successful in acquiring assets from banks. Of the 15 registered ARCs, the top three (ARCIL, JM Financial and Edelweiss) account for more than two-thirds of the total assets of all ARCs.

### **Maharashtra Government orders review of district cooperative banks**

The Maharashtra government has ordered review of alleged financial mismanagement in all 30 district central cooperative (DCC) banks during the last 15 years. It has also sought to fix responsibility over the financial losses incurred by them. State Revenue Minister Eknath Khadse, in a meeting with Agriculture and Cooperative Secretary Shailesh Kumar Sharma, took stock of the financial position and the amount of crop loans provided to farmers by DCC banks. "Government money was used for

improper purposes. Several DCC banks misused money meant for salaries of primary and secondary school teachers and have deliberately delayed the recovery of loans. We are figuring out the amount. I think the amount runs into thousands of crore," alleged Khadse. He said that bank guarantee given by the State government to various cooperative sugar and cotton mills is more than ₹1,200 crore and is yet to be recovered.

"We have given instructions to prepare a detailed report of all DCC

banks. The amount given to them by the State, the amount disbursed, the amount recovered, etc and fix the responsibility of any wrongdoings on the directors. We will attach the

properties of the directors and recover our money from the auction of their properties,” Khadse said.

### **Sovereign Gold Bond Scheme and the Gold Monetisation Scheme**

The Union Cabinet approved two schemes — the Sovereign Gold Bond Scheme and the Gold Monetisation Scheme — that could bring idle gold lying with Indian consumers into the economy and also reduce India’s dependence on gold imports. Through the Gold Monetisation Scheme, gold in any form can be deposited with banks for a period of one to 15 years. This gold will earn interest and redemption will be at the prevailing market value at the end of the tenure of deposit.

The Sovereign Gold Bond Scheme is aimed at customers looking to buy gold as an investment. Under the

Scheme, “there will be no need to buy actual gold as customers can buy gold bonds which will be relatable to the weight of gold,” Finance Minister Arun Jaitley said. “The bonds will be issued in denominations of 5 grams, 10 grams, 50 grams and 100 grams for a term of five years to seven years with a rate of interest to be calculated on the value of the metal at the time of investment,” Mr. Jaitley told. However, Mr. Jaitley announced that there would be a cap of 500 grams that a person can purchase in a year. Such bonds would be offered to only Indian citizens and institutions.

### **‘Quick fixes’ will not help – RBI Governor**

Flagging the issue of “Jugaad” — the way of “working around” difficulties by hook or by crook — RBI Governor Raghuram Rajan said it will neither help final product quality nor in sustainable economic growth. “Jugaad is a thoroughly Indian way of coping but it is predicated on a difficult or impossible business environment. And it encourages an attitude of short cuts and evasions, none of which help final product quality or in sustainable economic growth. “While we should respect the entrepreneurial abilities of our business people in difficult environments, it is better for us to

change the environment for the better. That is indeed what we are trying to do. All this requires patience,” said Rajan.

“The world is a difficult place. Let us recognise we are doing quite well in comparison – indeed, many industries in difficulty have a problem because exports are low or imports are very competitive, and not because domestic demand is inordinately weak. “We cannot compensate entirely for what is happening across our borders, else we will risk acquiring the problems our fellow emerging markets have,” said Rajan.

### **New 'rurban' scheme to get ₹5,142 crore**

The government has announced a scheme for rural areas with an outlay of ₹5,142.08 crore. The programme, named Shyama Prasad Mukherji Rurban Mission (SPMRM), will develop 300 rural clusters, each containing a population of about 50,000. The government says the 'rurban mission' will develop a cluster of smart villages.

The clusters would be developed by stimulating economic activities, developing skills and infrastructure amenities, as well as supporting local entrepreneurship. The government also aims to reduce migration to urban areas through the initiative.

### **Growth will be short-lived if it's too fast: RBI Governor**

RBI Governor Raghuram Rajan sought to stave off the same by saying that the focus should be on improving the business environment as a way to drive growth rather than extending stimulus and rate cuts. "While our policy will accommodate, substantial reforms are needed to create an environment for businesses. We want to keep inflation low even in the future," Rajan said while speaking at the 4<sup>th</sup> CK Prahalad Memorial Lecture organised by the CII.

CK Prahalad Memorial Lecture organised by the CII.

He stressed on the importance of being conservative. This, according to Rajan, is aimed at ensuring that "we get moderate nominal interest rates that satisfy not just the vocal borrowers but also the silent savers."

State governments will identify the clusters, which will be according to a 'Framework for Implementation' by the Union government. "The clusters will be geographically contiguous gram panchayats with a population of 25,000 to 50,000 in plain and coastal areas and a population of 5,000 to 15,000 in desert, hilly or tribal areas. There will be a separate approach for selection of clusters in Tribal and Non-Tribal Districts," a release said. The clusters will be developed based on demography, economy, tourism and pilgrimage significance, and transportation corridor impact.

Rajan, however, observed that the 3.6% retail inflation reading was seen to be low due to the "base effect". Adjusted for the base effect, it would be around mid-5%, he said.

Emphasising the need to achieve growth the right way, Rajan said Brazil was growing at about 7.6% a few years back but fast expansion and rapid interest rate cuts had dragged down the country's economy. "Growth has to be obtained in the right way. It is possible to grow too fast with substantial stimulus, as we did in 2010 and 2011, only to pay the price in higher inflation, higher deficits, and lower growth in 2013 and 2014," Rajan said. India, he said, must resist special interest pleas for targeted stimulus, additional tax breaks and protections, directed

credit, subventions and subsidies — all of which have historically

rendered industry uncompetitive, government overextended, and the

### **Banks can conduct factoring business without prior nod: RBI**

The Reserve Bank of India said banks can carry out the business of factoring departmentally, without obtaining its prior approval, subject to conditions. When a bank undertakes factoring, an enterprise sells its accounts receivable (invoices) to the bank at a discount. Later, the bank recovers money from the buyer on the maturity date of the invoices.

The RBI said banks may formulate a comprehensive factoring services policy with the approval of their Boards and offer the services to their customers in accordance with this policy. Factoring services may be provided either with recourse or without recourse or on limited recourse basis. These services should be extended in respect of invoices which represent genuine trade transactions, the RBI said.

In order to ensure that the bank offering factoring services has enough margin to cover any deficiencies in the payment of the related invoice, it should be ensured that the pre-payment amount offered by banks for the receivables acquired under factoring should not exceed 80% of the invoice value. Further, the RBI said setting up of factor subsidiaries or investments by banks in factoring companies will be subject to extant guidelines on investments by banks in subsidiaries and other companies. Investment of a bank in the shares of factoring companies inclusive of its subsidiary carrying on factoring business will not, in the aggregate, exceed 10% of the paid up capital and reserves of the bank.

### **RBI names 2 banks 'systemically important'**

The Reserve Bank of India (RBI) named State Bank of India (SBI) and ICICI Bank Ltd. as Systemically Important Banks, requiring them to keep aside an additional capital to cover risk. However, the additional capital requirement will be lower than previously estimated and the central bank has offered an easy passage for the banks to adhere to the new norms. The capital requirements will rise by 0.6% and 0.2% point for SBI and ICICI Bank, respectively to ring-fence the

financial system and the economy as a whole from global crisis. During a financial crisis, problems faced by certain large and highly interconnected financial system, hurting the real economy.

SBI currently has a much higher level of tier-I at 9.62% as opposed to 7.00% required under the current guidelines. SBI and ICICI Banks are systemically important due to their size, cross jurisdictional activities, complexity, lack of substitutability and interconnectedness. The

additional capital requirement may not have much significance because banks in India in general maintain more than two to three percentage points more capital than the regulatory stipulation.

RBI said the additional common equity tier-1 requirements for SBI and ICICI Banks will be applicable from April 1, 2016 in a phased manner and would become fully effective from April 1, 2019. This will be in addition to the capital conservation buffer. The Financial

Stability Board (FSB) recommended that all member countries needed to have in place a framework to reduce risks attributable to systematically important financial institutions in their jurisdictions. If a foreign bank having branch presence in India is a global systemically important bank, it has to maintain additional capital surcharge in India as applicable to it proportionate to its risk-weighted assets in India, RBI said.

### **Compensate PSBs for Jan-Dhan : Dr. Rajan**

Reserve Bank of India governor Raghuram Rajan has taken on the government for thrusting the Jan Dhan Yojana (JDY) on public sector banks and has called for compensating the PSU lenders. This observation from Rajan comes in the central bank's annual report which has a new section - 'Governor's overview'. "We should recognise that PSBs undertake public interest activities (like the rollout of accounts under the Pradhan Mantri Jan Dhan Yojana) that are not always fully compensated. Government should endeavor to keep the competitive playing field level by fully compensating banks for activities it wants undertaken in the public interest," the governor said in his review.

The Jan Dhan Yojana has been trumped as a major achievement by the NDA government. The scheme allowed every unbanked person to open a basic bank account with zero

balance requirement and avail of a debit card, ₹1 lakh accident insurance cover, ₹30,000 life insurance and an overdraft facility after satisfactory operation of the account for six months. In FY15 public sector banks opened 16.57 crore accounts under this scheme. Over 10 crore of the accounts are in rural areas and 45% of them have zero balance in them. The total deposits mobilized through the scheme was ₹22647.35 crore. PSU banks have said that zero balance accounts are a drain on their resources but express hope that direct benefit transfers would improve cash balances.

