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SHG Bank Linkage Programme

An Analysis

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EDITORIAL

The rural poor, with the intermediation of voluntary organizations join together for self help to secure better economic growth. This has resulted in the formation of a large number of self-help groups in the country, which mobilize savings and recycle the resources generated among the members. Self Help Groups (SHGs) form the basic constituent unit of the microfinance movement in India. The SHG movement in India aims to utilize the SHGs as an 'intermediary' between the banks and the rural poor to help drastically reduce transaction costs for both the banks and the rural clients.

Two thirds of country's consumers live in rural areas and almost half of the national income is generated there. Rural and small town economy, which accounts for 60 percent of India's income, has remained insulated from the economic slowdown. It is only natural that rural markets form an important part of the total market of India. Although rural India does offer a vast untapped potential, it should also be recognized that it is not that easy to operate in rural India due to several problems.

Water is lifeline of agriculture. It is a truth in agriculture "If we fail in irrigation, we will fail in agriculture". The Micro Irrigation System is a panacea for irrigation related problems. In this technology, fields are irrigated in the close vicinity of root zone of crop, which reduces water loss occurring through evaporation, conveyance and distribution. Therefore, high water use efficiency can be achieved. The reasons for lower productivity of major crops like onion in India could be mainly attributed to the limited availability of quality seed and lack of development of hybrids, amongst other limiting factors. More recently, increasing quantities of crop residues are becoming available as crop yields and cropping intensity has increased but the off-field uses of crop residues have tended to decrease. Open-field burning of crop residues is recognized as a major contributor to reduced air quality and human respiratory ailments. Of the total crop residues burnt, China and India contributed 44 and 33.6 percent, respectively. A great number of insect species feed on major crops such as alfalfa, a traditional and high nutrition value crop grown in cold arid regions, and some are capable of inflicting serious damage to the crops. Reducing post harvest losses is also a priority.

With increasing emphasis on horticulture and better understanding of the production systems, growers are increasingly adopting management approaches that result in safe, quality produce while maintaining conservation of resources. Several farmer success stories are been evidenced from different parts of the country. Horticulture systems, particularly perennial crops, contribute to protection of soils and minimize mechanical soil disturbance, and reduce erosion, soil salinity and prevent water loss from occurring within the soil. The introduction of day neutral cultivars, fertigation, green houses, standardization of agro techniques and improved storage techniques has revolutionized the strawberry industry.

The Indian economy at present is at a crucial juncture; on the one hand, the optimists are talking of India becoming one of the top economies of the world within the few decades and on the other, a huge Indian population is still living below poverty. If India is to take its due place among the league of developed nations, poverty alleviation must be accelerated and income disparities be reduced in the shortest possible time.

This issue covers the broad spectrum of issues discussed here. We hope you find the articles in this issue informative and enlightening.

Please do leave your suggestions and comments at fa.afcl@gmail.com

A.K. Garg
Editor-in-Chief

I N S

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I D E

Corrigendum

Dear Readers,

Due to inadvertent mistake of a co-author for the article 'Micro Insurance in India - An Overview,' published in the October 2011 issue of Financing Agriculture, the author's name was mentioned Mohd. Arshad Khan, which was incorrect. There were three authors who presented this paper in a conference with following authors.

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SHG Bank Linkage Programme – An Analysis

By **Dr. Rais Ahmad** *

This article is written against the backdrop of last year's MFI crisis in Andhra Pradesh where the Government led SHG Programme and MFIs have been functioning parallel to each other for several years. However during the period from 2005, the MFIs began to woo SHG members aggressively which culminated in the "Krishna Crisis". Matters came to a head with the promulgation of the Andhra Pradesh Microfinance Ordinance in October 2010 in response to suicides by borrowers due to indebtedness to MFIs. The Ordinance was a result of the thinking that:

- MFIs charged usurious interest rates;
- If clients failed to pay on time, MFIs used coercive methods to collect the interest;
- These practices forced the poor to commit suicide;
- MFIs made huge profits and had no social mission to help the poor.

In this context, it is felt that the SHG Bank Linkage Programme presents the most humane and financially viable option to SHGs for setting up micro enterprises for the social and economic wellbeing of the rural women.

Introduction

Poverty is a crucial problem in all developing countries in the present day world. It is felt that the problem of poverty can be solved through a concerted effort by the State. Sustainable livelihood opportunities can be provided to the deprived and the destitute by means of lending asset creating facilities. Micro-credit intervention programme has been well-recognized world over as an effective tool for poverty alleviation and for improving socio-economic conditions of rural poor. In India too, micro-credit is making a strong headway in its efforts to reduce poverty and empower the rural poor. The rural poor, with the intermediation of voluntary organizations join together for self help to secure better economic growth. This has resulted in the formation of a large number of self help groups in the country, which mobilize savings and recycle the resources generated among the members. SHG's are necessary to overcome exploitation and to create confidence among the rural poor for economic self-reliance. These groups enable the poor to come together for a common objective and gain strength from each other to deal with exploitation, which they are facing, in several forms.

India has been adopting rural development through various public policies since independence and the policy makers have been emphasizing upon the need of rural development ever since the advent of planning process in the country. The ultimate objective of rural development was the eradication of poverty and improving the quality of the masses. In formulating rural development policy, the whole approach has been fundamental and has been targeted towards alienating rural poor from the culture of poverty, which has been prevailing over the centuries.

Despite all this, India like most developing countries is facing the problem of extreme poverty especially in the rural areas where a huge population live well below the level at which they could become active participants in the larger economy.

Table 1 given below shows the Percentage of Population and number of persons below poverty line in India over various years.

be cost-effective for the banks and user-friendly for the poor. This way, the poor could relate to banks in a better manner, and the banks, in turn, could consider banking with them as a better business proposition. The challenge, therefore, was to link a large number of economically underprivileged ones to the formal banking sector, in a sustainable and cost-effective manner.

By the late 1980s, the rural financial system had virtually collapsed amid heavy regulations, distraught market conditions, dual lines of control, and mounting arrears. The beginning of 1990 saw India face one of the worst balance of payments crises. In 1991, India undertook a liberalization of its economy. Liberalization had an important bearing on the financial sector; banks, which had turned weak, were confronted with the challenge of making themselves profitable while maintaining their prudential requirements and competing with private and foreign banks in a new liberalized milieu. At this time,

Table 1: People Below Poverty Line in India over Various Years

	Percentage of People Below Poverty Line in India			Number of Persons Below Poverty Line (in Millions)		
Year	Rural	Urban	Combined	Rural	Urban	Combined
1973-74	56.4	49.0	54.9	261.3	60.0	321.3
1977-78	53.1	45.2	51.3	264.3	64.6	328.9
1982-83	45.7	40.8	44.5	252.0	70.9	322.9
1987-88	39.1	38.2	38.9	231.9	75.2	307.1
1993-94	37.3	32.4	36.0	244.0	76.3	320.3
1990-00	27.1	23.6	26.1	193.2	67.1	260.3
2003-04	28.3	25.7	27.5	220.90	80.8	301.7

Source: Compiled from XI Five Year Plan 2007-12, Planning Commission, GOI, New Delhi.

SHG Bank Linkage

Despite various poverty alleviation programmes initiated by Government as well as voluntary organizations, not much difference has been seen in the magnitude of poverty. Notwithstanding an impressive coverage, the formal banking sector has had a limited impact on lending to the poor. Over its entire lifetime, the formal rural banking system in India has struggled to balance the dual objectives of outreach and financial performance. Consequently, there was a need to put in place a new vehicle of financial intermediaries, which could

the rural credit system needed a fresh approach that could induce rationalization of the processes, policy, and regulations and consequently increase returns. Moreover, Asian countries like Bangladesh, Indonesia, Sri Lanka, and Thailand and Latin American countries like Bolivia, Cambodia, and Chile, were effectively adopting the new microfinance approach. One of the reasons for the universal popularity of the approach was the extraordinary repayment rate of 95 percent and more. (Bansal Hema, 2002) The failure of different approaches to provide credit to the poor gave rise to microfinance movement in India, In India the adaptation of the new microfinance approach by rural financial institutions assumed the form of the "Self-Help Group–Bank Linkage Programme". Microfinance groups or self-help groups (SHGs) began to be set up in India around three decades ago. These were essentially mutualities of poor people built up through their own routine savings. (Rath Nilakantha, 2007). Launched by some NGOs in the 1980s, this approach gathered momentum in the 1990s.Microfinance provides an important way to balance the outreach among the rural poor while keep the cost of lending low. To the extent that the costs of credit risk assessment and monitoring can be reduced with the help of NGOs, banks can actually reach out to a large number of truly poor households without incurring heavy transactional expenses.

The SHG movement in India aims to utilize the SHG's as an 'intermediary' between the banks and the rural poor to help drastically reduce transaction costs for both the banks and the rural clients. In India over the last two decades or so, National Bank for Agriculture and Rural Development (NABARD) has been working for linking Banks and SHGs. NABARD's programme Linking Banks and Self-Help Groups focuses on providing sustainable access to financial services to the rural poor, with a focus on those who had been considered un-bankable. By using the existing rural financial infrastructure of 150,000 banking and cooperative retail outlets and linking them to savings and credit groups with joint liability, there are economies of scale and scope, resulting in substantially lower transaction costs (Seibel Hans Dieter and Harishkumar R. Dave, 2002). Self-Help Groups usually at the behest of certain developmental non-government organizations (NGOs), have quietly mushroomed in most districts of India over the last few years. Millions of poor, predominantly women, are now members of thousands of SHGs. Till March 2002 the SHG Bank Linkage Programme of NABARD has covered 461,478 SHGs with total cumulative lending of Rs 1,026 crores (US$218.27 mn). The accumulated savings in SHGs exceeds Rs 875 crores (US$186.31 mn) by unofficial estimates. 90 percent of SHGs financed were exclusive women groups. 444 Banks (121 RRBs, 209 cooperatives banks, all 27 public sector banks and 17 private banks) with a total of 17,085 branches participated in the programme providing credit to about 7.8 million poor households in 488 districts. Average loan sizes were Rs 22,240 (US $ 463) per SHG and 1,300 (US $27) per member (Kropp and Suran, 2002). Providers of micro financial services to the poor include donor-supported, non-profit non-government organizations (NGOs), cooperatives; community-based development institutions like self-help groups and credit unions; commercial and state banks; insurance and credit card companies; wire services; post offices; and other points of sale. NGOs and other non-bank financial institutions have led the way in developing workable credit methodologies for the poor and reaching out to large numbers of the poor (Rauf F. Hansiya and Athambawa Jahfer 2009).

Beginning of the SHG Movement in India

In 1987, a study team led by NABARD comprising of other Indian members of APRACA, conducted a survey of about 40 to 50 organisations of varying sizes and representing various activities and regions; one of them was MYRADA, which had in place an alternate credit system owned and managed by SHGs of the poor. An action research projection SHGs was started by MYRADA in 1987 with NABARD providing a research and development grant. In the same year, the Ministry of Rural Development provided PRADAN with support to establish self-help groups in Rajasthan. Subsequently the pilot project of linking 500 SHGs to banks was started in 1992 with the objective of linking and financing existing SHGs as grassroots intermediaries to banks across the country for both savings mobilisation and credit delivery (Kropp and Suran, 2002). The Pilot phase was followed by setting up of a Working Group on NGOs and SHGs by the Reserve Bank of India in 1994, which came out with wide ranging recommendations on internalisation of the SHG concept as a potential intervention

tool in the area of banking with the poor. The Reserve Bank of India accepted most of the major recommendations and advised the banks to consider lending to the SHGs as part of their mainstream rural credit operations.

What is a SHG?

Self Help Groups (SHGs) form the basic constituent unit of the microfinance movement in India. Although the term self-help group is used in different countries to describe a variety of financial and nonfinancial associations, in India SHG refers to a group of a few individuals – usually poor and often women – who pool their savings into a fund from which they can borrow as and when necessary. Such a group is linked with a bank – a rural, co-operative or commercial bank– where they maintain a group account. Over time, the bank begins to lend to the group as a unit, without collateral, relying on self-monitoring and peer pressure within the group for repayment of these loans. SHG is a group of about 20 people from a homogeneous class, who come together for addressing their common problems. They are encouraged to make voluntary thrift on a regular basis. They use this pooled resource to make small interest bearing loans to their members. The process helps them imbibe the essentials of financial intermediation including prioritization of needs, set terms and conditions and maintain accounts. This gradually builds financial discipline & credit history for them, as the money involved in the lending operations is their own hard-earned money saved over time with great difficulty. This is 'warm money. They also learn to handle resources of a size that is much beyond their individual capacities. The SHG members begin to appreciate that resources are limited and have a cost. Once the groups show this mature financial behaviour, banks are encouraged to make loans to the SHG in certain multiples of the accumulated savings of the SHG (Puhazhendi V and K.C. Badatya, 2002). The SHG Bank Linkage model of NABARD focuses on participation, capacity building and empowerment of members and clients. This is a process oriented model where high emphasis is given on savings and credit activities through capacity building of the members who are organised into SHGs. Client base is built up over a period of time in a participatory manner. Creation of sustainable community basic institutions is the core component of this model. SHG bank Linkage

Programme adopted by NABARD with partner agencies has emerged as a socially significant as well as commercially viable credit delivery model (NABARD: 2004).