Acknowledging that the JDY had given a fillip to financial inclusion Rajan said that the government needs to ensure activity in these accounts by rolling out DBT for all payments. Also banks need to start rolling out credit products after due diligence and strengthen their

business correspondent network and increase awareness through financial literacy drives. According to Rajan, PSU banks are in a disadvantages position also because of skilled manpower. "Because PSBs compete in the same market place for talent as do private sector banks and foreign banks, and may skill gaps are increasing at the middle management levels because of past

hiring freezes, they will be unnecessarily hampered if they are unable to pay appropriate compensation to the middle and senior managers as well as board members," said Rajan. He added that the higher compensation should be with higher accountability and cost rationalization to bring overall costs in line with private banks.

### **Trying times for banking sector, says Deputy RBI Governor**

The banking sector is going through "trying times", characterised by low credit growth, impairment of assets and low profitability, HR Khan, Deputy Governor of the Reserve Bank of India (RBI) said. Addressing the inaugural ceremony of Bandhan Bank, he said credit growth dipped from 15% in FY-14 to below 10% last fiscal. Deposit growth has come down from 15% to 11%. The asset quality, including non-performing

assets and restructured loans, rose from 9% (FY-14) to 10% (FY-15). The return on equity stood at 9.88% last fiscal (against 10% in the year-ago-period). "On top of that, Indian banks are to meet the global capital requirements. The government's ₹75,000 crore capital infusion program will help towards that," he added. According to him, the banking space is set to become more competitive.

### **Bandhan Bank begins its journey with 501 branches**

Bandhan Bank started its journey, 14 years after Chandra Shekhar Ghosh started Bandhan micro finance institution (MFI). Bandhan will be the fourth bank to be headquartered in the city and also the first private bank to be based in Kolkata. Finance Minister Arun Jaitley, hoped the expansion of banks would curb Ponzi schemes. Bandhan has started with 501 branches in 22 States, 50 ATMs, 1.43 crore accounts and a loan-book of ₹10,000 crore brought forward from its MFI days. The depositors

include the 75 lakh MFI customer base, almost entirely women.

"We are the first bank to start its operations with so many branches and customers. No other bank had such a huge launch. We are committed to bringing a new era in Indian banking," says Ghosh, Managing Director and CEO of Bandhan Bank. However, he added that the elevation from MFI to a universal bank will not shift the focus of its operation. Access to cheap deposits, (replacing loans from commercial banks at an average



borrowing rate of 12.5%) will bolster its micro-credit activity. Bandhan, currently, records a 99% recovery rate from the segment.

HR Khan, RBI Deputy Governor, said, "Bandhan is suitably placed to

handle the challenge and meet the credit requirement of rural and unbanked people. There are some regulatory issues... they are being considered by RBI and will be considered sympathetically".

### **Overdraft under Jan Dhan scheme nears ₹120-cr mark**

Nearly ₹120 crore have been taken by bank account holders as overdraft under the Pradhan Mantri Jan Dhan Yojana (PMJDY). With repeated prodding by the government, banks had disbursed ₹11,825 lakh to ₹8.37 lakh account holders under the scheme as of October 30, 2015 according to Finance Ministry data.

In the past banks had often shied away from providing the facility over repayment concerns. To encourage banks to provide an overdraft facility to subscribers, the Reserve Bank of India had also included the funding as part of priority sector lending targets. An overdraft facility of ₹5,000 under the PMJDY is available to one of the earning (preferably a woman) account holders in each family after six months of satisfactory transactions. Of the total of 19.13 crore accounts opened under the PMJDY since August 2014, the overdraft facility is now

available in 43.31 lakh accounts and had been sanctioned for 22.43 lakh accounts by October 30, 2015.

"We are monitoring the progress of the overdraft facility as it is one of the main tools for financial inclusion. We have been talking to banks and expect that in the coming months more account holders will use the facility," said a Finance Ministry official, adding that the facility has now been automated. The Department of Financial Services in the Finance Ministry had also taken it up with banks, pointing out that the progress was very poor. "It has been requested by some State Governments to consider automation of the Overdraft facility based on transaction record so that this can be easily availed by a customer through ... on-line or ATM mode," it had said in a recent note to banks.

### **FM sets loan target of ₹1.22 lakh crore under PMMY**

Finance Minister Arun Jaitley has set a target of ₹1.22 lakh crore for loans to be given by state-run banks to promote new entrepreneurs under the Pradhan Mantri Mudra Yojana (PMMY) which will seek to "fund the unfunded." Making a pitch for promoting entrepreneurship, the

minister said that earlier there was no institutional mechanism to fund this unfunded segment and access to credit came at a high cost. Through this scheme, grassroots entrepreneurs will get cheaper credit based on their business activity, he said.

There is need to promote entrepreneurship because jobs in both public and private sectors are limited, the minister said. "Large industries offer only two crore jobs and they have their own challenges such as slowdown in the global economy," Jaitley said. The minister said about 5.77 crore small business units generate almost 11 crore jobs. So far, state-run banks have given loans to 37 lakh people totalling ₹24,000 crore, he said. Jaitley said some borrowers in large industries are not able to repay loans and seek

more time due to external factors such as economic slowdown. But financial institutions have experienced that 99% small borrowers repay on time, he said. State-run banks kick-started mega credit campaigns across the country to give a push to Pradhan Mantri Mudra Yojana. Mudra Ltd has been established as a subsidiary of SIDBI, with an initial corpus of ₹5,000 crore to provide refinance to all banks seeking refinancing of small business loans under Pradhan Mantri Mudra Yojana.

### **RBI rejects plan for 100% FDI in banks**

The Reserve Bank of India (RBI) has turned down a proposal from the government to allow up to 100% foreign direct investment (FDI) in banks. RBI has not provided a clear reason to turn down the proposal from the department of industrial policy and promotion (DIPP) that deals with FDI policy. But in the past the regulator has seen banking as a sensitive sector and opposed allowing significant shareholding by foreign institutional investors, who are seen as short-term investors and can enter or exit a stock for short durations, largely to book profits.

Private Banks are particularly keen on a higher ceiling and investors are also hoping for a relaxation. In fact, HDFC Bank recently got permission for 74% foreign investment and was also found to be in breach of the norms for a short period. A few years ago, in the draft norms for new banks, the RBI had suggested limiting FDI to 49%,

against the 74% cap. The finance ministry, however, saw it as a retrograde step and got the regulator to stick to the prescribed ceiling. In fact, a few years before that, during UPA's tenure, there had been a major battle between the finance ministry and the RBI on how the FDI norms should be applied, with North Block finally saying that setting the foreign investment rules was in its domain.

Currently, the government permits 74% FDI in private banks, with up to 49% allowed under the automatic route. Foreign holdings beyond 49% need to be cleared by the Foreign Investment Promotion Board (FIPB). Portfolio investment in the sector is capped at 49% and banking is one of the segments where the composite caps, which allow fungibility between FDI and FII flows, have not been applied as the government argued that it is a "sensitive sector".

### **Dr. Rajan is first Indian to be elected as BIS Vice Chairman**

Dr. Raghuram Rajan, the governor of the Reserve Bank of India, became the first Indian to be elected the vice-chairman of the Bank for International Settlements, the bank for global central banks which works to improve the financial stability and prescribes rules for banks across the globe. The 52-year-old Rajan who has been critical of central banks of the West for their excessive printing of money to bring back growth, would assist Jens Weidmann, chairman of BIS, who is also the head of Bundesbank, the German banking regulator.

"Raghuram Rajan was elected as the vice-chairman, the board of directors of the Bank for International Settlements (BIS), at its meeting in Basel held 9-11-2015 for a period of three years from November 10, 2015," the RBI said in a release on its website. Rajan, a former chief economist at the International Monetary Fund, saw his stature as an economist get a boost when he warned of the dangers of risks building up in the system in a

### **RBI paves the way for banking M&As in Banking**

The Reserve Bank of India RBI has thrown open the doors for mergers and acquisitions (M&As) in the banking industry by signaling that it is open to persons owning more than 10% stake in a bank. For the first time in decades the central bank has said that it could permit promoters, or investors to own more than 10% if the applicant meets certain

symposium in 2005. He was prescient. The global financial markets were hobbled during the credit crisis. Indeed, he criticises western central banks for their easy monetary policies, which may lead to next crisis. As the vice-chairman of BIS, he could attempt to influence rule making better than as a member. BIS, established in 1930 in Basel, Switzerland, is an international organisation consisting of central banks and monetary authorities of various countries. It was created through an international treaty (The Hague Agreements of 1930). Rajan who took over as the RBI governor in September 2013, joined the BIS board in December 2013. His current term as RBI governor ends in 2016."The board is responsible for determining the strategic and policy direction of the BIS, supervising BIS Management, and fulfilling the specific tasks given to it by the Bank's Statutes. It meets at least six times a year," BIS said on its website.

conditions including if 'it is in public interest' and in the 'desirability of diversified ownership.'

Many investors who owned up to 4.99% in banks and were keen on raising it but did not do so till now will have an opportunity to raise their holdings. If they get the central bank permission to buy 5%, then they automatically have a right to go up to

10%. "This indicates that RBI would be willing to allow shareholding of more than 10% for purposes of consolidation," said Shinjini Kumar, Partner at consultants PwC. "With the ability to grant 26% voting rights as per the amendment bill even though not automatically extended here, this could pave the way for increased promoter shareholding and consolidation activity in banking." For a central bank which has been rigid about the 5% cap on ownership and a 10% voting rights to ensure that no single holder gets a dominant position in running a bank, the latest is a reversal of policy. Indeed, there were instances such as Axis Bank (then UTI Bank) where RBI forced HSBC to cut its stake which led to an eventual exit. It had even ordered Uday Kotak to cut his stake and set a time line to bring it down. Kotak owns 34% in the eponymous bank.