The overall strategy adopted by NABARD relies on two main planks: (i) expanding the range of formal and informal agencies that can work as SHG promoting institutions, and (ii) building up capacities of the increasing number of stakeholders. The key to all such initiatives has been training and capacity building of various stakeholders including the SHG members themselves (Puhazhendi V. and Badatya K.C. 2002). NABARD has been instrumental in facilitating various activities under microfinance sector, involving all possible partners in the arena. It has been encouraging the voluntary agencies, bankers, socially spirited individuals, other formal and informal entities, and also government functionaries to promote and nurture SHGs. The focus in this direction has been on training and capacity building of partners, promotional grant assistance to Self Help Promoting Institutions (SHPIs), Revolving Fund Assistance (RFA) to MFIs, equity/capital support to MFIs to supplement their financial resources and provision of 100 percent refinance against bank loans provided by various banks for microfinance activities (NABARD: 2009).

Major Advantages of the SHG Bank Linkage Programme

- By aggregating their individual savings into a single deposit, self-help groups minimize the bank's transaction costs and generate an attractive volume of deposits;
- Through self-help groups, the banks can serve small rural depositors while paying them a market rate of interest;
- An economically poor individual gains strength as part of a group. Besides, financing through SHGs reduces transaction costs for both lenders and borrowers;
- Lenders have to handle only a single SHG account instead of a large number of small-sized individual accounts;
- SHG members cut down expenses on travel to branch and other places for completing paper work and on the loss of workdays in canvassing for loans;
- Most Indian SHG programs reach out to vulnerable and marginalized people, who own little or no land, are predominantly illiterate, and who lack access to formal sources of financing.

The Indian microfinance sector has played a laudable role in improving the lot of the economically disadvantaged. What is more, it has unleashed the potential of the economically challenged, propelling them up the economic ladder. The microfinance movement has channelled resources of the banking sector to the economically challenged in towns and villages (Balasubramanian R: 2010).

The Ten Pillars of the SHG Linkage Programme

- Self Help supplemented with mutual help can be an effective instrument for the amelioration of the economic conditions of the poor.
- Participative financial service management is more efficient and responsive.
- Poor can save and are Bankable.
- The capabilities of the banking system can meet the expectations of the poor.
- Poor need credit support as well as savings and other services.

- Small cohesive groups of the poor with initial outside support can effectively manage and supervise micro credit among its members.
- SHG is a pre micro enterprise stage for a majority of the poor.
- SHGs as clients facilitate wider outreach and lower transaction cost including risk costs.
- Empowerment of poor and especially women could be one of the major outcomes.

(NABARD: 2000).

Different Models of Linkage

Broadly, three different models have emerged under the linkage programme in the country. Model 1 in which the bank itself acts as SHPI(Self Help Promotional Institutions)and forms and nurtures the SHG, Model 2 in which the NGOs act as SHPIs and banks lend to the SHGs directly, and Model 3 in which the NGOs act as both SHPI and Micro Credit intermediaries. In Model 3 banks lend to the NGOs for on-lending to the SHGs.

Progress of SHG - Bank Linkage Programme in India

Though there are different modes for purveying micro finance, the self help group (SHG) Bank Linkage Programme has emerged as the major micro finance programme in the country. It is being implemented by the commercial banks, RRBs and cooperative banks. The objective of the "SHG - Bank Linkage Programme" initiated by NABARD in 1992 is to enable formal banking services to provide financial services to the rural poor through the process of savings and credit linkage of Self Help Groups. The growth of SHGs in India over various years is shown in the Table 2.

Table 2: Progress in Credit Linked SHGs

Year	Cumulative Number of SHGs	
	Number	Growth % over the previous year
2000	114,775	247.8
2001	263,825	129.8
2002	461,478	74.9
2003	717,360	55.4
2004	1,079,091	50.4
2005	1,618,456	49.9
2006	2,238,565	38.3
2007	4,160,584	85.8
2008	5,009,794	20.4
2009	6,121,147	22.2
2010	6,953,250	13.6

Source: various Annual Reports of NABARD and its website

Indian microfinance covers several million borrowing clients, and is amongst the fastest growing globally. The year 2009-10 marked nineteen years of SHG-Bank Linkage Programme

in India. Just 19 Years back i.e. in 1992, NABARD launched a Pilot Project that aimed at a target of 500 SHGs to be linked to Bank-finance, which could be achieved overwhelmingly i.e. 600 SHGs to be financed by March 1993. This response from Banks encouraged the Reserve Bank of India (RBI) to incorporate SHG-Bank linkage in the priority sector lending, which ultimately became the mainstream activity during 1996. The Govt. of India also gave attention to this activity in the Annual Budget of 1999. As a result, a synergy was created by Public and Private Sector Commercial Banks, Regional Rural Banks and Co-operative Banks to promote this movement.

This scheme has made tremendous progress in the recent years, according to data available from the NABARD there were more than 69.53 lakh SHGs currently present in India (up to March 2010), covering around 9.7 crore households with an average loan amount outstanding per SHG as on March 2010 was Rs 57,795. More than 76 percent (53.10 lakh) of them were women groups. These SHGs are operating in all the states of India. During 2009-10, 18 public banks, 14 private banks, 81 regional rural banks and 318 cooperative banks have been reported to have taken part in the SHG programme in India (NABARD 2010).

Table 3: Total Bank Loans Disbursed to SHGs during Various Years

Year	Bank Loan disbursed during the various years	
	Amt. (Rs. in crores)	Growth %
1999-00	135.91	138
2000-01	287.89	112
2001-02	545.47	89
2002-03	1,022.34	87
2003-04	1,855.53	81
2004-05	2,994.25	62
2005-06	4,499.09	50
2006-07	6,570.39	46
2007-08	8,849.26	35
2008-09	12,253.51	39
2009-10	14,453.30	18

Source: NABARD

It terms of rupees, banks loans disbursed to SHGs increased from Rs 135.91 crores during 1999-00 to Rs 14453.30 crores during the year 2009-10, thus showing a tremendous growth over various years. Growth of bank loan disbursed to SHGs over various years is shown in Table 3.

Notwithstanding the remarkable progress, geographically there has been a skewed development of SHG-Bank linkage programme in India. There is wide regional disparity both in terms of the spread of SHGs linked to banks and cumulative bank loans disbursed under the programme as shown in the table 4 below:

amount) during the 2009-10 North-Eastern region received only Rs 28716.99 lakhs (1.99% of the total amount).Also the northern region received only Rs 30633.33lakhs (only 2.12% of the total amount).

The agency-wise details of SHGs linked with Banks and loans disbursed by banks (agency wise) to SHGs during the year 2009-10 are given in Table 5.

As on 31 March 2010, the Commercial Banks lead with savings accounts of 40,52,915 SHGs (58.3%) followed by RRBs having savings bank accounts of 18,20,870 SHGs (26.2%) and

Table 4: Region wise progress of NABARD SHG Bank Linkage Programme (to March 2010)

	Region/State	No. of SHGs	Saving Amount (Rs in Lakhs)	Percentage of Total SHGs in India	No. of SHGs	Amount of loan dis-bursed in 2009-10 (Rs Lakhs)	Percentage of Total loan dis bursed to all SHGs in 2009-10 in India
A.	Northern Region	351801	34207.31	5.52	37375	30633.33	2.12
B.	North Eastern Region	292188	12167.09	1.96	49307	28716.99	1.99
C.	Eastern Region	1374242	112014.60	18.07	277446	154018.65	10.66
D.	Central Region	765965	51363.57	8.29	77846	63209.88	4.37
E.	Western Region	945620	92667.48	14.95	149130	64697.54	4.48
F.	Southern Region	3223434	317450.84	51.21	995718	1104053.97	76.39
	Grand Total	6953250	619870.89	100	1586822	1445330.36	100

Source: NABARD

As can be seen from the table that till March 2010, while the Southern Region accounted for 51.21 percent (317450.84 lakh SHGs) of the total SHGs, the share of North- Eastern Region was just 1.96 percent (12167.09 lakh SHGs) (Table-4). Northern region, the most densely populated region in India where the majority of the population is poor, accounts just for 5.52 percent (34207.31 lakh SHGs) of the total SHGs in India.

Similarly in the case of amount disbursed, while the Southern-Region receive Rs 1104053.97 lakhs (76.39% of the total

Cooperative Banks having savings bank accounts of 1,079,465 SHGs (15.5 %) as shown in the Table 5.

During 2009-10, banks have financed 15.87 lakh SHGs, including repeat loan to the existing SHGs, with total bank loans of Rs.14,453.30 crores. The agency-wise details of loans disbursed by banks to SHGs during the year 2009-10 are given in Table 5. It may be observed from Tables-4 and 5 that as always, Commercial Banks lead in disbursement of loans to SHGs during 2009-10 with 67.67 percentage share of the total loans disbursed followed by Regional Rural Banks

Table 5: Progress under Microfinance –Agency-wise position as on 31 March 2010

Sr. No	Name of Agency	Self Help Groups		Total loans disbursed by Banks to SHGs during the year 2009-10	
		Number of SHGs	Percentage Share	Amt. (Rs. Crore)	Percentage of total loan disbursed
1.	Commercial Banks	4052915	58.29	9780.18	67.67
2.	Regional Rural Banks	1820870	26.19	3333.20	23.06
3.	Cooperative Banks	1079465	15.52	1339.92	9.27
	Total	6,953,250	100	14,453.30	100

Source: NABARD

with a share of 23.06 percent and Cooperative Banks with a share of 9.27 percent.

Certain Factors that are Hampering the SHG Movement in India

There are certain factors that have undermined the strength and effectiveness of the initiative to promote the SHG movement. As a result, there are several areas in India where there was good growth in the number of SHGs but their quality was poor, and many are collapsing as a result. The major factors affecting the SHG movement in India are:

- Funds must be increased for the purpose of training of SHGs. Unfortunately, even where sufficient sums were provided for capacity-building, the government departments managing the programme in some areas used these funds not for training SHGs, but for other purposes (such as organizing large gatherings with a political agenda or funding infrastructure of training institutions which is of little use). As a result, the institutional capacity of the group as a whole did not improve.
- Lately there was too much involvement of politics in the SHG movement; this may harm the growth of SHG movement in India. Politicians are keen to transform the success of the SHG movement for their political ambitions. Political parties in their respective areas are trying to claim ownership of these groups, instead of realizing that they are 'owned' by the members. Numbers of political statements were issued by various political parties in the recent crisis involving MFIs just to gain the political mileage.
- Some of the Bank workers think that they have to work additionally for the success of the SHGs without getting any financial benefit in return. As a result some banks in some parts of the country have been reluctant to adopt the linkage programme wholeheartedly, and this coupled with poor banking infrastructure and performance has resulted in skewed growth of SHGs in various regions of India as discussed previously (some states in the north, some central states and most states in the east of the country fall in this category).
- As often happens, the SHG strategy was promoted as the answer to the search for a 'one-dimensional' strategy to eradicate poverty. Two pioneers of microfinance, Yunus in Bangladesh and Mahajan in India, agree that microcredit is not enough. We must link poor people to markets, financial institutions and even to multinationals. But the government must finance infrastructure and skills, apart from basic education and health to create the conditions in which higher-income livelihoods become possible (Aiyar, S. S. Anklesaria, 2006). It must be understood that credit is only one of the several instruments needed for fighting poverty. What in fact is needed is a combination of microfinance with other innovative programs (like programs on education, health, employment etc.) which will help in unleashing people's potential to work for reducing poverty. These initiatives will help in creating livelihood options and opportunities for the effective use of credit to improve livelihoods in a sustained manner.

We must link poor people to markets, financial institutions and even to multinationals. But the government must finance infrastructure and skills, apart from basic education and health to create the conditions in which higher-income livelihoods become possible

- The unhealthy competition among states to claim the highest number of SHGs, with no concern for quality, led to a rapid increase in forming these groups. As a result many SHGs were formed by people, who had no idea, that for what purpose these SHGs were created. Some of the groups were provided matching funds and even loans within the first few months, with little or no institutional capacity-building. As a result, many SHGs collapsed, and this in turn led to a certain hesitation on the part of promoting agencies to pursue the programme.

Achievement of SHGs through SHG-Banking

The SHG system allows members to maintain a more regular financial support for the family and for the micro enterprise operated by the family/SHG. Microfinance stands out as a commercially viable alternative system of financial access for the poor. A highly flexible financial service structure has been made available to poor households with the introduction of "SHG-Banking", which allowed them to increase their income in most cases and to stabilize their irregular income flow. It enables borrowing for the SHG members for a variety of self chosen purposes at irregular intervals from the SHGs. It tunes the allocation of funds with the needs of group members at local level inside the SHG dominated financial self help system (without formal requirements). At bank branch level to the SHGs it provides a very flexible credit line from the banking system at an accepted interest rate (mostly 12 percent p.a.) and also provides small loans to the SHG members internally from the SHG-fund. It offers deposit facilities both at the group and at the bank level that enables conduct of regular saving transactions both separately and on group saving accounts (almost 24 hours a day).

The SHG movement is an ideal combination of "banking with poor" and "banking by the people" with which it has been born and which also includes the formal banking sectors. In the future it may also help in providing insurance services to the SHG members on large scale. The economic impact of SHG-Banking on poor households has been captured in several studies; some evidence indicates that it:

- Enables better propensity to save;
- Permits superior net incremental income;
- Also helps in smoothening income inequalities;
- Assists reduction of indebtedness with money lenders and freedom from bondages;
- Enables additional employment (person days) generation;
- Plays very important role in empowerment of women;
- The good performance of the SHG-Bank-Linkage Programme is due to its strategy to mobilize underused capacities (that is skills and assets of low income group people particularly women) of the target group.

Conclusion

The result achieved so far by NABARD is remarkable for linking SHGs with formal banking system and providing credit for the poorest of the poor throughout the country. The formal Banking System in India has accepted the challenge of incorporating microfinance into their business policy. Formal microfinance services are-not only in theory but now they are available and accessible to low income families. An increasing number of formal financial institutions like branches of RRBs, Commercial Bank branches and Cooperative banking Institutions are offering microfinance services now. The lopsided geographical spread of SHG-Banking is on account of non availability of suitable partners in SHG-formation. In areas (state/provinces) with potential for SHG-banking promotion like Bihar, Madhya Pradesh, Rajasthan, Uttar Pradesh, Orissa, it is non-availability of capable NGOs which cause serious constraints for a quick spread of the programme. India's labour force has been increasing at a rapid rate because of the age composition of the population resulting from a demographic transition. This is a potential strength of the economy, but enough jobs need to be created to reap the economic gains from it. But it is almost impossible for the government to create jobs for such a large section of the population. In such a scenario availability of microfinance will help the poor people in starting the self employment basically in the rural areas which will help in the overall growth of the Indian economy. The Indian economy at present is at a crucial juncture, on one hand, the optimists are talking of India becoming one of the top economies of the world within the few decades and on the other hand a huge Indian population is still living below poverty. The enormity of the task can be understood from the above and if India is to stand among the league of developed nations, there is no denying the fact that poverty alleviation & reduction of income inequalities has to be the top most priority. In this backdrop, the impressive gains made by SHG-Bank linkage programme in coverage of rural population with financial services offers a ray of hope to achieve a distant dream of poverty free India.

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Why India Needs Effective Rural Marketing System?

By **Nizamuddin Khan* & Mohammad Muqeet Khan****

The Indian rural market with its vast size and demand base offers great opportunities to marketers. Two third of country's consumers live in rural areas and almost half of the national income is generated there. It is only natural that rural markets form an important part of the total market of India. Our nation is classified in around 626 districts and approximately 638,596 villages which can be sorted in different parameters such as literacy levels, accessibility, income levels, penetration, distances from nearest towns, etc. Rural India, which accounts for more than 70 percent of the country's more than one billion population, is not just witnessing an increase in its income but also in consumption and production. Rural and small town economy, which accounts for 60 percent of India's income, has remained insulated from the economic slowdown. Moreover, rural incomes are on the rise driven largely due to continuous growth in agriculture for the last few consecutive years. Although the rural market does offer a vast untapped potential, it should also be recognized that it is not that easy to operate in rural market because of several problems. Rural marketing is a time consuming affair and requires considerable investments in terms of evolving appropriate strategies with a view to tackle the problems.

In India, around 70 percent of the population resides in rural or semi urban area, which makes it over 750 million people. There are more than 600,000 villages in India. According to census of India, rural areas are those that are not part of municipality, corporation, cantonment or notified town area and which satisfy certain criteria, i.e. population of below 5000, with a population density of less than 400 sq km. Furthermore, there should be at least 75 percent of the male working population employed in agriculture.

Presently most people living in rural areas are dependent upon agriculture for a livelihood either as a labourer or as owner of a farm. However, as the land size is shrinking, sizes of family members are growing, and low per capita earning in rural areas, the quality of life is poor. The majority of the rural population does not have basic civic amenities such

as safe drinking water, sewage, roads, communication and electricity, mainly due to absence of municipal boards. People have to face extreme hardships in their daily routines thereby reducing their work efficiency and productivity. Though the rural literacy rate has improved, it is still extremely poor considering that less than one-tenth of the population is educated up to the primary level in more than one-third of the districts and only 6 percent of the rural males are educated up to the middle level, despite several literacy programmes initiated by government and non-government organizations. Thus, large sections of the rural population remain deprived of better employment opportunities.

The rural markets are estimated to be growing more rapidly as compared to the urban markets. The potentiality of rural markets has been said to be like an 'awaken sleeping giant'. In recent years, rural markets have acquired significance in countries like China and India, as the overall growth of the economy has resulted into substantial increase in the purchasing power of the rural communities. Because of the green revolution in India, the rural areas are consuming a large quantity of industrial and urban manufactured products. In this context, a special marketing strategy, namely, rural marketing has taken shape. Sometimes, rural marketing is confused with agricultural marketing – the later denotes marketing of produce of the rural areas to the urban consumers or industrial consumers, whereas rural marketing involves delivering manufactured or processed inputs or services to rural producers or consumers.

Indian market centres mostly exhibit a picture of rural life as they provide primarily a base for collection and subsequent distribution of various agricultural products of the surrounding area. These market centres are not only the centres of marketing activity but they are also the nucleus of development. They are the controlling centres of marketing systems and have an important role in stimulating production and consumption, and they also help to accelerate economic development. Thus, development of market centres implies the economic development and their growth always follows the development of agriculture, transportation, industries etc., which ultimately leads to overall regional development.

What is Rural Marketing?

The terms 'Rural Market' and 'Rural Marketing' evoke kaleidoscopic images in one's mind like small-size packs, haats and mandis, ultra price-sensitive consumers, seasonal purchase cycle linked to harvesting seasons, and so on. However, it would not be appropriate to follow the one-size-fit rule for all rural consumers.

Rural marketing involves the process of developing, pricing, promoting, and distributing rural specific products and a services leading to exchange between rural and urban market, which satisfies consumer demand and achieves organizational objectives.

- **Urban to Rural:** A major part of rural marketing falls in this category. It involves the selling of products and services by urban marketers in rural areas. These include pesticides, FMCG products, consumer durables, etc.
- **Rural to Urban:** Transactions in this category fall under agricultural marketing, where a rural producer seeks to sell his produce in an urban market. An agent or an intermediary plays a crucial role in the marketing process. Some of the important items sold from the rural to urban areas are seeds, fruits and vegetables, milk and related products, forest produce, spices, etc.
- **Rural to Rural:** This includes the activities that take place between two villages in close proximity to each other. The transactions relate to the areas of expertise the particular village has. These include selling of agricultural tools, cattle, carts and others to another village in its proximity.

Globalization and Rural Marketing

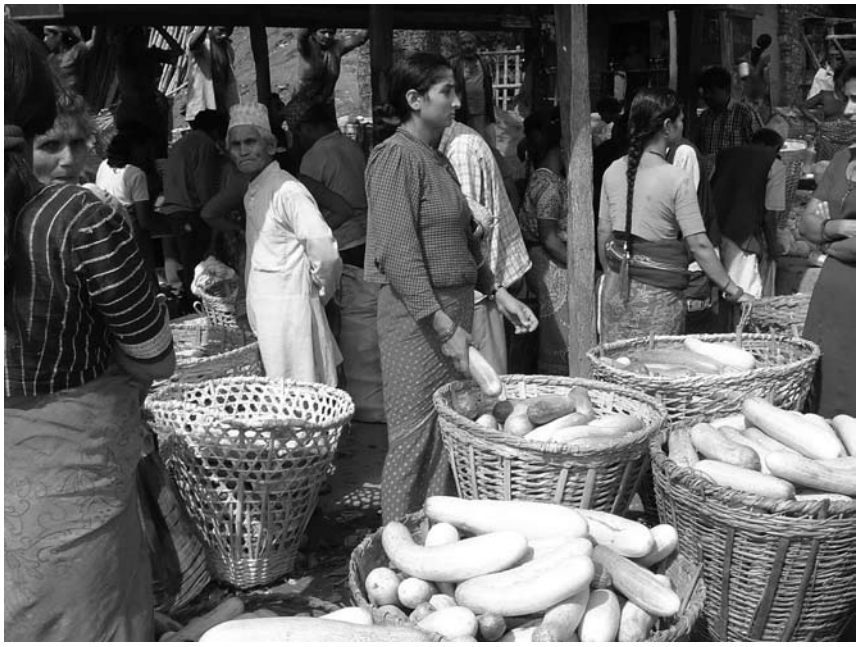
India in the last twenty years has witnessed a remarkable shift in its economic, social and technological environment. The liberalization and privatization policies initiated by the Indian government in early nineties, and the subsequent phenomenon of globalization have led to huge inflow of massive foreign investments and entry of large numbers of multinational corporations in India. These companies are mostly operating in BFSI (banking, financial services and insurance), retail, automobile, telecom, consumer durable and IT sectors. Many other domestic Indian companies, especially those in ICT, automobile, textile and engineering products have also expanded their operations into overseas markets. As products and markets are turning global, companies are facing intense competition both within the domestic as well as in the international markets. The task of marketers in recent years has become more challenging due to shift in the demographic profile and requirements of customers. Firms operating in industries such as FMCG, telecommunication,

insurance, financial services, consumer durable and automobiles are nowadays employing innovative marketing practices for their survival as well as to increase their market share. These companies are now shifting their focus away from the already saturated metros and tier-I cities to the rural and semi-urban towns, to increase their revenues and market base. However, rural areas have their own limitations in terms of large number of villages with thin population density, accessibility, infrastructure, telecommunication network, illiteracy, social and cultural backwardness, and low disposable incomes. Besides, even though the 70 percent of Indian population resides in the rural areas, the income contributed by the agricultural sector in the total GDP is lower than 17 percent. The majority of the rural population has relatively low disposable income as well as consumption rates as compared to their urban counterparts. Yet they have aspirations and wants for most of the urban products.

The factors that have contributed to the rising aspirations and demands among rural buyers are: increase in literacy levels; migration to urban areas; growth in media and telecommunication networks; availability of credit schemes; globalization, cheaper technology products such as television, mobile, music system, camera, etc.; government sponsored employment generating schemes such as NREGA; and, tax concessions and loan waivers.

Global Recession: Impact on Rural Markets

Due to global recession, India is in a downturn, which shows the overall market slowdown visible in real GDP, real income, capital inflows, employment, industrial production and wholesale/ retail sales. In contrast, rural India, home to about two-third of country's 1 billion plus population, has not only witnessing an increase in incomes but also in consumption and production for four consecutive years. This initiated marketers to undertake studies so as to know whether global recession had an impact on the rural markets or not, and subsequently found that the rural and small town economy (locations with less than 50,000 population) which account for 60 percent of India's income, has



remained insulated from the economic slowdown as employment opportunity and income streams are intact and growing steadily with consistent demand for goods and services, because of untapped market, socio-economic changes, orientation to basic needs, low export dependence, and government initiatives towards rural upliftment.

Factors Encouraging FMCG Companies to Go Rural

Change in Rural Lifestyle: Lifestyle changes are also witnessed in the rural areas. Contrary to popular perception, the potential rural market is not confined to a few million large farmer households. The boom in the rural market is not due to sporadic indulgence by a privileged rural minority, but reflects instead the changing priorities sweeping the entire hinterland. There is also an up gradation from local or unbranded products to national brands and from low priced brands to premium brands. This is primarily due to the influence of youth in the households. The rural youth are more open to new ideas as against their elderly family members. They are better educated and have aspirations similar to those of the youth in urban India.

Advantage of Product Life Cycle: Many products have achieved near maturity in urban markets, while in rural markets they are in the growth phase. The reason for the variation in product life cycle stages may be attributed to the different rates of adoption-diffusion process in urban and rural markets.