### **German cooperative banks DZ, WGZ finally agree to merge**

German cooperative lenders DZ Bank and WGZ Bank have agreed in principle to merge after several failed attempts to join forces, creating the country's fourth-largest lender with around 500 billion euros (\$534 billion) in assets. Six years after scrapping the last attempt, DZ Bank and WGZ Bank will pool investment to take on challenges such as tougher banking rules, increased competition and demand for more digital services.

The deal is Germany's largest banking merger since Deutsche

But the central bank has detailed the 'fit and proper criterion' that would be used to grant permission for bigger stakes. "The applicant's integrity, reputation and track record in financial matters and compliance with tax laws," will be a barometer to judge the 'fit and proper criteria', the central bank said in a note. "Where the applicant is a body corporate, its track record or reputation for operating in a manner that is consistent with the standards of good corporate governance, financial strength and integrity in addition to the assessment of individuals and other entities associated with the body corporate." These directions will also apply to compulsorily convertible bonds, voting rights or convert optionally convertible bonds, RBI said in a press release.

Bank's takeover of Postbank in 2010 - will create a unified bank for the country's more than 1,000 cooperative lenders, whose customers are also their owners. The lenders expect annual cost savings of at least 100 million euros and plan to cut jobs "moderately" from their combined 32,000-strong workforce, spreading the burden evenly between them. DZ Bank and WGZ Bank's function is to supply services such as transaction banking or liquidity management to cooperative banks as well as products such as

Union Investment-branded investment funds, Schwaebisch Hall-branded home loans or R+V-branded insurance policies. They also back corporate loans if single items exceed a local cooperative bank's means.

The banks said they had agreed on a memorandum of understanding and expected to sign a merger contract in March or April 2016, with the combined bank to start in

August. It will be the fourth-largest bank by assets after Deutsche Bank, Commerz bank and KfW. So far, no estimates have been made yet on the one-off costs of the merger, they said. DZ Bank Chief Executive Wolfgang Kirsch and Chairman Helmut Gottschalk will lead the combined group, while WGZ CEO Hans-Bernd Wolberg and WGZ chairman Werner Boehnke are poised to become deputies.

### **RRBs can provide Internet Banking facility**

Regional Rural Banks (RRBs) will be allowed to provide basic Internet banking facilities to its customers. At present, RRBs are not permitted to provide such facilities. The RBI guidelines has suggested that Internet banking facility is strictly for non-transactional services, such as balance enquiry, balance viewing, account statement download, request for supply of cheque books,

etc. and no online fund-based transactions are allowed. RRBs providing such facilities must have a capital of over 10% and networth of ₹100 crore as on March 31 of the immediate preceding financial year and must have no accumulated losses. The gross NPAs must be less than 7% and net NPAs not more than 3%, among other requirements.

### **Changes in ARDBs**

1) Smt. K.S.M. Lakshmi, has assumed charge as Managing Director of the Andhra Pradesh State Coop. Bank Ltd., w.e.f. 8.10.2015.

## AGRICULTURAL NEWS

### Sugarcane: Seeds of a successful business model

Income generation is the most important issue for a farmer today as several agriculture produces do not get a good price and marketing facilities are not always readily available. If proper technology is provided on time and implemented with the combination of market avenues it can lead to profitable farming. In line with this finding, the Water Technology Centre, at the Tamil Nadu Agricultural University (TNAU) has developed a technique called seedling production in sugarcane to help sugarcane growers.

This technology has been identified as a separate enterprise and promoted among many nursery growers. In this method the sugarcane buds are grown in trays and then transplanted when they are 25-35 days old in the main field under wider spacing combined with sub surface drip irrigation (SSDI). Though Tamil Nadu ranks first in cane productivity in India (production stand at 105 tonnes a hectare an average) the mills have not been paying money on time to the growers and there is no provision for interest on late payments. And a farmer can sell his cane only to a particular sugar mill and he is at the mercy of the mill owner for accepting his produce and getting some payment on time.

Apart from this there are a host of problems like labour shortage, lack

of mechanical availability for planting and harvesting, water and electricity shortage. "Though the main issue is non payment on time which is largely a government based decision as technical experts we on our part have tried to ease the financial crunch of the farmers by encouraging them to also take up seedling production. Many farmers in the state have taken this up as an additional activity and are earning a better revenue," explains Dr.B.J. Pandian, Director, Water Technology Centre, TNAU. Mr. B. Jayabal, Thatchan Thottam, Cheyuar, Tiruppur District entered into this line with technology support from the University. "Within two years, I have produced 5.50 lakh seedlings earning nearly ₹2.5 lakhs as income. I was advised to develop a business model by printing visiting cards and registered my nursery as a firm to participate in Government programmes on a competitive basis," he says. Another producer Mr.T. Marirajan, from Tiruppuvanam in Sivagangai says, "Production for one seedling is only ₹0.80 and the selling price is ₹1.40 per seedling. I produce 50,000 seedlings per batch and get ₹25,000 profit in a month."

The popularity of this technology is fast catching up even with professionals like Mr. R. Ramesh Kumar an engineer from Papanulam in Tiruppur District. He runs his production unit like a factory



employing 5-6 women labour daily with automated bud chippers and producing 1.00 lakh seedlings in every batch with his available two shade nets. Admitting to the fact that grievances from farmers across the state on disbursement of money not being done on time Dr. Pandian says, "If these farmers can take up this initiative they can easily overcome their financial strain till the mills disburse the amount." This

technology has twin advantages. For the farmers it helps achieve higher productivity (under normal planting 105 tonnes are harvested under SSI cultivation 105 to 110 tonnes from a hectare is harvested), better return and saving on water, electricity and labour. For the sugar factories it ensures higher recovery in increase crushing days and additional employment.

### **Controlling rhizome rot in Ginger**

Rhizome rot, also called soft rot, is one of the most devastating diseases of ginger. Initial symptoms of the disease appear as light yellowing of leaf tips which gradually spread down to the leaf blade and leaf sheath along the margin. During early stages, the middle portion of the lamina remains green while the margin turns yellow. Subsequently the yellowing spreads to all leaves followed by drooping, withering and drying. Infected shoot can be easily pulled out from the soil.

Use of healthy rhizome is one of the most important preventive measures. Cultivars such as Maran, Nadiya and Narasapattom are reported to be resistant to this infestation. Water-logging in the field must be avoided. A raised bed of 30 cm height and 1m width is recommended. Provide proper drainage and keep land free from weeds at all times. Collect the diseased material as and when the disease is noticed and burn them. Plan early planting during April.

Crop rotation with non-host crops like leguminous crops, maize, ragi, paddy will not only benefit the soil nutrient supplementation but also keep the diseases under check.

Seed rhizome dip treatment with *Trichoderma harzianum* 10 gm per litre of cow dung slurry, before sowing is effective. One per cent of bordeaux mixture spray just after extraction is also effective. Drenching the seeds with bordeaux mixture in 25 litres of water dissolved in 6 kg of copper sulphate solution and again after germination at 2-3 weeks interval gives partial control. Rhizomes treated with (*Trichoderma* bio-control agent) at rate of 5gm / kg of rhizome for 30 minutes proves effective. Application of *Trichoderma* bio-control agent (2.5 kg mixed with 50 kg FYM) 10-15 days before sowing and oil cakes making are recommended. Soil drenching with Mancozeb (0.3 per cent) or Metalaxyl at 500 ppm is recommended in epidemic disease areas.

## **Wider spacing in crops helps tide over water scarcity**

The challenge in increasing crop productivity is more especially in dry areas, where it is a tough task for both farmers and scientists alike. While digging ponds to store rainwater might be advised, the impracticality of doing it by small farmers with less than three acres is still an issue. For such small farmers the krishi vigyan kendra in Bijapur, Karnataka, has developed a method to overcome water scarcity. It is a simple method where farmers are advised to plant their crops with a wider spacing between them. Bijapur is situated in northern Karnataka and is frequently hit by droughts. This area receives an annual rainfall of 593.3 mm which is insufficient for most of the dry-land crops.

“In general, farmers adopt narrow row spacing for planting the crops. There is a standard procedure with farmers adopting their own measurements according to their choice. By doing so, there tends to be a stiff competition between the plants for moisture as the plant grows. The moisture requirement will be more especially during the peak flowering and grain filling phases, but there will be less soil moisture leftover, thereby affecting the yield of the dry-land crops,” explains Dr.S.S.Nooli, scientist at the Kendra. In collaboration with the All India Coordinated Project for Dry Land Agriculture and Regional Agricultural Research Station, 34 awareness programmes were conducted for farmers from 80 villages on the need

for adopting this method. The Kendra also conducted 108 frontline demonstrations for 270 farmers and suggested they plant the high yielding hybrids of pearl millet (bajra/cumbu) and sunflower provided by the kendra with wider row spacing.

Farmers in Bijapur region started planting their crops with wider row spacing of 120 cm (between rows) x 5-10 cm (between plants) and were able to get 20-25% better yield. Cases of infestations were also noticed to be quite low. “We did a systematic study on pearl millet and sunflower since these two crops are quite common in this region. An additional net profit of ₹3,910 per hectare was achieved in pearl millet and ₹8,580 a hectare in sunflower over the conventional method,” says another scientist Dr. S.Y. Wali. This technology is presently being adopted in 15,500 hectares in Bijapur, Bagalkot and Koppal districts of Karnataka.

Crop productivity is largely determined by the amount of soil moisture. Crops cultivated with wider row spacing coupled with repeated deep inter cultivation helps to create dust mulch on the soil surface. This dust mulch acts as a barrier from higher evaporation losses, which ultimately leads to better moisture availability and hence better yield. Farmers should note that this project on pearl millet and sunflower was tested only in Bijapur region, Karnataka. It cannot be generalised for other states, according to the research team.

### **TNAU develops better efficiency stoves**

In India, 80% of the total population lives in villages. The major energy demand of rural population is for cooking which contributes to about 98% of their total energy consumption. Wood, agricultural waste and biomass are used as fuel in rural kitchens. Conventional stoves (chulha) take more time for cooking, more difficult to fire and consume more fuel. They also waste a lot of energy and pose many pollution hazards. Most traditional stoves can utilise only 2 – 10% of the energy generated by the fuel. The growing gap between availability and demand for firewood caused by traditional stoves forced technologists to concentrate their attention on improving the thermal efficiency of stoves.

In view of this the department of Bioenergy at the Tamil Nadu Agricultural University, Coimbatore has developed a single-pot chulha. The single-pot chulha has a double wall with a gap of 2.5 cm. It has a grate at the bottom of the combustion chamber. The ash can be collected below the grate. The

outer wall has two rectangular secondary air openings on both sides at the lower portion. The inner wall has 1cm diameter holes which maintain a triangular pitch of approximately 3 cm. Separate mounds are provided for holding bigger and smaller vessels. The secondary air enters through the rectangular opening in the outer wall, gets heated in the annular chamber and distributed through the holes in the combustion chamber. The preheated air helps in proper burning of the fuel.

Another one called double pot portable chulha (chimney-less) is made with two walls with an air gap of 2.5 cm. There are two secondary air inlets, one on the outer wall with rectangular shape (17 cm x 1 cm) near the combustion chamber and the other a circular hole of diameter 5 cm at the bottom of the second pot. A cast iron grate is placed at the bottom of the combustion chamber. Those interested can contact the department for further details and availability of the chulhas.

### **A note - Why it doesn't pay to be a small farmer**

Every second male worker and two out of three female workers in the country are involved in agriculture. There are nearly 120 million cultivators and 144 million landless agricultural labourers. Between 2001 and 2011, 9 million people quit cultivation but 38 million joined the ranks of agricultural labourers.

What are the causes behind this agrarian crisis? VK Ramachandran, professor at Indian Statistical Institute, who has carried out extensive village studies in different parts of India, stresses that this is not a generalized crisis affecting all farmers. "The crisis affects the small and marginal farmer, and less

severely, the medium one. Large farmers are thriving," he says. Recent survey reports of the National Sample Survey Organisation (NSSO) seem to confirm this. A revealing analysis of the economics of farmers based on data collected in 2012-13 shows the shocking condition of farmers owning less than a hectare of land. Although such small holders make up nearly 83% of cultivator households, their average monthly income-expenditure shows that they are all in the red — their expenditure is more than income. This is despite the fact that all cultivators supplement their incomes from cultivation with other incomes. The small landholder does this by animal husbandry, wage labour in others' fields and through a range of non-farm activities including casual labour in construction, petty sale of goods and services, etc. The medium landholder starts making some savings and is able to invest in productive assets like pumps, agricultural machines etc. But what emerges most starkly from this data is this: for the big land-holder, say, with over 10 hectares of land, monthly incomes are nearly ten times more than the farmer with less than half-a-hectare land. Even the big land-holder draws income from nonfarm activities, but these are salaries from better paying jobs, rent, and other commercial income.

Why can large land-holders do well while the smaller ones fail? Pramod Kumar Joshi of the International Food Policy Research

Institute, an international think tank, says that they succeed because the big farmers have a large area under cultivation, yielding more marketable surplus and they can bargain for more remunerative prices for their produce. "Small holders have low production (due to less area) and, thereby, less marketable surplus. Their transactions costs are very high. Large farmers also have access to credit, extension, technology, which the small holders do not," Joshi told. Ramachandran underlines another key reason behind the small farmers' distress — the unrelenting rise in input costs, which the small farmers are unable to cope with while the big ones, though affected, can still take in their stride. "All input costs — water, fertilizer, seeds, machines, labour and fuel — have gone up, while prices obtained for the final produce have not risen commensurately. Withdrawal of subsidies by public authorities has further aggravated the burden. This has made small holdings unviable," Ramachandran said.

Among all the inputs needed for agriculture, water is the most crucial. In India, out of the net sown area of 141 million hectares just 65 million hectares is the net irrigated area. This means that about 54% of the sown area is dependent on rains. This constitutes the biggest source of vulnerability for small farmers. Either they have to pay to get water from tube wells or just pray that the rain gods do not fail them. According

to the NSSO survey, among all farmers with irrigated fields, 71% were using groundwater while only 17% could use water from irrigation canals. That's because canals need public investment while groundwater is drawn by using pumps that have to be bought by farmers.

Fragmentation of land has reduced the average size of holdings in India to just 0.6 hectares, according to the NSSO survey report. About 103 million hectares of land is cultivated in India but it is divided into a staggering 449 million plots of land, some of them just a few hundred square feet in size. Just 6% of cultivated land is in 10 hectare or larger holdings. So, what needs to be done? Regionally differentiated policies are needed to protect the

interest of smallholders, says Joshi. Agro-processing contract farming, cooperatives, cluster farming and farmer producer organizations need to be strengthened by attracting corporate sector in agri-business, he suggests.

Taking a different view, Ramachandran urges ensuring credit to small holders, delivery of extension services to bring best scientific progress, subsidized inputs like fertilizers and pesticides, and availability of irrigation water. "Increase in public investment in agriculture is the key to provide sustainable and dignified livelihoods to our farmers. Their issues have become marginalized and they need to be given top priority," he said.

### **Planting method for better yield in coconut**

Reasons such as decreasing yields, lack of commercial returns and problems like eriophid mite and black headed caterpillar menace are forcing coconut farmers to grow other crops in place of the trees. "Not only for coconuts but also for any other crop the ability to maximise the yield is important for a farmer and Mr. Renukarya has been able to prove that by changing the planting method, yield can be increased in coconut," says Dr. T.N. Devaraja, Programme Coordinator, Taralabalu KVK, Davanagere.

Mr. M.K. Renukarya from U. Kallahalli village in Davangere district, who worked as farm manager in University of Agricultural Sciences (UAS), Bengaluru, for three decades,

wanted to use his experience to change this situation. He started in his own land which is drought prone and unfertile, to demonstrate cropping pattern in dryland horticulture. In order to increase the number of coconut palms per unit area and to get maximum income, Mr. Renukarya adopted a new system of planting called pentagonal and paired system of planting which is his own innovation. Conventionally, coconut seedlings are planted in straight lines in fields. Further, if they are to be planted on field borders single seedlings are planted at closer or wider distances.

In pentagonal type of planting, seedlings are placed in such a way that one plant is planted in centre and

four plants at a distance of eight feet in all four directions. A pit for planting is dug and inputs like water, manure etc are placed into it along with the seedlings. Organic wastes are also dumped into the pits which act as vermicomposting sites. The whole area is covered with fallen coconut fronds and other organic waste. In paired system, the inter-space between the seedlings is reduced to six feet. Two plants are planted in a three cubic metre pit filled with coconut husk, compost, red earth tank silt etc. The entire pit is covered with fallen coconut fronds and other available organic waste of farm. In between the coconut seedlings arecanuts are also planted. Along with this, fodder grass and legumes are also planted on the field bunds for fodder for cattle. Two trenches are dug about eight feet away from the pit which act as catchment for rainwater.

“Paired and pentagonal planting of coconut accommodates more number of coconut palms. In normal system 56 seedlings are required for an acre. In this system 70 seedlings

may be required. Though initial cost of planting using labour might be a bit more, by this method each tree has been found to yield an average of 80 nuts a year. “This is significantly high because in the conventional planting trees in the region yield anywhere between 55- 65 nuts a year depending on the region,” says Mr. Renukarya. The cultivation cost is considerably reduced since once planted and manure applied the trees do not need maintenance except watering. Paired and pentagonal planting of coconut has almost doubled the palm population when compared to conventional method of coconut planting,” he says. In addition to coconut, the farmer has dug five farm ponds for growing fishes. The ponds also help in groundwater recharge for not only in his farm but also surrounding farmers’ fields. Meticulous farm planning is the basic tool to maximize farm income according to him. The farmer has received the best farmer award by University of Agricultural Sciences, Bengaluru.

### **Integrated management of grapevine thrips**

Grapevine thrips is the most destructive pest in India. It also damages other crops such as jamun, guava, mango, cashew nut, rose, etc. It is active during March-May and September-October. Adults and nymphs feed by rasping on the ventral side of the leaves and flowers’ stalk and suck the oozing sap. As a result of their intensive feeding, leaves develop silvery white scorches and gradually get deformed and fall

down. The attack on flower stalks result in flower shedding. The feeding on the developing berries results in scab formation.

There are two other species of thrips such as *Scirtothrips dorsalis* and *Thripshawaiiensis* which exclusively attack blossoms and developing berries causing scarred fruits resulting poor quality and low price in the market. The life cycle of this thrips is completed in 11 to 25



days according to weather conditions and there are five to eight generations in a year. They undergo hibernations as pupae deep into the soil surface during winter. Young nymphs appear reddish and adults are yellowish brown. They reproduce both in sexual and parthenogenetic ways.