Rural Market Growth Rates Higher than Urban: FMCG sector in rural areas is expected to grow by 40 percent as against 25 percent in urban areas. The growth rates of some FMCG products like toilet soaps, talcum powder, cooking medium (oil and vanaspati), tea, cigarettes and hair oil is more than 50 percent. Rising rural incomes, healthy agriculture growth, boost in demand, rising consumerism across India, and better penetration of FMCG products in the rural market are contributing to high growth and rapid expansion of the FMCG industry in rural India. Even in the durable goods category rural demand is much higher as compared to urban counterparts.

Rural Markets are Safer than Urban Markets: The stock market crash in previous years has dampened urban spending power did had not affected rural incomes at all. Traditionally, villagers park their savings in post offices, nationalized banks and government backed saving instruments. Their exposure to the stock market is almost zero. The rural market is safe from any such ill effects of the stock market. Farmers have always been exposed to risks. Hence, they know when to spend or preserve money. They

comprise a market that is three times the urban market.

Lower Promotion Cost: Promotion campaigns need to be specially devised for the rural market. Rural communication can make most of the low clutter. One needs to believe that the rural market will bring in the volumes, and hence not spend the entire budget on urban advertising. Villagers have less accessibility towards conventional media such as television and radio; the marketers need to look at various non-conventional media as an alternative that can be used to tap the rural psyche. Drama, messages on moving objects, wall paintings, direct mails, pops, haats, melas (fairs), and natunki (folk operatic theatre performance) are some which are much cheaper than conventional media.

Challenges in Rural Marketing

Today, the major challenge for the rural marketer is to reach out to the most remote rural destinations and increase rural incomes. About 750 million Indians reside in about 0.6 million villages and even the powerful marketers like HLL and ITC have recently been able to cover only about 0.2 to 0.25 million villages while about 0.1 to 0.15 million villages have been connected through Project Shakti and E-Chaupal initiatives. A lot needs to be done for expanding distribution coverage and the daunting task ahead is to overcome the following challenges:

Poor Infrastructure: Most of the villages are suffering from the inadequate infrastructure facilities like warehousing, transportation, pucca (metalled) roads and financial facilities. Although on paper approximately 90 percent of the villages appear electrified, in reality only one-third of the rural households have electricity connections. Only 12 percent of villages are connected with railway networks and only 33 percent of villages have a good road. Planning physical distribution, managing distribution and controlling marketing communication are major impediments for entering rural markets.

Non-Availability of Shops: In India, approximately 30 percent villages have no regular shops; leave alone the proper distribution setup. According to Indian Market Research Bureau (IMRB) approximately 60,000 villages do not even have a single retail outlet. Even the outlet density is low in rural India compared to urban India. To make matters worse, most of the villages do not have the proper connectivity with roads due to harass terrain.

Poor Literacy Level: As per the census of 2001, rural literacy level is 59.4 percent as compared to the urban literacy rate, which is 80.3 percent. Low education level leads to lack of awareness and herd mentality because of which villagers are not able to find the difference between the products of good and bad quality. It is because of this so many spurious brands are flourishing in the rural areas with somewhat similar names and packaging than that of branded companies. It is virtually impossible for a marketer to track all these spurious brands and initiate any legal procedure. The only way for fighting these evils is to increase the level of education in the rural areas and increase awareness about the benefits of good quality products.

Poor Media Penetration: Only 57 percent of rural households have any type of mass media connections. Of these, 23 percent have access to print media and 36 percent are the viewers of television. With about 0.2 million haats in India, the greatest challenge before a marketer is the cost per contact. The cost of reaching the customers sitting or located in rural and remote areas requires a lot of investment especially in the case of unconventional modes. There is also limitation in establishing an exposure and point of purchase in rural markets.

Seasonal Demand: As agriculture happens to be the main occupation in rural India, demand for goods heavily depends on the monsoons. Therefore, the buying capacity is not stable or regular as compared to the urban market.

Dispersed Population, Customs and Traditions: Population density in rural areas is much lower as compared to that in urban areas. It therefore becomes more challenging to reach out to a large number of people at an affordable cost. At the same time, people do not adapt to new practices, as life in rural areas is based very strongly on tradition and customs.

Ten Steps Approach for Effective Rural Marketing System

1. Commitment from Top Management: This must be total, and management must realize that it is along haul and an investment into the future, otherwise rural marketing will not give long term results.
2. Getting a Dedicated Task Force: Rural marketing requires a dedicated mindset, which many urban oriented MBA's do not possess. Hiring of the rural marketing team or students

from rural marketing institutes like IIRM or students with fire in their belly about rural marketing from second level institutes, those who have taken rural marketing as an elective course, can prove to be more fruitful.

3. Setting Clear Objectives: It is important to clearly define, in the early stages, the goals for the rural marketing initiative and whether the initiative is a tactical effort to achieve increased sales in specific areas during specific time, or build strong equity for the brand in rural India.

4. Understanding the Mindset of Consumers: Understanding of the mindset of the rural customer is important for the rural specialist to come up with a customized plan of action.

5. Ensuring Availability: In most cases, distribution is one of the biggest nightmares; the task of reaching products to 600,000 plus villages is a challenge. Urban consumer goods have raised the aspirations of the rural customer and made him demand the product from the local shopkeeper, who then buys the required quantity from the nearest feeder markets that he visits regularly for his supplies. Hence, feeder markets such as towns and villages with populations of 10,000 to 15,000 initially must be provided in order to start the first steps towards rural marketing.

6. Evolving a Comprehensive Strategy: A comprehensive strategy involving multimedia as well as mass media, has better results as compared to those one-off projects with limited goals.

7. Involve the Region: Rural marketing is a highly regional subject, with a company's regional teams being specialists in their respective regions. Involving them from the start so as to ensure ownership of the campaign by the region, and also getting their insights and inputs in the development, implementation of the campaign, is essential.

8. Developing Foolproof Plan for Implementation: Conducting a pilot study in one district of a state to gain insights from it, before a national roll out of a rural campaign is not realistic. The implementation plan must be as comprehensive as possible to ensure that all the elements to be checked out are included in the plan. Implementation of any rural campaign requires meticulous ground level planning, and a thorough briefing and training of the field level people before execution.

Rural marketing is thus a time consuming affair and requires considerable investments in terms of evolving appropriate strategies with a view to tackle the problems

9. Provide Adequate Budget: A decent budget could be spelt out by a rural specialist, depending on the task and the region. If the budget is limited, it should not be spread thin by trying to look at too many markets. If a company feels that it has a bright future in rural markets, or would like to target the rural markets, then it is better to invest today so that the early mover advantage is gained to reap rich rewards in the future.

10. Evaluating Results: The two areas that should be studied to understand the impact of a rural campaign and devising sales strategies are brand awareness and brand conversion.

Conclusion

Although the rural market does offer a vast untapped potential, it should also be recognized that it is not that easy to operate in because of the above-mentioned problems. Rural marketing is thus a time consuming affair and requires considerable investments in terms of evolving appropriate strategies with a view to tackle the problems. Thus, looking at the opportunities and challenges, which rural markets offer to the marketers and the manufacturers, it can be said that the future is very promising for those who can understand the dynamics of rural markets and make use of them to their best advantage. A radical change in attitudes of marketers towards the cheerful and budding rural markets so that they can successfully impress more than 850 million rural consumers spread over approximately six hundred thousand villages in rural India is the call of the hour.

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Irrigation Revolution Micro Irrigation Systems

By **Dr. Sarvesh Kumar Shah ***

India is predominantly an agricultural country and even with current orientation towards services, agriculture still contributes 25 percent of total GDP of the country, 15 percent of total export and 65 percent of total population's livelihood. After independence, India made remarkable progress in increasing food production and productivity. Credit goes to concerted efforts made under various Agri revolutions. For agriculture 'Land and Water' are the two most important resources, of which water (irrigation) becomes the lifeline of agriculture. It is a truth in agriculture "if we fail in irrigation, we will fail in agriculture."

Water is required for agriculture as well as for other sectors (Domestic, Industries, etc.) and the demand of water is increasing alarmingly. At present levels, agriculture consumes over 80 percent of total water consumption in India. The country is endowed with many perennial and seasonal rivers. The river system which constitutes 71 percent of water resources is concentrated in 36 percent of geographic area. Most of agricultural fields are irrigated by use of underground water for assured irrigation, however, erratic, monsoon-based rainfall is the source of water for rain fed agriculture. Though water is a renewable resource, the recharge is ultimately limited to rain. Drought like situation in Indian agriculture is more common and occurs frequently in some of the parts of the vast geography of the country almost every year. Excessive and unbalanced use of water became a common practice to grow more and more so as to earn more and more. In other words, the water resources are being depleted by current practice of farming and we will be devoid of sufficient irrigation water if the trend continues in years to come. All these factors are focusing the need of judicious and efficient use of water for agricultural use.

Various types of flood method of irrigation are commonly and traditionally followed in almost the whole India. This system is liable to loss of water due to conveyance, distribution and evaporation. Therefore, about 30-40 percent of applied water is being utilized by the crop, while the rest is leached out, evaporated, or lost through surface run off.

Micro Irrigation System is a panacea for irrigation related problems. In this technology, field is irrigated in the close vicinity of root zone of crop. It reduces water loss occurring through evaporation, conveyance and distribution. Therefore high water use efficiency can be achieved (Table 1) The non-irrigated rain fed cropped area, could be irrigated with the water saved by this technology and become a potential source of food production for the benefit of country's food security.

Micro-irrigation system is the best available way to utilize water and

fertilizer efficiently under farm conditions. The type of Micro irrigation system may vary with the type of crop selected and amount of water available for irrigation (Table 2). However, modern technology has been developed in Israel. Since MIS is a well planned and scientifically designed way of farming, it also provides option for Crop diversification. Unlike surface irrigation, drip irrigation is more suitable and economical if it is introduced in water scarce areas with undulated topography, shallow and sandy soils, barren land, and for wide spaced high value crops. It reduces cost of cultivation, increases productivity and reduces energy (electricity) consumption.

The advantages of drip irrigation:

- Minimized fertilizer/nutrient loss due to localized application and reduced leaching;
- High water application efficiency;
- Levelling of the field not necessary;
- Ability to irrigate irregular shaped fields;
- Allows safe use of recycled water;
- Moisture within the root zone can be maintained at field capacity;
- Soil type plays less important role in frequency of irrigation;
- Minimized soil erosion;
- Highly uniform distribution of water i.e., controlled by output of each nozzle;
- Lower labour cost;
- Variation in supply can be regulated by regulating the valves and drippers;
- Fertilization can easily be included with minimal waste of fertilizers;
- Foliage remains dry thus reducing the risk of disease; and,
- Usually operated at lower pressure than other types of pressurised irrigation, involves lesser energy costs.

Crop-wise water saving over surface irrigation method and increase in yield is presented in table (Table 3).

Although having many benefits, the reach of MIS among the farmers is restricted. The government is trying to

Table 1: Irrigation Efficiency under Different Methods of Irrigation

Irrigation efficiencies (Percentage)	Methods of Irrigation		
	Surface	Sprinkler	Drip
Conveyance efficiency	40-50 (canal) 60-70 (well)	100	100
Application efficiency	60-70	70-80	90
Surface water moisture evaporation	30-40	30-40	20-25
Overall efficiency	30-45	50-60	80-90

Table 2: Crop Group Wise Advisable Micro Irrigation System

Crop	Crop Spacing	Advisable Micro Irrigation System
Horticulture Crop	12 m to 3 m between crops raw. (wide spaced)	Drip Irrigation System/ Pours Pipe
Crops fruit part underground like Potato, Groundnut, Turmeric, Ginger, Vegetables, Medicinal Crops etc.	Less than 1 m between crops raw. (Narrow)	Drip Irrigation/Sprinkler Irrigation/Rain gun
Field Crops like Cotton, Castor, Tobacco, Pulses, Sugarcane, Banana, Vegetables etc.	Less than 3 m between two crops	Drip Irrigation
Fodder Crops / Nursery Raising of Vegetables, Ornamental Crops etc.	-	Sprinkler Irrigation/Rain gun

Table 3: Crop-Wise Water Saving and Increase in Yield

Surface	Crop	yield (q/ha)			Irrigation	
		Drip	% Increase	Surface	Drip	% Saving
Beet root	5.7	8.8	54	86	18	79
Bitter gourd	32	43	34	76	33	57
Brinjal	91	148	63	168	64	62
Broccoli	140	195	39	70	60	14
Chilli	171	274	60	27	18	33
Cucumber	42.3	60.9	44	109	41.7	62
Okra	155	225	45	54	24	56
Onion	284	342	20	52	26	50
Potato	172	291	69	60	27.5	54
Radish	10.5	11.9	13	46	11	76
Sweet potato	42.4	58.9	39	63	25	60
Tomato	61.8	88.7	44	49.8	10.7	79
Banana	575	875	52	176	97	45
Grapes	264	325	23	53	28	47
Papaya	130	230	77	228	73	68
Pomegranate	34	67	97	21	16	24
Watermelon	82.1	504	514	72	25	65

Promotion of Micro Irrigation System in India

1. Concerted efforts taken by the Government/NGOs and the MIS companies for widespread awareness about the usefulness of the wonderful technology.
2. Efforts should be made to ensure the production and supply of good quality micro irrigation system to the farmers by enforcing strict quality control measures.
3. Micro irrigation should be made an integral part of all irrigation projects.
4. The micro irrigation system manufacturers should also guide the farmers in adopting suitable agronomic practices along with micro irrigation.
5. After sales service should be strengthened.
6. Technological intervention is required to cut down the cost of Micro-irrigation systems.