### **Integrated Management**

— Varieties of grapevine with thick and hairy leaves are known to be tolerant to thrips attack.

— Collect and destroy damaged leaves, fruits and flower.

— Install 10-13 blue / yellow sticky coloured sheets traps/ha.

— Grow cowpea around the field bunds to conserve predatory

coccinellid beetles.

— Raise eco-feast crops viz. castor, mustard, sunflower, marigold and coriander around the crop to conserve and encourage entomophagous insects.

— Spray beauveria bassiana at 5 ml or 5 g/lit under humid climatic conditions.

— Apply 500 ml of malathion or 1.5 kg of carbaryl 50 WP in 500 litres of water per 100 vines.

— Spray methyl demeton 25 EC at 2 ml/ lit, dimethoate 30 EC at 2 ml / lit, monocrotophos 36WSC at 1.25ml/lit, quinalphos 25EC at 1ml/lit, or ethion 50EC at 1ml/lit

### **Handy cycle weeder for small farmers**

Weeds are the biggest problem in crop production. Nearly 30 to 50% of yield loss is due to weeds. These unwanted plants remove nearly 25 to 60% of nutrients from the soil making them unavailable for plants and also act as host for several pests and infestations. Weed management is a big problem mainly because of labour shortage. Agricultural activity in India is largely labour based and shortage of manual labour has a direct impact on crop production. Tarabalu Krishi Vigyan Kendra in Davanagere recently introduced a cycle weeder for farmers in the region, priced at an affordable rate, and easy to operate for removing weeds, according to Mr. B.O.Mallikarjuna, specialist at the institute. "In the training, we had

demonstrated the use of this device for weeding different crops. After the training programme, selected farmers were given the weeder for use in their own farms under our technical guidance. "We suggested to farmers that it can be used for all the crops like groundnut, sunflower, maize and vegetables with the spacing of 30-40 cm between the lines and 15-20 cm within the plants," says Dr. T.N. Devaraja, Programme Coordinator.

As a trial, the weeding technology was demonstrated in a vegetable field of a farmer, followed by frequent visits by the KVK team to access and record data on weed menace, time taken by the device for weeding, and yield. Farmers using this device expressed their satisfaction that the

weeder was well suited for those whose land holding was two acres or less. Though it can be used for any crop it is best suited for vegetables since the space between plants is more for operating this device. The weeder can penetrate the soil to a depth of 2-2.5 cm. It can be used for weeding 1 to 1.5 acre in a day and can be either operated by a single person or/and also attached to bullocks. It is ideal to use this device after 15-20 days of planting the crops in the main field.

Previously manual labourers were used for weeding work. The main problem with labourers is that many of them were inefficient and demanded high wages during planting, weeding or harvesting time. "Unlike foreign countries, where hundreds of acres are available without any borders, in India it is the other way around. Here 80 percent of our farmers are small and marginal growers with small land holdings divided by bunds on all four sides making it difficult to use big machines for any operations. Also

the hiring charges per day are quite heavy and may not be feasible for a small farmer. For such people this type of machine may be useful," says Mr. Mallikarjuna.

Mr. Renukarya, a retired agriculture scientist who has been using this device says: "I have been using this machine and find it beneficial as I don't need to depend on external man power for operating it. I think this is the best technology for future agriculture when land holdings are reducing in size. "The population is increasing day by day but not the land and there will be more fragmented lands in future and this type of device will be very suitable for small farmers." The machine operates efficiently when the field is irrigated for the device to pull out the weeds. Farmers should note that the field must not be hard since it would be difficult to use the device. Taralabalu KVK is popularizing this technology in and around their region. The weeders are priced at ₹2,000 to ₹2,500 a piece.

### **Managing fruit fly in Mango**

The mango fruit fly is believed to be the single largest crop damager in India. It accounts for about 27% of harvesting loss. The flies attack semi ripe and mature fruits during the months of April and May. Other fruits like guava, citrus, plum, peach, sapota, loquat, etc are also susceptible to this pest attack. Damage is caused both by adults and maggots. Adult female punctures the rind of near ripe fruits with its needle

like ovipositor and lays eggs. The legless yellowish maggots after hatching bore and feed on fruit pulp and on maturity come out of the fruit, drop on the ground and pupate deep under the soil. Thus the maggots destroy the pulp making it foul smelling and discoloured. Infested fruits develop brown rotten patches on them and fall to the ground ultimately.

### Management

— Collect the fallen infested fruits and dispose them by dumping and burying in 60 cm deep pits.

— Plough the interspaces in the orchard during summer to expose fly puparia to kill them under hot sun rays.

— Timely harvest of mature fruits should be done and the fruits may be treated with hot water for one hour at 48 degree celcius.

— Install methyl eugenol traps at 6 nos./acre.

— Adopt male annihilation technique of using bait traps with 100 ml of 0.1 per cent methyl eugenol

### **Thuthukudi farmers grow beans to overcome water shortage**

Thuthukudi district in Tamil Nadu is largely rainfed. Cotton, sunflower, maize, pulses, millets are some of the crops grown in the district which has predominantly black soil. Farmers are heavily dependent on the monsoon for their crops. Prolonged drought, hot and humid conditions, high evaporation, irregular monsoon are some of the chronic problems plaguing the cultivators in the region for a long time. Farmers with borewells and open wells seldom opt to grow crops like brinjal, chilli, tomato, banana etc. Since vegetable crops are highly sensitive to climate and temperature change. By the time they are harvested and packed to the market they shrivel because of the heat.

Because of these problems, coupled with low level in the ground water table, cereals, minor millets and fodder crops are the preferred

(1ml/lit) and 0.05 per cent malathion 50EC (1ml/lit) taken in 250 ml capacity wide mouthed bottles fitted with hanging devices.

— Another poison bait may be prepared by adding 100g of jaggery and 2ml of decamethrin 2.8EC in 1 lit of water and sprayed on the tree trunks at weekly interval. The bait could be sprayed on the nearby hedges and vegetation.

— Spray deltamethrin 0.025% thrice at least 15 days interval commencing 45 days after fruit set.

— Spraying of 0.03% dimethoate up to two weeks period to picking the fruits is also effective.

crops. Some two years back, the percentage of farmers growing vegetables had practically dropped to nil because of water scarcity. SCAD (social change and development) KVK selected 10 villages in Vilathikulam block and decided to grow Dolichos bean variety (called Avarakkai in Tamil) on a trial basis in five farmer's fields to assess the yield potential. The results obtained were quite encouraging and it was decided to extend the cultivation to 10 more farmers' fields. "The variety Dolichos CO 14 is capable of producing 8-10 tonnes of green pod per hectare and the crop fetches a maximum of ₹38 a kg and minimum of ₹22 a kg from the local vilathikulam market. Farmers are able to earn more than ₹85,000 to ₹90,000 as net income in hardly 100 days. After seeing this, more than 100 farmers have approached us for seeds," says Dr. G Alagukannan

Programme coordinator, Vagaikulam, Thuthukudi.

Plans are on to bring in 150-170 acres under this bean cultivation. Five farmers have been identified to produce seeds to meet the demand of the farmers. "This bean variety needs to be popularised in a larger way in areas where the farmers are having issues like less water and adverse condition in the ensuing season," he says. A complete package of practices is provided from the kendra. Farmers were advised to sow seeds at 45x30cm spacing after treating it with Rhizobium solution.

The first flowering was on the 38<sup>th</sup>

### **Seedless Cucumber hybrids in polyhouses**

The Kerala Agricultural University (KAU) has developed a seedless hybrid cucumber that is ideal for polyhouse cultivation. This is the first such hybrid developed in South India by a public sector research team. Polyhouse cultivation requires specific cultivars in each crop and farmers presently depend on the seed produced in countries like Korea, Thailand which are imported and marketed by multinational companies in various names.

The Government of Kerala has accorded high priority to polyhouse cultivation by providing subsidy schemes for setting them up in all the 1,000 odd panchayats in the state. Farmers depend on corporate sector for hybrid seeds and the price of cucumber hybrid seed ranges from ₹5-7 per seed. Thus development of this hybrid by the University is

day after sowing and it continues up to 80 days. About 30ml of effective microorganism (EM) in one litre solution is to be sprayed on 45<sup>th</sup>, 60<sup>th</sup> and 75<sup>th</sup> day to boost the flower and fruit production. In addition to this three gm of "vegetable special" a crop booster was also suggested to be sprayed after diluting it in one litre on 40<sup>th</sup>, 55<sup>th</sup> and 70<sup>th</sup> days. To control the fruit borer and jassids a spray with 20ml of neem oil in one litre with soap solution was resorted. The crop comes to harvest on the 52<sup>nd</sup> day after sowing and one can harvest 11 times from a single crop, according to Dr. Alagukannan.

significant as it offers increased availability of indigenously developed seed at affordable rates to farmers, paving way for a fillip in poly house Cucumber cultivation.

KAU Cucumber Hybrid-1 (KPCH-1) is found to be significantly superior to commercial hybrids with respect to fruit number, yield and earliness. The Research extension advisory council of the University has recommended this hybrid for testing across polyhouse in all districts. The research team which developed this hybrid had earlier developed seedless hybrids of yellow and red watermelon, for the first time in the country.

Cucumber is an ideal vegetable variety for polyhouse cultivation as the fruit is harvested at an immature stage and vertical height of the polyhouse structure can be exploited

for producing more fruiting nodes. Normal varieties bear both male and female flowers and require pollination for fruit development. Honey bees act as the pollinator. However protected structure

prevents the entry of all insects including honey bees. Hence only specific types which produce fruits without pollination can be cultivated inside polyhouses.