Table 4: Decade Wise Development in the Field of Micro-Irrigation

Decade	Focus of Research/Extension
Seventies	Comparisons of micro irrigation system with conventional systems in terms of water savings and yield enhancements.
Eighties	Estimate water requirements, modifications of crop geometry and use of mulches in drip irrigated fields for realizing the potential benefits of the system.
Nineties	Develop hardware and software for cost reduction, design modifications and fertigation and chemigation
Twenty first century	Precision farming, including the use and application of software and more efficient instruments in agriculture besides the use of simulation and modelling of moisture and nutrient movement under different soil and dripper characteristics

promote the technology through part financial support to offset its high initial cost requirements. Few adoptions were observed in the decade of eighties and nineties (Table 4). Putting together efforts of all machineries under one, total coverage of land under MIS is less than 1 percent, which underlines the need of integrated efforts to be made by all stake holders. The rural electrification is another major constraint for the popularization of drip systems among farmers. The high care as well as meagre crop and soil specific technology are few major constraints for deeper reach of the technology among farmers.

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Quality Seed Production Technology of Onion Crops in India

By **Dr. B.S. Tomar** *

Onion (Allium cepa L.) is a major bulbous crop among the cultivated vegetable crops and it is of global importance. In India it has been grown in 0.52 million ha with the production of 6.5 million tons (FAO, 2002). The productivity of onion in India is 12.5 t/ha, which is much lower than the productivity of USA (41.12 t/ha). The higher productivity of onion in USA is due to the growing of the long day hybrids and op varieties. The reasons for lower productivity of onion in India could be attributed to the limited availability of quality seed and lack of development of hybrids in onion, among the others.

Status of Requirements and Supply of Quality Seed of Onion in India

The estimated requirement of quality seed of onion was 3120 t (assuming seed rate 6 kg/ha) during 2002 and out of that only 9.6 percent of the demand was catered by public sector organizations such as NHRDF, NSC, ICAR institutes (IARI &, IIHR) and SAU's. Most of the demand for quality seed was either met by private sectors or unorganized program or own saved seed. Therefore, it is important to increase the supply of quality seed through the efficient use of the technology. On the other hand sincere efforts should be made for the development and release of hybrids.

Potential Areas for Seed Production

In India, the short day types of onion is cultivated on large scale in the northern plains, central and southern part of the country except higher hills where the long day types onion varieties like Brown Spanish and Yellow Spanish etc. are grown over a limited area. Therefore, the seed production of the short day types of onion is done in central part of the country particularly in Mandore and Khandawa region of MP, Nasik and Pune of Maharashtra and Rajkot district of Gujarat. However, Northern states like Punjab, Haryana and Rajasthan are not preferred by the seed industry due the severe attack of stemphylium and purple blotch and lower seed yield but there is a potential for seed production in north under delayed planting.

Land Requirement

Land to be used for seed production of onion should be free from volunteer plants. Although onion can be grown nearly in all types of soil from sandy loam to heavy clay soil, but clays are not satisfactory unless well supplied with humus to lighten them. The soil pH should preferably be 6.0-6.8.

Isolation

Onion seed field should be isolated from contaminant that is fields of other varieties and the fields of the same variety not confirming to varietal purity requirement, for certification at least 5 m for foundation seed and certified seed during months of bulb production and 1000 m and 500 m for foundation and certified seed production respectively during seed production, is required.

However, the maximum permissible limit for bulb not confirming to the varietal characteristics is 0.10 percent and 0.20 percent (by numbers) for foundation and certified seed during months of bulb production. The maximum permissible limit of off- types is 0.1 and 0.2 percent for FS and CS at and after flowering during seed production. Onion seed crop must also be isolated from any flowering multiplier types of onion and shallots.

Nutrition

The ratio of N: P: K applied during seedbed preparation should be 1:2:2 but the nitrogen ratio can be increased according to the status of the soil. Very limited work has been reported on the effects of nutrition in the first year and on seed production in the second year. Ahmed (1982) showed that application of N: P: K @ 150 kg ha-1 produced the largest bulbs and highest total bulb yield at the end of first year and that supplementary N application not exceeding 100 kg/ha in second year applied during anthesis enhanced seed quality. Higher levels of N increased the seed yield both at the expense of seed quality. The high K levels during bulb production were carried over to the second year and enhanced seed quality.

During, mother bulb production the deficiency of copper or manganese

should not be allowed. The deficiency of copper is indicated by bulbs of poor colour with thin, fragile scales that come off in handling. Therefore, the application of 80-120 kg powdered copper sulphate control the deficiency.

Irrigation

Hawthorn (1951) found that high soil moisture in the seedling year performed high seed yields. Borgo et al. (1993) reported that water stress during bulb sprouting and beginnings of the anthesis reduce the number of umbels and flowers/plant. However, in practice, the soil surface should not be continuously wet because it will predispose the crop to infection and to root rot/damping.

The methods of irrigation also greatly influence the seed yield and seed quality of onion. Tomar et al. (2004) observed that drip method of irrigation gave higher seed yield (894.94 q/ha) than the surface irrigation (648.94 q/ha), in onions. The seed vigour index is also higher in drip (876.49) than surface (663.71) irrigation in onions.

Floral Biology and Pollination

Anthesis occurs in early morning (6-7 hrs). Anther dehiscence is between 7.00 and 17.00 hr and on next day also with peak between 9.30 and 17.00 hr. Pollen fertility is highest on the days of anthesis. Stigma receptivity is also high on the day of anthesis (Jones, 1933). The duration of anthesis is approximately 4 weeks on individual umbel. The anthesis begins from outer flowers and goes centrally in succession. The flower is protandrous in nature and stigma becomes receptive when shedding of pollen is over. Onion is cross- pollinated in nature and bees, flies and other insects do pollination. It is essential to ensure that there is sufficient population of pollinating insects to achieve the full potential of onion seed. It is also possible in some situation to encourage the development of increased blowfly population by distributing suitable carrier or dried fish among the flowering crop (Currah and Proctor, 1990).

Method of Seed Production

There are two methods of seed production. The seed to seed and bulbs to seed methods and both the methods

are in use in onion seed production. But the bulb to seed method is the most commonly used method of seed production.

Bulb to seed method: In this method, the seed is sown in raised bed at 4-5 cm spacing for raising the seedling. The seedlings of 12-15 cm length are transplanted and this height is attained 7-8 weeks after the seed sowing. Thus, 6-8 kg seed ha-1 is sown. The seedlings are transplanted in previously developed beds in 15x10 cm spacing. The weedicides (Stomp) is sprayed after the transplanting and followed by irrigation to check the growth of the weeds in early crop growth stage. The recommended cultural practices are followed to raise healthy bulb crop.

The bulbs are lifted when the 75 percent plant show neck fall/top die down. The bulbs are dried under naturally ventilated place then neck is trimmed leaving 2-3 cm attached with bulb. The bulbs are roughed at this stage based upon the colour, shape and size. The damaged, twin bulbs and long necked bulbs if any are discarded. The medium size bulbs weighing (50-80 g) are selected and stored. The bulbs are examined again before replanting in the following season.

One hectare of bulbs from the first year can plant 3-5 ha for the seed production. The bulbs selected for seed production are usually referred to as mother bulbs. However, the area coverage is greatly affected by storage methods and losses occur during storage. The storage temperature also influences seed yield. The temperature ranging from 4.5 to 140°C with an optimum of about 120°C is the best for the storage of mother bulbs that are to be planted for seed production. The plants from such bulbs produce early and heavy yield than those grown from bulbs that have been stored at higher or lower temperatures. The roots of the bulbs should be left intact after harvest.

The 1\3 parts of the bulb are cut before planting to examine the number of glumes, which is related to the compactness, and shape of the bulbs. More the number of glumes with flatter shapes, the poor the storability. To avoid rotting due to fungal infection of the bulbs in field, Bavistin 10 gm in 10 lit of water is used for dipping the bulbs before planting. This should be a practice in NS/BS seed production

Seed to seed method: In this method seedlings are transplanted in first week of October and allowed over-wintering and bolting (flowering). The seeds are threshed from the mature umbel. This method does not allow to examine the mature bulb characters and field is rouged by off-types. Seed to seed method is not popular, since all the varieties are not suitable for annual seed production due to poor bolting habit and lower seed yield. The seed produced in this method is not suitable for further multiplication.

Time of Planting

The time of planting has great impact over the seed yield and incidence of the disease. It has been seen that seed crop planted in first fortnight of October is subjected to heavy incidence of diseases and poor seed yield. Tomar and Negi (2002) have recorded the highest seed yield of 576.80kg/ha with low incidence of diseases and better seed quality in 15th November planting during rabi season in 1999. However, the higher seed yield (1251.66kg/ha) with complete escape from the incidence of disease was recorded during rabi season in 2000.

Bulb Weight and Size

The bulb weight has markedly influenced the seed production in onion. The increases in bulb weight have increased the seed yield. Although an increase in wt. and size of bulb results in higher seed yield, but very large size bulbs (<90gm) if used will need a very high seed rate (60q/ha). Large size bulbs (3-4 cm diameter) and weighing <90gm may seed yield 10.00q/ha, Choudhary (1967).

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Strawberry Cultivation for **Higher Return**

By **Akath Singh, Bidyut C. Deka and Pradeep Kumar ***

Strawberry (Fragaria x Anamosa Duch.) is one of the best natural sources of antioxidants, vitamin C, proteins and minerals like P, K, Ca and Fe. It is also anti-carcinogenic and anti-diabetic. The introduction of day neutral cultivars, fertigation, green house, standardization of agro techniques and improved storage techniques has revolutionized the strawberry industry.

Soil and Climate Requirement

Strawberry prefers soil reasonably rich in humus because of 70-90 percent of its roots grows in the top 15 cm soil. Strawberry should not be grown continuously on the same land and on the land previously devoted to potato, tomato, eggplant, pepper and raspberry. It grows well on soil with pH 5.0-7.5. However, the plant thrives best in slightly acidic soil (pH 5.5-6.5). Soil with pH value of 4.5-5.5 needs liming.

The strawberry plants are strongly affected by the environmental parameters like temperature, photoperiod and light intensity. In cold climate, frost as well as winter seriously reduce yield of strawberry. Photoperiod has a marked effect on strawberry vegetative growth, plant morphology and yields.

Suitable Varieties

Growers should grow varieties which are resistant to pests and diseases, adapted to the desired climate, remain productive over a long period, have high yield and ability to retain size after the third picking, good processing quality and have good runnering capacity. Most suitable varieties are Camarosa, Festival, Ofra, Sweet Charlie, Chandler, Elista, Fair Fox and Seascape.

Strawberry Propagation

Strawberry is propagated through runners, which is considered as natural vegetative propagation.

The stolon, a creeping stalk is produced in the leaf axils and grows out from the parent plant during summer. At the second node of stolon a runner plant is formed and a new stolon arises on the runner plant. Initially runner plants produce fewer roots but thereafter put forth excessive fibrous roots. When acquired sufficient growth and roots, runners are separated from the mother plant and can be planted elsewhere.

A separate bed should be used for runner production. The planting should be done at 1.2 x 1.2m or 1.8 x1.8 m distance. Usually 30-40 runners per plant are considered satisfactory rate of production. Rate of runner production can be enhanced by GA3 (50-100 ppm) spray. For greater survival and fast growth, the runners should be lifted in September and planted in poly bags using the potting media of 1 soil: 1 sand: 2 FYM for one month.

Planting and Mulching

Healthy runners with a medium to large crown and well-developed root system are planted in Hill row system either in single or double rows on 15-20 cm raised beds with plant to plant and row to row, distance of 30x30-45 cm and 90-120 cm is kept between twin rows. The outer leaves should be stripped off and soils of the roots of the runner should be washed. The depth at which runners are planted should be carefully measured. If the crown is set too shallow it will dry out, and if set too deep it may be smothered. Planting during mid September to mid October is best time in open conditions which does not require much special care for establishment.

Mulching minimizes the freezing injury, suppresses weed growth and more importantly reduces the chances of softening of fruits. The commonly used mulching materials include clean straw, black and double coloured polythene. Mulching with black or double colour polythene material gives good weed control, advances early cropping and increases total yield.

Where space is at a premium, strawberries will also grow well for a year or two in bags, troughs, pots and hanging baskets, and this approach has several advantages over plants grown in the open. For pot culture of strawberry soilless composts or those with low loam content, usually porous media is recommended. Soil: Sand: FYM in the ratio of 1:1:2 is considered as best potting media. Freshly dug runners are planted from August to mid-October to allow proper establishment and a good crop in the first summer but for getting fruits other than normal season planting time can be manipulated accordingly because one can shift the bags/containers in shade net or poly house whenever needed.

Irrigation

Frequent irrigation rather than a few heavy ones favours the crop. Excess irrigation is detrimental in encouraging the growth of leaves and stolon at the expense of fruit and flower and increases the incidence of Botrytis rot and makes the fruit soft. To minimize the water requirement, sprinkler and trickle or drip

Different System of Planting

irrigation may be resorted. Following points should be kept in mind while irrigating strawberry.

Nutrient Management

A dressing of bulky organic manure is most wanted aspects in strawberry cultivation. Organic manures applied in sufficient quantity (70-80 t/ha) may fulfil the nutritional requirement, if planted for annual cropping. The pre-planting application of 20 tonnes of FYM and 20-40-40 NPK kg/ha and annual application of 40kg P/ha and 80kg K/ha is recommended to ensure a good crop of strawberry. In addition to recommended dose of manures and fertilizers, foliar application of urea (2%), zinc sulphate (0.5%), calcium sulphate (0.5%) and boric acid (0.2%) is beneficial for quality and higher yield.

Pollination and Fruit Set

Most of the cultivars produce hermaphrodite flowers and are self fertile. However, some also produce male or staminate, imperfect and pistilate flower, which requires cross-pollination. Honeybees are the chief insect pollinators. Four strong honey-bees colonies should be placed in the field/ha for effective pollination. A typical inflorescence bears primary, secondary, tertiary and quaternary flowers Majority of fruits develops from tertiary flowers rather than from primary and secondary flowers.

Harvesting and Yield

Berries are harvested when 50 to 75 percent skin of the berry develops colours. For long distance market, berries are harvested immediately after reaching full colour. Fruits are picked along with the caps or calyx and the stalk, one to two inches from the calyx. During peak period, fruits should be picked daily or in alternate days. On an average, the recommended varieties yield about 200-500 g/plant.

Packaging

Storage of fresh strawberry, even for short periods is not recommended because of their high perishability. Due to its climacteric nature, it ripens very fast and gets spoiled easily. The strawberries are packed in plastic punnets and are placed in the corrugated fibre trays or ventilated cardboard boxes.

Plant Protection

Strawberry plants are affected by a number of pests and diseases but the severity may vary according to locality.

White Grubs and Cut Worms: Cut the root and stem of young plants. Can be control by deep ploughing and drenching the soil with chlorpyriphos @ 2ml/L water.

Root Weevil: Make deep tunnels in the crown base and finally the plants collapse. Control measures are application of Carbofuran (6-10 kg/ha) and Parathion (0.017 %) around the plants

Verticillium Wilt: The older leaves turn brown and get shrivelled, finally plants may die. The proper crop rotation besides soil fumigation with formalin (5000 L/ ha) or chloropicrin (210 L/ha) are the precautionary measures.

Leaf spot complex: Spot of different shapes and sizes appears on the leaves which may dry and defoliate. 2-3 sprays of hexaconazole (0.5 ml/ L water) or 5 sprays of carbendazim (0.5g/L water) at 21 days intervals can check the disease.

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Analysis of Factors Responsible for Outbreak of Alfalfa Weevil (Hypera postica Gyllenhal)

By **Bashir Ahmad Rather and Sushil Kumar ***

Introduction

Forage production occupies a top priority by farmers in cold arid regions because a long severe winter of 7-8 months is devoid of any vegetation greenery. Alfalfa (Medicago sativa L.) also called as the 'Queen of Fodder or Green Gold' is the most important fodder crop grown in the Ladakh region owing to its well adaptability in the region. It is locally named as 'Buksukh'. The crop being highly suited to the farming community, the cropping area has picked up and covered almost the entire area under fodder crops. It is a very important leguminous fodder grown as a perennial crop in cold arid zone. Once sown it continues to show good re-growth for 6-8 years with low management and care in subsequent years. It is one of the wonder plants of cold deserts that nurture soil, animals and human beings. The crop is well adapted to vagaries of cold arid climates and provides safety and security through ensured returns to farmers. It is a persistent, productive, as well as heat and drought resistant crop that provides better seasonal distribution than berseem.

Alfalfa is a traditional crop in cold arid region and so far no new variety has been identified or released. Only the one local land race known as 'Ole' or 'Yarkandi Ole' is cultivated. Presently three cultivars are morphologically easily distinguishable (Chaurasia and Singh, 1996) which are as follow:

Medicago Falcata: It is yellow flower species and highly productive species compared to other species. Plant height varies from 30-150 cm. It shows mild resistance to insect pests.

Medicago Sativa: It is purple flower species and mostly preferred due to more leafiness. Plant height varies from 30-100 cm. It is relatively more susceptible to insect attack.

Alfalfa adult weevil

Medicago Media: It is white, dull white, light yellow to light purple species. It is tall vigorous plant species. It is intermediate in adaptation and more susceptible to insect attack as compared to other species.

A great number of insect species feed on alfalfa and some are capable of inflicting serious damage to the crop. Alfalfa weevil (Hypera postca Gyllenhal) is the most important species consuming foliage. The principal damage to alfalfa crop is caused by the feeding of larvae on inter veinal tissues, sometimes leaving only the leaf veins. Alfalfa weevil is an early season pest of alfalfa that affects the first cutting and sometimes the early re-growth of the second cutting. However, losses from this insect vary from year-to-year, but in some seasons they can be large enough to justify the application of an insecticide. During a diagnostic field survey in 2009 in Kargil region viz. Minge, Hardass, Akchamal, Shilikchey, Sankoo, Gongma and Khurbathang it was observed that the alfalfa weevil caused a significant damage to the alfalfa fodder crop at all the locations, particularly in Khurbathang zone which is the major alfalfa growing area in the Kargil region. The key to economical management of the alfalfa weevil is combining crop management practices, biological control and the use of insecticides when weevil numbers are high enough to ensure that yield benefits outweigh treatment costs. The possible responsible factors for outbreak are mentioned here as under:

A. Abiotic Factors

An analysis of the problem in relation to region revealed that the atmospheric temperature played a crucial role in the faster multiplication of the pest. The

During the prolonged cold spring the alfalfa weevil larvae do not grow as fast as alfalfa. In this situation the plant matures before weevil larvae can severely damage it. During warmer spring conditions larval populations increase faster than plant growth resulting in extensive damage

Nature of damage of alfalfa weevil

prevalence of rainfall, snowfall and subsequently the low temperature up to the end of May influenced the severity of alfalfa damage to a greater extent during this period. But the onset of optimum temperature is above 15 degrees Celsius from first week of June during the bud or flower initiation stage resulting in faster multiplication of the pest which gave a sudden spurt in the population of the pest and caused significant losses to the farmers. Spring weather conditions influence the severity of alfalfa damage. During the prolonged cold spring the alfalfa weevil larvae do not grow as fast as alfalfa. In this situation the plant matures before weevil larvae can severely damage it. During warmer spring conditions larval populations increase faster than plant growth resulting in extensive damage (Metcalf and Lukemann, 1982).

B. Biotic Factors

1. Cultural Practices

- **Monoculture:** There has been monoculture of this fodder crop from very long ago due to the best adaptability of this crop in this region. Moreover, there is very little diversity in this fodder crop; almost the entire fodder crop is under two to three genotypes. Availability of a suitable host is important for outbreak of any pest species. A mixed planting of alfalfa and other palatable grasses, which normally grow along with alfalfa, has been found to reduce the alfalfa weevil infestation in many areas. It is therefore recommended to maintain diversity of various naturally growing different types of grasses in alfalfa fields. According to Bowman (1992), a mixed planting of alfalfa and other grasses can reduce infestation of alfalfa weevil larvae and leaf hopper levels in some areas.

  Presently Oat (Avena sativa), which provides both fresh and dried fodder and does not need any plant protection measures, offers a viable economic alternative means of fodder production in cold region. It will also increase the diversity of the fodder cropping system and can reduce infestation of insect pests.

- **Lack of Crop Management:** Any crop management practice that helps to produce a dense, uniform stand will make the crop better able to tolerate insect feeding. Almost no attention is given towards crop management practices in terms of irrigation, manuring and fertilization and on weed control. Common weeds seen in alfalfa are Artemisia sp; Melilotus sp; Convolvulus arvensis; Lepidium latifolium; Chenopodium album and Agropyron repens. Dodder (Cuscuta reflexa Roxb.) which is a parasitic weed on Lucerne has been spreading fast over the last few years. It propagates vegetatively and through seeds. Control of its seed setting is important.

- **Delay in Harvesting:** Lucerne is preferred for harvesting at the initial or half bloom stage considering the nutritive value of herbage, maximum dry matter accumulation and the critical LAI of the crop during the season. The harvesting should be done after 50-55 days of sprouting (second half of June to first week of July) in case of double cut varieties. A 30 percent increase in total produce has been reported by Singh (1999) in two times cutting compared to single cutting at maturity. It has been observed that the fodder crop was not harvested at optimum time, due to its poor growth and development as a result it fell prey to the attack of insect pests. Immediate cutting can be an alternative to the insecticide application if an economic infestation develops during the season. If cutting cannot be made within the week then insecticide application should probably be made. Cutting before the optimum growth stage can reduce the dry matter yields although hay quality may be increased.

2. Balance in Nature

The pest has shown prolific reproductive and feeding potential only during the last few years. Thus it is necessary to understand the interaction between the forces which determine the insect

Alfalfa weevil Larvae

population (reproductive potential of an insect itself under optimum condition) and the forces of annihilation or environmental resistance which denote the resistance offered by biotic and abiotic forces in an environment to the detriment of species (Pradhan, 1983). Nature is able to maintain a striking balance between the forces of reproduction and annihilation. The environment gives rise to a force of annihilation which results in huge destruction which is necessary to keep the population below economic threshold level. Thus, a residual population is always present in ecosystem including an agro-ecosystem. A congenial environment, mainly temperature, leads to unusual or uncontrolled population resulting in population explosion.

3. Extension of Cultivated Area

This fodder crop is grown extensively in the region and every year the area has been increasing. This also leads to easy availability of host plants for development of insects.

Tactics for Alfalfa Weevil Management

The tactics for alfalfa weevil management can be grouped into two general categories:

1. Cultural Control

This involves the use of regular or slightly altered crop management practices to adversely affect pest species. The optimum time for harvesting of alfalfa crop is 50-55 days after sprouting. The damage due to weevil larvae coincides with blooming stage of the alfalfa crop. Timing of harvest is the most important manipulation to reduce weevil problems. Immediate cutting can be an alternative even to the insecticide application if an economic infestation develops during the bud or early bloom stage.

2. Chemical Control

To determine the need for insecticide treatment; assess the severity of an infestation by calculating the percentage of damaged terminals or by counting the number of larvae per stem or by counting the number of larvae captured with a standard 15-inch diameter sweep net. If 30 to 50 percent of the terminals are damaged or if larval counts average 1.5 to 2 per stem or if larvae average 20 per 180 degree sweep then make an insecticide treatment with Chloropyriphos 20 EC @ 0.02% or Dimethoate 30 EC @ 0.03% or Malathion 50 EC @ 0.05% or Endosulphan 35 EC @ 0.03% or Quinalphos 25 EC @ 0.04% or cut the crop immediately. If weevil numbers are high and the crop is starting to bloom, harvest rather than spray.

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Post Harvest Technology

By **Crisologo Ramasasa ***

What is Post Harvest Technology?

Post harvest technology involves harvesting, handling, storing, moving the produce to reduce losses and to keep them fresh up to the market. It's of utmost importance to maintain the freshness or to minimize the deterioration of products from harvesting, marketing and to the time they are consumed. The increase in vegetable and fruit production doesn't guarantee sufficient supply of good quality product for consumers to eat and the grower to sell, due to post harvest losses.

Causes of Post Harvest Losses

Technological – Post harvest losses cover the following causes:

Decay or rotting – Vegetable easily decay or rot when not properly handled, especially the leafy ones. Fruits last a little longer but they easily rot as well.

Yellowing – Yellowing mostly happens to leafy vegetables. For fruits yellowing is a sign of ripening and later decay.

Wilting – This is common to leafy vegetables.

Softening – Softening is mostly prevalent to fruits and some leafy crops.