### **Effectiveness of sex pheromones in IPM**

Sex pheromones are generally produced by female insects to attract males of the same species for mating. In Integrated pest management (IPM), pheromones are used in different ways such as monitoring through trap catch, killing through mass trapping, mating disruption and attracticide (lure and kill) methods. Pheromone traps in stored insect management can be used to detect both the presence and the density of pests. They are useful to define areas of pest infestation, particularly where the overall distribution and life cycle are poorly understood.

Their purpose is to achieve a more accurate control and to limit the usage of insecticides to only when strictly necessary. Pheromone traps are generally effective when pest numbers are very low and so they can be used qualitatively to provide an early warning of pest incidence. To successfully capture attracted pest insects, a trap has to be escape-proof, which can be achieved by a sticky surface to which the trapped insects become irreversibly attached or by some kind of funnel or pitfall

systems. In the case of female-produced sex pheromones only males are trapped. Hence, any attempt to suppress the population by trapping males would require a sufficient number of trapped males so that nearly all females would go unmated.

Theoretical considerations of mass-trapping males take into account the density of males in the population and the potential number of matings a male is able to secure in its lifetime. If a male can mate with ten females in a lifetime then up to 90% of the male population can be trapped without affecting the number of mated females as well as the subsequent larval generation. The attracticide (or lure and kill) concept-based method involves using a pheromone to lure insects to a specific point source or an area whereby they contact a toxicant which causes a rapid kill or contamination with some kind of pathogen. In the protection of stored products there are many promising results on the use of the attracticide concept in flour mills and confectionary industries.

### **Nendran Banana and Rose Onion got GI tag**

Kerala's sumptuous Nendran Banana and Karnataka's Bangalore

Rose Onion have got geographical indication (GI Tag) registrations from

the Geographical Indications Registry, Chennai. Chengazhikodan Nendran Banana, also known as Chengazhikode Banana, is among the most popular traditional fruits cultivated in Thrissur district, Kerala. This variety of Nendran Banana is famed for its characteristic taste, bunch shape and fruit colour. The mature fruits are pale yellow and, on ripening, turn golden yellow with red patches.

Bunches of Chengaliodan are particularly used as 'Kazhchakula' (auspicious sighting) to be offered in temples and also as gift to relatives and friends, particularly during the Onam season. The crop is mainly cultivated in organic mode and the crop duration is 13-14 months. The Chengaliodan Banana Growers' Association, Erumapetty, was given the registration. The Bangalore Rose Onion grown in Bangalore and its surrounding areas is famous for its high pungency compared to other varieties.

Geographical indication (GI) refers to any indication that identifies the goods as originating from a particular place, where a given quality, reputation or other

characteristic of the goods is essentially attributable to its geographical origin. Chinnaraja G. Naidu, Assistant Registrar of the Geographical Indications Registry, said GI helps a community of producers to differentiate their products from competing products in the market and build goodwill around their products, which often fetches a premium price.

As per the Act, any association of persons or producers or any organization established by or under any law for the time being in force representing the interest of the producers of concerned goods, can apply in writing to the Registrar of GI. Among GI tag recipients are the Naga Tree Tomato, Arunachal Orange, Sikkim Large Cardamom, Mizo Chilli, Assam Karbi Anglong Ginger, Tripura Queen Pineapple, Tezpur Litchi, Khasi Mandarin and Kachai Lemon, handicraft items such as Khurja Pottery, Banaras Gulabi Meenakari Craft, Varanasi Wooden Lacquer Wear and Toys and foods such as Ratlami Sev of Madhya Pradesh, Joynagarer Mocha from West Bengal and Rajasthan's Makrana Marble.

### **Small growers join forces to build their own warehouses**

Germalam in Erode district, Tamil Nadu, is covered by thick reserve forests. Agriculture and livestock are the key livelihood for the people there. The land holding of each farmer is about one to three acres of dry land where cultivation predominantly depends on the monsoon. Maize is the main crop

grown extensively apart from ragi, lablab, tapioca, black gram, horse gram and french beans as minor crops.

"The small farmers used to borrow from moneylenders at 3-5 per cent interest per month for purchasing seeds and fertilizers and the moneylenders usually arrived at the



farm during harvesting season — and took away from the farmer a volume of produce equal to the loan principal and interest. “Being indebted, farmers did not have much control over the rates the moneylenders fixed. Besides, the moneylenders used their own faulty weighing scales,” says Dr. P. Alagesan, Programme Coordinator, Myrada (Mysore Resettlement and Development Agency), Gobichettipalayam, Tamil Nadu. Farmers therefore lost out both on rates as well as the weight of their produce. Since they had no idea of the market availability or the prevailing rate for maize they did not have much choice. Some of them tried to market the produce themselves but the high cost incurred on transportation (especially, since they had small volumes each) forced them to sell the maize as soon as it was harvested. And the market was a buyers’ arena. Traders offered low prices for the produce taking advantage of the fact that the sellers were not locals and had come from faraway places. Farmers were often forced to agree to the buyers’ rates as they wanted to go back home early and there were costs involved for storing their maize in warehouses.

Stored grain also lost moisture and its quality deteriorated. There was not enough place in Germalam to store all the maize. A decade back when this problem was being discussed among the local community one of the ideas that

emerged was the construction of community warehouses in their own areas. Accordingly they approached Myrada institute in their region to see whether this was possible. Based on the area of maize grown and the number of farmers who would directly benefit from this project, it was decided that two warehouses could be constructed in two villages. Both the warehouses would be managed by the self-help groups in the respective villages. Since it was community managed and maize being a seasonal crop, both the warehouses did not require year-round management. “The model cut labour costs as farmers themselves brought in their produce from their farms to the warehouse. No full time staff was required. Members from the local self-help groups volunteered to work for free. Therefore the annual maintenance costs for the warehouse was as low as ₹1,000 — mainly for whitewashing and cleaning and this was paid out of the warehouse account,” explains Dr. Alagesan.

The warehouses charge different rentals for those who have contributed to its construction — chiefly self-help groups and outsiders. The groups pay a rent of ₹1 per bag stored per month. Other individuals pay ₹1.50 per bag per month. No additional charges are levied as the transportation, loading and unloading costs from the farm to warehouse are borne by producers themselves. After deducting all the expenditures, the warehouse

committee bank account currently has a balance of about ₹30,000.

Based on the success of these two warehouses the government has also come forward to support setting up of two more warehouses with active support from Myrada. Presently the four warehouses constructed by the Myrada Germalam Project have

### **Smart technologies for water management in crops**

Irrigation projects have always been part of the top agenda in any government policy. "Irrigation projects are like bank ATMs. One knows how much water is being released from reservoirs but does not know how each drop is being distributed or utilised. The interest shown in creating infrastructure is not shown in management of water resources. Without monitoring water use, its management is not possible," says Dr. N. Sai Bhaskar Reddy, Coordinator, ClimaAdapt Project, Walamtari, Andhra Pradesh.

Walamtari is a government organisation in Hyderabad serving farmers of both Telangana and Andhra Pradesh States. Presently they are working on low cost sensors for water use efficiency, soil moisture and environmental parameters, through a project called Clima Adapt, supported by the Norwegian Government. "Unlike in olden days, today several smart technologies like sensors are available to monitor water resources distribution and utilisation. The cost of monitoring water usage with the aid of these technologies is more reliable and convenient as compared to human

proved their worth and the government is rapidly replicating the programme. Apart from the three already supported by the government, six more are being build in the Kadambur and Thalavady hills in collaboration with the District Rural Development Agency (DRDA).

resources engaged for monitoring," says Mr. Bhaskar Reddy. All the farmer needs to do is to buy and install one or two sensors in his field and irrigation outlets in the fields for measuring water flow, soil moisture, temperature and relative humidity in the atmosphere. Once every two to three hours information on the above is sent to the farmer's mobile as a message.

As part of a project to popularise it and bring awareness among farmers Walamtari set up sensors for measuring water use in paddy crops in the field of a beneficiary farmer Mr. K. Prabhakar from Kondrapole village, Miryalaguda, Nalgonda District, Telangana. Mr. Prabhakar, had been cultivating the paddy crop for the last 30 years in about two hectares. He was utilising water without any measurement. "I used to worry when there was no water standing in the field. I was given training and also taken for an exposure visit on alternate wetting and drying (AWD) method in paddy by Walamtari. Through them I learnt that there was no need to keep the paddy field always flooded with water. The water level can be allowed

to even recede 15 cm below the surface. This will not affect crop yield. There is a saving of 30 to 40 % water by this method. “And also the crop production is high as the roots penetrate deeper with receding water and there are more tillers and increase in paddy yield. The crop also stands well. Although all sensors are installed in the field openly, none of the sensors was damaged or lost due to theft” he says.

After setting up the sensors in his field, Mr. Prabhakar is able to get information every three hours on his mobile about the water flow, air temperature, soil moisture etc on his mobile phone. With these systems in place he is able to schedule his cropping pattern as per the requirement. Mr. Prabhakar was

asked to speak to other farmers in his region about his experience and hearing him, farmers growing chillies and cotton have come forward to try and use this technique.

Some farmers expressed that they were also willing to buy these sensors on their own for irrigation management. Sensors are priced at ₹2,000 to ₹3,000. “Being a Government organisation, it does not market sensors commercially. At present a farmer cannot buy directly from us, but we can guide them to the right place from where they can purchase,” says Mr. Sai. Though this is a new concept in an area that already faces several problems, the need of the hour is for farmers across the country to become aware about this concept and try them personally.