Sprouting – Some root vegetables when stored longer tends to sprout (e.g. carrots, potato, sweet potato, onion, garlic, etc.)

Non-technological – Post harvest losses mostly occurs when there is lack in transportation and storage facilities causing the delay of the harvested products. Non-technological losses cover the following factors:

Transportation – Lack of transportation is one factor that causes post harvest losses. Before you venture into vegetable production you should provide this very important equipment in your priority list.

Storage – Storage facilities plays a vital role for a success in vegetable endeavour. If transportation facilities is vital, storage area is also important

Adverse weather conditions – Changing weather condition greatly affects your cropping pattern. Study the condition in your area, what particular crop or crops that thrives best to a particular weather condition.

Inefficiency of distribution – If your distribution channel is inefficient crop damage will be severe. Therefore, make your strategy feasible so that your product could reach to the buyers fresh.

Lack of market demand – Consider surveying the market if the crop you'll plant is needed or in demand. This is one factor that causes crop losses because nobody buys your product.

Physiological damage – Crop damage is caused due to changes in texture, flavour and aroma.

Mechanical damage – Crop losses due to rough and careless picking, packing, loading or unloading. The damage maybe in the form of cuts, punctures, cracks, splits, changes in forms and shape or partial or full separation of the outer covering.

Insect damage – Damages caused by insect occurs at storage or directly in the field before harvest. You've to control immediately those insect found in the field prior to harvesting or in your storage area. Your storage room should be disinfected before placing your harvested products.

Basis of Post Harvest Technology

Vegetables are perishable in nature – Whether they're already harvested and not in the soil anymore, they're still living things. They still undergo all the biological processes connected with life. When harvested, the intake of energy through respiration and manufacture foods through photosynthetic process is cut and there's no replacement for the lost reserves. The faster it respires, the faster it rots. Vegetables contain 80 – 95 water. This is lost to the atmosphere through transpiration especially during dry and hot months.

Differences in Morphology, Structure and Chemical Composition: The changes depend on what morphological parts the vegetable is…

- Leafy vegetable – The leaves wilt and turn yellow.
- Fruit vegetables – Ripens eventually become over ripe
- Flower vegetables – The flowers opens.
- Modified stem – Produces new buds and sprouts.

Changes on structural differences of each morphological parts…

- Leafy vegetables – Have bigger and more stomata on upper and lower surface, therefore have faster respiration and transpiration.
- Fruits, roots, tubers, and bulbs – Have reserve surface areas and few or no stomata but have few lenticels.

Response of Vegetables to Environment – Respiration and transpiration of vegetable changes in response to the environment:

- Temperature – The most critical environmental factors that influences the deterioration rate of vegetables. Decrease in temperature decreases respiration, transpirations, microbial activities and insect growth.
- Relative humidity – The ratio or content of water vapour in the air.
- Gases in the atmosphere – Ideal content of air is 78% Nitrogen, 21% Oxygen, and 0.03% Carbon dioxide.
- Microorganisms and insects – Vegetables serves as food for microorganisms and insects. The more we keep away vegetables from them, the longer we can keep vegetables.

How to Reduce Vegetable Losses

Start with good quality seeds or planting materials – You've to look into the characteristics of your stock in relation to its size, shape, colour, texture, weight and nutrient content.

- Influence of Environmental Condition – The quality of your vegetable at or after harvest is affected by temperature, light, rainfall and other environmental factors.
- Effects of Cultural Management – You should start your field preparation exactly right. This includes seedbed preparation along with water management, weeding, fertilization, control of pests and diseases. If you neglect these cultural management practices, the quality of your product will be greatly affected.
- Avoid Physical Damage – Physical damages starts during harvesting up to sorting, cleaning, transport from the field to the storage area and down to the market.
- Strictly follow the correct method of handling your product to avoid physical damage at serious level.
- Control Environmental Factors – Using low temperature (Refrigerator) during transport or storage and application of chemical to control post harvest decay is one strategy to avoid crop damage. You can apply the following strategies:

- Temperature management – Avoid high temperature to lengthen the life span of your vegetables.

The use of refrigerator is the most effective way of lowering temperature. In the absence of Refrigerated facilities, you can apply the following methods to minimize crop losses:

- Harvest as early or as late in the day as possible.
- Avoid exposing vegetables to direct sunlight at anytime.
- Put sufficient ventilation during transport.
- Use white colour canvass for covering vegetables.
- Travel as early or at night if possible.

Relative Humidity Management – You've to increase the relative humidity to 85% . Methods of increasing Relative Humidity are as follow:

- Wet the floor of the area where vegetables are kept.
- Introduce a fine mist of water or steam into the ventilating fan.
- In a small room keep open containers filled with water.
- Use evaporative cooling system.

Control of Gases in the Environment – Decrease in oxygen and increase in carbon dioxide makes transport and storage in low temperature. The use of polyethylene bag allows the accumulation of carbon dioxide and depletion of oxygen inside the bag with few holes to allow ventilation. Ethylene use should be avoided except where ripening of fruits is involved.

How to Avoid Ethylene Effect

- Ensure good ventilation to dilute the concentration of ethylene – Ventilation is vital during storage and transport so that ethylene accumulation can be avoided.
- Don't store ripening fruits with fresh vegetables in the same room – Separate fruit vegetables from the leafy ones. Ethylene is for ripening purposes only. If it would combine with leafy vegetables the leaves becomes yellowish.
- Proper handling during transport and storage should be practiced at all times – Proper handling means, you should apply the correct storage and transport procedure to insure that the vegetables are safe and free from any damage.
- Sort products and separate diseased and injured vegetables – It is important that you should separate the diseased and injured products. Ones they're not sorted, the tendency is the spread of the diseases would affect the other that are in good conditions. Avoid keeping vegetables in enclosed areas where there is smoke – You've to do away your products in enclosed areas where there's no ventilation especially when there's smoke around the area – this will affect the quality of the products.

How to Reduce Micro-organisms Multiplication

- Make the container, vehicle, room clean before placing the products – This is self explanatory, clean surroundings is always the ideal place for storing anything.
- Handle vegetables carefully to avoid injury – Carefully handle your products with care to avoid crop injury. Injured areas are the ones where bacteria or virus enters which may cause the deterioration of the products.
- Avoid hot and moist condition – Hot and moist condition attracts some deadly micro-organisms which is their ideal place to live and multiply. You should make sure that the area is dry and there is a free circulation of air all around.
- Sort the products and separate diseased vegetables – As I explained in number 4 above, you've to separate the diseased and injured products to avoid contamination to the other crops that are good.
- If vegetables are likely to be disinfected, use Alum or Lime – If you're to store or transport your products, it's best to disinfect them with Alum or Lime to lengthen their life span. This is mostly applicable to leafy vegetables where their shelf-life is only short.
- Cure root and bulb crops before storage and transport up to 20-35 °C – Curing your products increases their shelf-life especially when you store them for a longer time or transporting in a long distance.

** Crisologo Ramasasa, horticulture and gardening expert*

Need to Harmonize Competing Uses of Crop Residues and Sustaining Natural Resources Quality

Dr **Bijay Singh** *

Historically, crop residues have often been removed from fields for livestock bedding and feed, fuel for cooking, and other off-field purposes. More recently, increasing quantities of crop residues are becoming available as crop yields and cropping intensity increased but the off-field uses of crop residues have tended to decrease. The intensification of land use results in less time between crops for managing residues as these can interfere with tillage and seeding operations for the next crop. Due to lack of alternative uses for crop residues and lack of appropriate machinery to handle increasing quantities of residue, farmers are increasingly burning crop residues as a method of disposal. Open-field burning of crop residues is recognized as a major contributor to reduced air quality and human respiratory ailments. Of the total crop residues burnt, China and India contributed 44 and 33.6 percent, respectively.

Open-field burning of straw also leads to loss of nutrients contained in residues. Many governments in Asia have made it illegal to burn crop residues, but these laws have been difficult to enforce. In recent years there has been increasing realization that crop residues are a readily available resource of nutrients and organic material for farmers. Residue management also influences availability of micronutrients such as zinc and iron. However, residues must be carefully managed for obtaining positive effects on soil and crop production and avoiding negative effects such as interference with the planting of crops, nitrogen immobilization, and emission of greenhouse gases. So as to develop residue management technologies, which provide agronomic benefits in a cost-effective and environmentally acceptable fashion, it is necessary to scientifically understand the short- and long-term effects of different crop residue management practices.

Recently, Bijay-Singh et al. (2008) evaluated crop residue management options based on criteria of productivity, profitability, environmental impact and sustainability. These criteria are in agreement with the approach of ecological intensification for intensive crop production systems, which aims to satisfy the increasing demand for food, feed, fibre, and fuel while meeting acceptable quality standards of environmental and natural resources. Based on information available in the literature, it was inferred that incorporation of crop residues in both flooded rice and non-flooded crops usually does not increase yield of the following crop, irrespective of amount of residue, timing of incorporation, or amount of fertilizer applied. Even productivity of the crop following the one that receives the residue is also usually not benefited.

Residue incorporation often involves extra expenditure for tillage operations

to turn the residue into the soil, unless the residue can be incorporated along with preparatory tillage. Particularly in non-flooded soils, incorporated residues can, however, beneficially influence soil chemical and physical properties. Anaerobic residue decomposition can have detrimental effects on young rice seedlings and result in production of more methane than would be emitted from a flooded soil without incorporated residue. These disadvantages can be overcome by incorporating the residue several months before land preparation and flooding, but it involves additional cost that rarely translates into increased productivity or profitability for the farmer. And in intensive cropping systems with only a brief interval between crops, this does not even seem feasible.

In sharp contrast to incorporation, mulching is an attractive alternative for residue management as it generally improves yield (Bijay-Singh et al. 2008), has almost no added expenses, particularly when used in reduced and no tillage systems, and has a number of indirect beneficial effects on crop growth. Thus leaving the crop residue on soil surface as mulch is more likely to be profitable for farmers growing crops in reduced or no till soils provided extra labour cost for crop establishment in the presence of stubble and loose straw is substantially reduced by using appropriate machinery. Significant breakthroughs have already been made in this direction for seeding zero-till wheat into rice residue in the Indo-Gangetic Plain in South Asia. However, it is important to prioritize continued development of machinery and crop establishment techniques that enable the seeding of non-flooded crops into standing stubble and loose mulch. Because puddled soil by definition involves tillage, mulching is more attractive in non-flooded crops than in flooded rice. Some indirect benefits of mulching include weed suppression and conservation of soil water resulting in savings in irrigation water at some locations.

A simplified decision tree as shown in Fig. 1 sums up the guidelines for managing residues in cropping systems, based on evaluation of the productivity, profitability, and sustainability of the various options. Removal of residue from puddled fields for off-field use rather than incorporating it can be a viable option, unless the energy costs for removal negate the benefits gained from off-field alternatives. This removal would be easier to accomplish in places where farmers usually thresh off-field. In non-flooded crops like upland rice, wheat, maize and legumes, residue should be retained as mulch in a reduced or no tillage system unless disease pressure becomes high. In those situations occasional removal of residue should work. Residue incorporation has no significant advantage over mulching in terms of sustainability of soil organic matter, and is less likely to improve productivity.

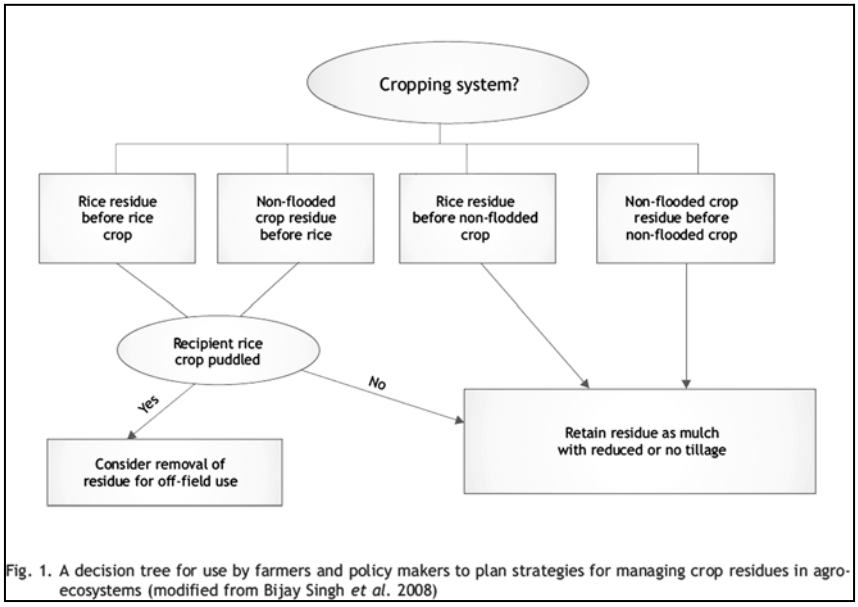

Fig. 1. A decision tree for use by farmers and policy makers to plan strategies for managing crop residues in agro-ecosystems (modified from Bijay Singh *et al.* 2008)

In addition to incorporation and mulching, the two main residue management options, there are also other options practiced by a small group of farmers. Crop residues are sometimes transferred from the field and transported to a location for use as mulch in high-value crops and vegetables. Other alternatives include in situ composting, off-field composting, animal feed, and controlled burning as a household fuel. Local traditions and economic situations influence farmer's decisions on use of these alternatives. Overall superiority of leaving crop residues on the non- or minimum-tilled soil as mulch rather than incorporation into the soil in terms of

productivity, profitability, sustainability and environmental concerns is in complete accord with conservation agriculture defined as a land management system based essentially on three principal practices:

- Elimination or reduction of tillage;
- Year-round soil cover with crops or crop residues; and,
- Cropping systems which include crops such as cereals grown in rotation with N2-fixing legumes.