### **Management practices for mango malformation**

Mango malformation is a fungal disease. It was reported for the first time from Darbhanga, Bihar. The disease is more in northwest than in the northeast and South India. Malformation is one of the most important problems of mango and a serious threat. This disorder is widespread in flowers and vegetative shoots. Broadly three distinct types of symptoms are there. These are vegetative malformation and floral malformation. Later, these were grouped under two broad categories that is vegetative and floral malformation.

Vegetative Malformation (VM) is more commonly found on young seedlings. The seedlings produce small shootlets bearing small scaly

leaves with a bunch like appearance on the shoot apex. Seedling remains stunted and die while those getting infected later resume normal growth. Floral malformation (FM) is the malformation of panicles. The severity of malformation may vary on the same shoot from light to medium or heavy malformation of panicles. Heavily malformed panicles are compact and overcrowded due to larger flowers. They continue to grow and remain as black masses of dry tissue during summer but some of them continue to grow till the next season.

#### **Management**

— Diseased plants should be destroyed. Use disease free planting material.

— Scion sticks from infected trees should not be used.

— As soon as the disease appears, the affected terminals along with the basal 15-20 cm healthy portion should be removed or pruned and burnt.

— If more than 25% plant is affected, de-blossoming at bud burst stage should be done to delay the

flowering.

— Spraying of Planofix (200 ppm) during the first week of October followed by deblossoming at bud burst stage is recommended.

A single foliar application of 1,000 ppm cobalt sulphate prior to flower bud differentiation successfully reduce the floral malformation.

### **ICRISAT to step up focus on ‘smart crops’ millets**

As millets making a slow but steady comeback, Icrisat has said it would have a special focus on millets, which it considers ‘smart crops’, considered the life-line of small and marginal farmers in semi-arid areas. Headquartered at Patancheru, the International Crops Research Institute for Semi-Arid Tropics (ICRISAT) has said sorghum, pearl and finger millets are among the mandate crops. Icrisat’s Director-General David Bergvinson has said that millets played a crucial role for countries such as India, with

a large number of small and marginal farmers. “They are rich in nutrition and consume less water. These water- efficient crops are relevant for India. They help farmers face the changes in climate,” he added.

Icrisat has gathered about 6,000 finger millet germplasm accessions from 24 countries for conservation and research and development. He said his immediate priorities as the head of the institute was to focus on demand-driven innovation and to make agriculture viable for farmers.

### **Water farms with a tap on your phone**

Vijay Bhaskar Reddy Dinnepu spent most of his childhood on his family’s field in rural Andhra Pradesh, sitting in front of the irrigation motor pump, devotedly monitoring it. On days when he was distracted by friends and wandered off, the motor would crash due to voltage fluctuations. After a 12-year stint at technology corporations like Intel and Cisco, Dinnepu, an IIT-Madras graduate, launched Vinfinet Technologies Ltd to provide automated irrigation solutions to Indian farmers. In 2012, the

company launched its first product, Kisanraja. The box-shaped device sits next to the motor. With it, phones become remote controls for irrigation pumps. All it needs is power supply and a working sim card. Through Interactive Voice Response (IVR) in the local language, the device informs the farmer when the power is back on and kick-starts the motor if the farmer chooses to. The device is designed for an Indian setting - where power supply is unscheduled, and farmers are housed far away from their fields. Advanced models

also alert the farmer when the water level goes down in the borewell or when there is an attempt to forcibly remove the device. Investors who back ventures focused on the agri-sector are of the view that startups enabling efficiency in agriculture through technology will gain attention.

"The key is good margins and differentiation in the product / sourcing strategy," said Srikrishna Ramamoorthy, Partner at Unitus Seed Fund India, which specialises in impact investing. At present some 15,000 farmers use the device developed by Vinfinet. For farmers

### **Success saga in inland farming**

Farmers in the country usually follow the agricultural practices only after successful practices and inventions set by scientists of government and public sector research institutes and Universities. K. Saseendran, a progressive farmer at Thekkumthara in Kerala's Wayanad district has distinguished himself by setting a model in conserving the endemic and endangered fish varieties of the district to be emulated even by the government institutes.

Saseendran set up the first, and only, hatchery in the district in 2011 to provide fingerlings of edible and ornamental fish to other farmers. Ornamental fisheries has become a lucrative venture for farmers in the recent times. While the Fisheries department and research institutes keep away from efforts to conserve the endemic and endangered fish

like KesuPatil, owner of 2.5 acres of farmland in Pura village of Mysore district, who lives nearly 20 kms away from his farm, the device has proven to be more than just useful. "Earlier, I had to keep a man at the farm just to monitor the motor. With this instrument, I saved that money and got return on the investment in a few months," said Patil. For Dinnepu, who estimates the number of irrigation pumps in use on Indian farms to be in the number of two crore, the challenge now is to ensure that more farmers start using his device.

wealth of the State, Saseendran, a national award winner in inland fisheries in 2013, has taken the bold initiative to breed and propagate the rare fish varieties. He also bagged the state award for the best inland fish farmer in 2011. "When I first set up the hatchery, some tribal fishermen brought my notice the dangerous extinction of various species of fish endemic to Wayanad, especially of the River – varieties. They claimed there were nearly 62 species till a decade ago, but the number has now shrunk alarmingly due to the unethical application of pesticides on banana and ginger crops, the two major cash crops in Wayanad", he says.

At first he was able to collect the breeding stock of only one of the species, locally called Cherumeen (Channamarulius), three years ago. Chrumeen grows up to 7 kg a year.

He could produce nearly 2,000 fingerlings in a year from the original stock, and started selling to the farmers. He also collected a breeding stock of 200 fingerlings of Varaal (*Channa striatus*), another endangered species of fish. Inspired from the success of Mr. Saseendran, the Fisheries department in Wayanad is now planning to set up an aqua park of endemic and endangered fish varieties of the district, at Pookode Lake at a cost of ₹20 lakh. A major issue to be faced by the fish farmers of the district is the high cost of fish-feed, which takes up nearly 60 percent of the production cost in fish farming, according to B.K. Sudheerkishan, Assistant Director, Kerala Fisheries Department. Saseendran has successfully developed a low-cost feed made from locally available materials (rice, wheat, millet and Cassava etc) to help reduce the production cost in fish farming.

The Aquaculture Development Authority of India has selected four farmers for a trial plot to cultivate Genetically Improved Farm Tilapia (GIFT) project and Mr. Saseendran is one among them, Mr. Sudheerkishan, says. Mr. Saseendran also runs a free farm school titled 'Shyam farm school' near his house to impart his knowledge on aqua culture to other farmers, especially novices to the sector. Saseendran entered into the venture of inland fish farming when the Kerala state Fisheries Department had launched the People's Fish Culture Programme in

2002. In that year he started fish farming by depositing nearly 150 fingerlings of *Cyprinus carpio* (locally called Chembally), *Labeo rohita* (rohu), and the common grass carp (*Pomoxis anabeta*) in a small pond made on one and a half cent of land.

However he failed in his first stint, primarily due to lack of technical know-how. But he did not give up. The very next year he deposited nearly 200 fingerlings of the same varieties of fish, this time with the help and direction provided by the fisheries department officials. He could harvest nearly 3 quintals of fish — that was his first taste of success. Gradually he started to expand, and now he rears seven species of edible and 14 species of ornamental fishes in 16 ponds spread over his five – acres of land. “I harvested nearly four tons of edible fishes and sold hundreds of ornamental fishes last year. Marketing is not an issue, as the demand for the fresh water fish is very huge in the hill district of Wayanad”, affirms Saseendran. Farmers in Wayanad are taking to inland fish farming for better income, inspired by the increasing number of success stories in the sector. When the Department started 'Matsya Samrudhi' project in 2009 there were only 400 farmers to pick up the venture. But now there are around 4000 farmers ready to try their luck in fish farming. The farming area also has gone up, from 20 to 190 hectares,” Mr. Sudheerkishan added.



## **Trap crops in insect pest management**

Trap crops are the plant stands that are grown to attract insects or other organisms to protect target crops from pest attack. Protection may be achieved either by preventing the pests from reaching the crop or by concentrating them in certain part of the field where they can economically be destroyed. The principle of trap cropping rests on the fact that virtually all pests show a distinct preference to certain crop stage. Manipulation of stand in time and space so that attractive host plants are offered at critical time in pests and the crop phenology leads to the concentration of the pests at the desired site, the crop.

Farmers are being motivated to utilize trap cropping because of the difficulties in cropping with the pest situations in other ways. Some times the cost of chemical pesticides and the number of treatments required is so high that more economical ways have to be developed, additionally, the pests have often evolved resistance to commonly used pesticides, which requires some alternative control strategies. Further, motivations to use trap cropping are economical and environmental benefits are often associated with this strategy. Besides, its potential role in improving the environmental soundness, trap cropping techniques may have special preference of conventional agriculture to sustainable farming in developing countries.

Additionally, the increasing sector of organic farming also could exploit this strategy of pest control. Yet another function of trap crop is their use of attracting natural enemies of pest insects to the fields and concentrating them there to enhance naturally occurring biological control. The essential features of the trap cropping are that the trap crop must be attractive to the pest then the main crop, it should occupy small area as far as possible and it should be established early or later or along with the main crop.

The important trap crops commonly used in pest management included, bhendi/okra in cotton to trap bollworms at the ratio of 1:10 and marigold at the border of the field. Sesamum is commonly being used as trap crop to attract Diamondback moth in both cabbage and cauliflower. Two rows of sesamum for every 25 rows of cabbage or cauliflower can be planted to trap the pest. In groundnut, castor or sunflower can be used to attract leaf eating caterpillar on the border of the field. In tomato marigold or cucumber is commonly used as trap crop for every 15 rows of the main crop to attract tomato fruit borer. In case of field beans, chrysanthamum acts as a trap crop against leaf minor. Marigold is a potential trap crop in potato and rice against nematodes and snails, respectively. To trap corn stalk borer in maize sorghum has been exploited as trap crop. Bihar

hairy caterpillar in cowpea can be trapped by planting Gingelly.

Trap cropping has indicated a great benefit in terms of economic returns on an average of 10-30 per cent increase in net profits mainly resulting from reduced insecticide use and pest attack. Trap cropping is

### **From ‘per acre’ to ‘per drop’**

Prime Minister Narendra Modi, said India needs a “second” Green Revolution. But unlike the “first” one that was centred in North-West India — basically Punjab, Haryana and western Uttar Pradesh — the cradle of the next Green Revolution will have to be Eastern India, covering east UP, Bihar, Jharkhand, Odisha, West Bengal and Assam. The main reason for this — although Modi did not specifically allude to it — is water availability.

The Commission for Agricultural Costs and Prices (CACP), in its latest Price Policy for Kharif Crops report for 2015-16, has shown that the average Punjab farmer uses as much as 5,337 litres of water from irrigation to produce one kg of rice. As opposed to this, the irrigation requirement is just 2,605 litres for every kg of rice in West Bengal. Paddy farmers in Assam, Bihar and Odisha — besides Karnataka and Andhra Pradesh — are also more water-efficient relative to their Punjab and Haryana counterparts. Much of this has to do with policies that encourage inefficiency in domestic resource use. Paddy yields in Punjab, at 5.8 tonnes per hectare, may be higher than the 4.1 tonnes for

a useful strategy in the management of several pests in various cropping systems. It offers significant economic and environmental benefits and it can successfully integrated with cultural, biological and chemical control methods.

West Bengal or the all-India average of 3.6 tonnes. But the most efficient state in terms of land productivity isn’t necessarily the most efficient with regard to use of the other important factor of production: water.

Punjab receives hardly 40 per cent of the monsoon rainfall than West Bengal, Bihar or Odisha get and just over a quarter of Assam’s seasonal average. Yet its farmers grow paddy. And they do mainly by drawing groundwater, that too during the summer months when evaporation rates are high as well. “Rice as a crop is clearly not suited for Punjab. The state, in fact, used to traditionally grow makka (maize) and sarson (mustard), which it no longer does. Today, given the increasing scarcity of water and depleting of aquifers, the focus has to be more crop not just per acre of land, but also per drop of water,” says Ashok Vishandas, chairman, CACP. That would mean promoting rice cultivation more in states (Eastern India) where water is relatively abundant.

The CACP report has recommended metering of electricity and water used in irrigation alongside fixing of quantitative

ceilings on a per-hectare basis. Farmers who use less water/electricity than the prescribed ceilings may be rewarded through cash incentives equivalent to the unused units valued at the

appropriate market rates. This would encourage farmers to go in for drip irrigation, direct-seeded rice production and other such practices, leading to improved water use efficiency in agriculture.

### **Organic farming in mulberry for sustainable silk production**

Indiscriminate use of chemical inputs is an indeterminable setback to many industries associated with agriculture. Similarly is the case in sericulture. Mulberry, the food plant of silkworm is a perennial crop and once planted can be maintained for years together without much effort. Production of quality mulberry leaves is mandatory for the sericulture farmers to ensure healthy growth of silkworms and better silk thread harvest. Therefore the agronomical practices such as application of fertilizers, weeding, irrigation, plant protection measures at bimonthly intervals after each leaf harvest are important for good and healthy leaf production.

Like in many crops, here too chemical inputs are indiscriminately applied to gain short term results. "In general one acre of mulberry garden receives 1.5 metric tonne of fertilizers and 12-15 sprays of toxic insecticides annually which causes deleterious effects on the beneficial organisms and on silkworms," says Dr. V. Sivaprasad, Director, Central Sericulture Research and Training Institute, Central Silk Board, Mysore. Though chemical farming initially yields good results, its negative impact on leaf yield, quality and cocoon productivity is

pronounced in a few years. Therefore, promotion of organic farming in sericulture is imperative to sustain the industry and intensive research on production of organic silk is in the pipeline, he adds.

The institute has already standardised application of a number of organic inputs like farmyard manure, compost, vermicompost, and green manures, and developed special formulations of bio-fertilizers and foliar sprays to minimise the use of chemical fertilizers and to organically promote soil health in mulberry gardens. Other eco-friendly formulations like bionema and nemahari to control root knot nematodes, chetak and navinya for management of root rot disease and spraying strong jets of water on mulberry garden are found effective to manage sucking pests and are advised for farmers. Similarly, thermal weeding and black polythene mulching are also introduced to avoid application of weedicides as well as to overcome the labour scarcity problem for manual weeding.

According to Dr. Sivaprasad, about 12-15 metric tonnes of sericulture waste, comprising silkworm litter, unfed leftover

mulberry leaves, soft twigs, farm weeds etc are obtained from a hectare of mulberry garden annually, from which the plant nutrients such as nitrogen (280-300kg), phosphorous (90-100kg) and potash (150-200kg) as well as all essential micro nutrients can be generated when properly composted. This is nutritionally much superior than farmyard manure. The technology for composting sericulture waste is widely popularised by the institute among growers. Most of the farmers in different parts of the state supplement the nutrient requirement of their mulberry garden with the locally available organic inputs like farmyard manures, composts, pressmud, poultry manures, sheep and goat manures.

Sheep penning is also a tradition practised commonly in Tamil Nadu

### **‘Mulching’ to reduce water and chemical consumption**

After sowing turmeric around late-May/early-June, Avtar Singh covers his entire field with a 3-4 inch-thick layer of paddy straw. “I do it so that my crop and the soil get proper shade from direct sunlight,” says this farmer from Mullanpur in Mohali district of Punjab, while referring to a practice known as ‘mulching’. But wouldn’t having such a thick cover hinder germination? “On the contrary, germination is advanced by 10 days when compared to the non-mulched field, while giving me at least 10 per cent more yield,” claims Avtar.

for enhancing soil fertility naturally. “Organic farmers successfully harvest cocoons all through the season and their average cocoon production is greater than 80 kg per 100 disease free laying while the farmers who practice chemical based farming frequently met with crop failures and their productivity remains below 60kg. Tamil Nadu is leading in silk production mainly because of more adoption of organic farming practices, explains N.Sakthivel, extension scientist, Central silk board, Srivilliputtur. A technical bulletin titled “Organic farming in mulberry: Recent break through,” for the benefit of sericulture farmers, field functionaries and researchers has been published by the board. The details of eco-friendly inputs of sericulture and the packages of organic farming are available on the website [csrtimys.res.in](http://csrtimys.res.in)

Mulching basically involves application of a protective layer of material to the field soil surface just after sowing any crop. The material could be organic and biodegradable (paddy straw, sugarcane bark, dry grass, trees leaves and even newspaper) or inorganic and non biodegradable such as polythene sheets. According to GS Butter, Head of Agronomy at Punjab Agricultural University (PAU) in Ludhiana, mulching is very effective for pest management and disease control. “Weed seedlings cannot survive under the mulch, which also means

not having to use chemical weedicides. Besides, mulching reduces evaporation from the soil bed. This not only brings down the frequency of irrigation, but also protects the soil from erosion,” he explains. Surjit Singh, a retired PAU scientist, points out that biodegradable mulches like dry paddy straw contain 50-70 per cent nutrients that slowly decompose in the soil, enhancing its fertility even without using fertilisers. “Mulching creates an ideal environment for earthworms and other beneficial organisms to grow on the soil. We have been recommended mulching for turmeric, potatoes, sugarcane, melons and all types of vegetables,” he adds.

Sadly though, only a few hundred out of Punjab’s 12 lakh-odd farmers practice mulching. A state with the country’s highest average fertilizer and pesticide usage, apart from 75 per cent of its area under the ‘dark zone’ signifying severe groundwater scarcity, ought to be paying more attention to such environment-friendly practices. Punjab, moreover, produces an estimated 38 million tonnes of straw annually, over half of which is from paddy. While wheat straw is used as cattle feed, there is no such use for paddy straw. About 80 per cent of the latter — some 16 million tonnes — is simply burnt in

the fields after harvesting to clear the land for the next sowing. This abundant straw can potentially be used by every farmer for mulching, thereby addressing a major source of air pollution in the state.

Amarjit Singh from Char Ke village in Jalandhar says that crops normally require irrigation every second day during the summer months. But with mulching, the watering requirement is only after 7-10 days, depending on the crop. At the Punjab government’s Centre of Excellence for Vegetables in Kartarpur near Jalandhar, set up under an Indo-Israel project, scientists are showcasing vegetable cultivation using polythene sheets for mulching. “We use 30 micron sheets to cover the entire fields. Even the open space between the bed rows is covered in order to control weeds. The vegetable seedlings are transplanted in the soil through holes in the sheet that are a few inches apart to maintain plant-to-plant distance,” says Daljeet Singh, who heads the Centre. The sheets, he informs, would cost Rs 12,000-13,000 per acre and can be used in two or more seasons. The polythene mulch enhances crop yields by keeping the soil warm in winters and providing much-needed moisture to the plant in the summer.