Conservation agriculture sounds too good to be true. Instead of burning crop residues after the harvest, or ploughing biomass into the ground, these are left in place as soil cover. At the start of the next cropping season, the field is not ploughed. Instead, using special equipment, seeds are directly drilled into the soil. Crop residues remaining on the soil surface produce a layer of mulch. This layer not only protects the soil from the physical impact of rain and wind but also stabilizes the soil moisture and temperature in the surface soil layers. This zone also becomes a habitat for a number of organisms including large insects, soil-borne fungi and bacteria. These organisms macerate the mulch,

Crop residues remaining on the soil surface produce a layer of mulch. This layer not only protects the soil from the physical impact of rain and wind but also stabilizes the soil moisture and temperature in the surface soil layers

incorporate and mix it with the soil and decompose it so that it becomes humus and contributes to the physical stabilization of the soil structure. The soil organic matter also provides a buffer function for water and nutrients. Soil fauna, such as earthworms, provide a soil structuring effect producing very stable soil aggregates as well as uninterrupted macro-pores leading from the soil surface straight to the subsoil.

An emerging issue in crop residue management is its potential use in bio energy production. The main bio fuel option for crop residues is cellulosic ethanol production. Energy from residues can also be produced through combustion, gasification and anaerobic digestion. According to an analysis carried out by Lal (2008), 1 billion tonnes of residues are equivalent to 2800 billion litres of ethanol or 56×109 GJ of energy. But, removal of crop residues exacerbates soil degradation, increases net emission of CO2, and aggravates food insecurity. Increasing soil organic pool by 1 tonne C/ha/year through residue retention on soil can increase world food grain production by 24-40 Mt/year and root/tuber production by 6-11 Mt/year.

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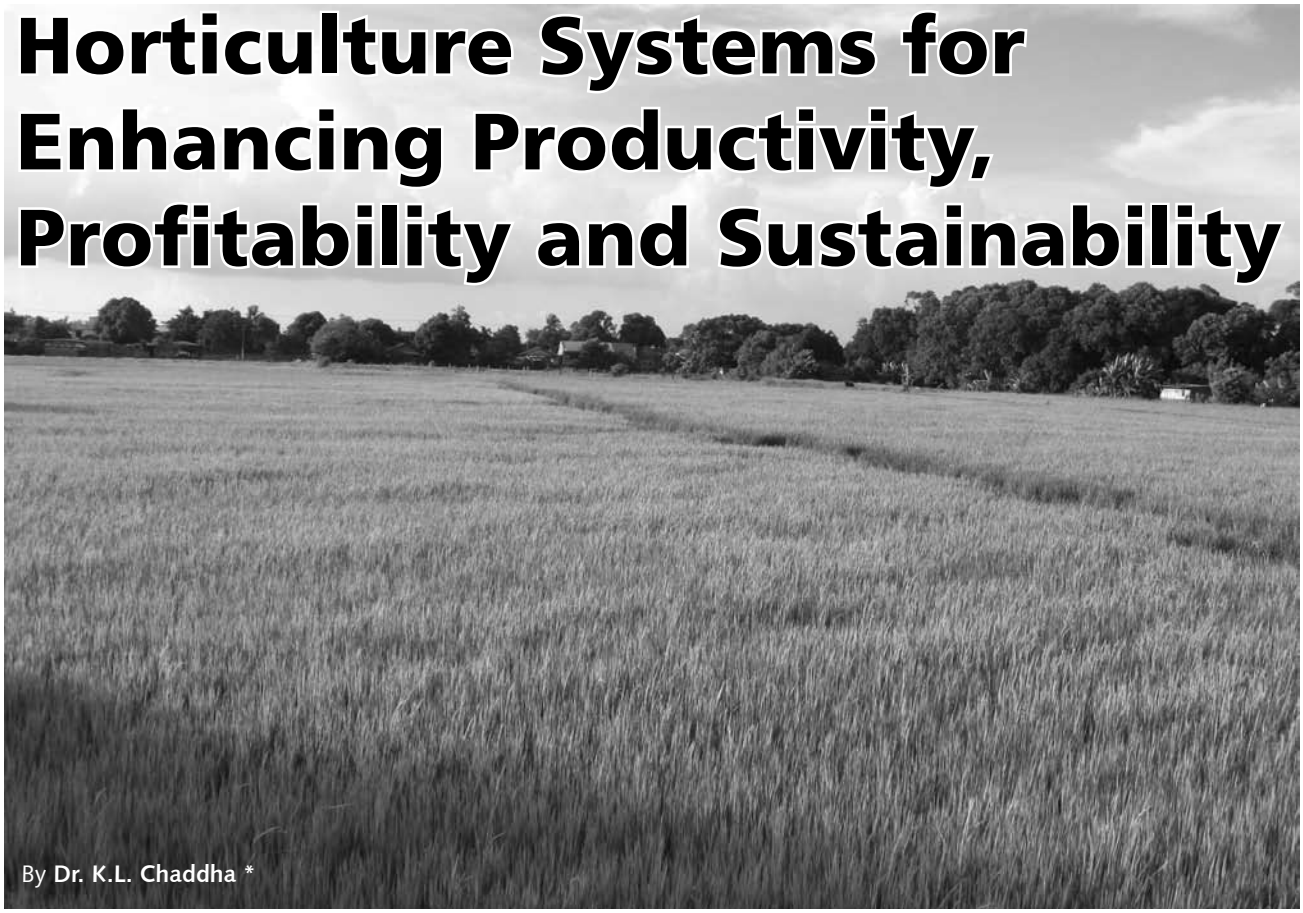
** Source: Dr Bijay Singh, ICAR National Professor at Punjab Agricultural University*

Horticulture Systems for Enhancing Productivity, Profitability and Sustainability



By **Dr. K.L. Chaddha** *

There is now increasing realization that injudicious use of natural resources is leading to deleterious effects both on farmland and crops. These effects include depletion of topsoil, and contamination of groundwater which cause high costs of production, resulting in disintegration of economic and social conditions in rural communities. This calls for the need of conservation agriculture, which is an application of modern agricultural technologies to improve production while concurrently protecting and enhancing the land resources on which production depends. It is based on the principles of rebuilding the soil, optimizing crop production inputs including labour and optimizing profits.

Conservation agriculture promotes minimal disturbance of the soil by zero tillage, balanced application of chemical inputs, and careful management of residue and waste. This reduces land and water pollution and soil erosion, and long-term dependency on external inputs, improves water quality and water use efficiency, reduces emissions of greenhouse gases through lessened use of fossil fuels, and enhances environmental management. Conservation agriculture can be achieved by growing horticulture and agro forestry crops besides permanent cropping systems which in turn promote food sufficiency, and value-added production through improved crop production and market opportunities, and consequently help in poverty reduction. Some issues in conservation agriculture that require attention are soil erosion and degradation, soil salinity, raised or decreasing water tables, and pesticides residues toxicities.

With increasing emphasis on horticulture and better understanding of the production systems, growers are increasingly adopting management approaches that result in safe, quality produce while maintaining conservation of resources. Some ways in which horticulture crop production is able to achieve objectives of conservation agriculture are briefly mentioned. Horticulture systems, particularly perennial crops, contribute to protection of soils and minimize mechanical soil disturbance, reduce erosion, soil salinity and prevent water loss from occurring within the soil. Sustainable horticulture also helps in protecting and enhancing soil health. Tree growing also protects soil loss due to erosion by wind or water.

The Poplar tree is one of the most commonly used windbreaks grown by the farming community. Deep root systems of fruit and plantation crops and perennial grasses hold the soil firmly, prevent erosion and improve its water-holding capacity. Several horticultural crops like, beach rose, jasmine, bougainvillea, and winter berry are of strong salt resistant nature and can be successfully grown in salt affected areas. The water requirements of horticulture crops have not been systematically determined. A properly planned, and managed irrigation and drainage system besides a healthy and vigorous crop, results in minimum loss of water and lays emphasis on fertigation options, and drainage management.

Another factor in efficient water use is the delivery system. Water use efficiency increases with increasing precision of water delivery, which could be met through micro-irrigation systems. Micro-sprinklers or dripper systems target the root zones of the crop, and are the most efficient irrigation systems. These systems can also be used with advantage for fertigation where dissolved fertilizer is supplied to the crop through the irrigation system. Micro irrigation and fertigation systems are ideally suited for horticultural crop production and are covering increasing acreage as a result of programmes launched by GoI under the National Horticulture Mission. It facilitates frequent small applications of fertilizers that supply nutrients to the root zone as needed, and reduces the risk of nutrients being transported off-site by runoff. This also results in saving of labour.

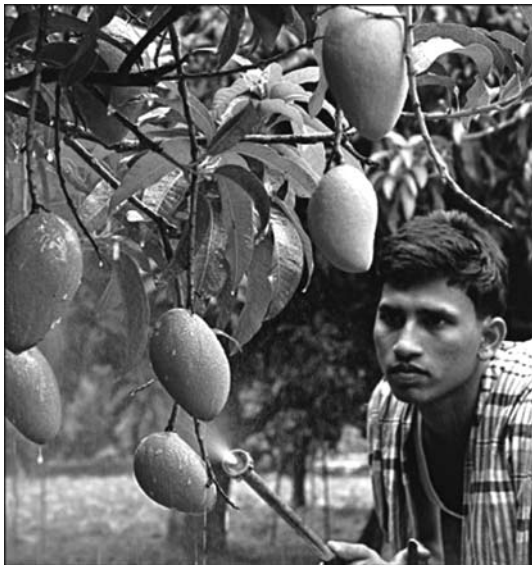
Cover crops are also one of the possible ways in preventing soil erosion and for improvement of soil tilth. Besides, cover crops also aid in nutrient cycling, reduce soil temperature fluctuations, provide habitat for beneficial insects, and suppress weed populations. Most of the perennial horticultural crops have provision for inter-row cover crops between the trees, which, among other benefits, protect soil from erosion by wind or water. Some of the cover crops are, field pea, strawberry, clover and lupine. Incorporating green manure crops in vegetable production systems and mulching under tree crops protects soil from wind and water erosion as well as adds organic matter to the soil. Organic matter is vital to sustain the productive life of the soil and improves aeration and drainage, and structure of the soil. It also provides a slow release form of nutrients, and helps in holding large amounts of nutrients in the soil so that applied fertilizers are better protected against leaching. Organic matter levels in horticulture plantation can be maintained or increased through a number of practices. Cover crops make a valuable contribution; particularly those with dense fibrous roots are more useful than those with fewer fleshier deep roots. Inter-row cover crops in orchards can also be mown and put into the crop row to supply leaf matter.

Several systems of conservation agriculture are now being advocated worldwide. Besides improving soil health, plant products from organic farming are substantially better in quality like, bigger size, flavour and aroma, and animal products are of better quality when fed with feed and fodder produced organically. The underground water of the area under such farming system is generally free of toxic chemicals. It ensures optimum utilization of natural resources for short-term benefit and helps in conserving them for future generation. Vermicompost, which is a preferred nutrient source for organic farming is eco-friendly, non-toxic, consumes low energy input for composting and is a recycled biological product. It enhances the decomposition of organic matter in soil, improves soil structure, texture, aeration, and water holding capacity, and prevents soil erosion. It is rich in beneficial micro flora such as N-fixers, P-solubilizers, cellulose decomposing micro-flora etc. besides improving soil environment.

Horticultural crops attract a large number of pests and diseases, and require a large number of sprays often with systemic insecticides

Organic farming systems are most suited for high value horticultural crops. The area under such crops is increasing globally and thus indirectly adding to the concept of conservation agriculture.

Achieving sustainable production also depends on protecting crops from the threat of various pests and diseases and resulting toxicities. Horticultural crops attract a large number of pests and diseases, and require a large number of sprays often with systemic insecticides. Following a balanced approach in pest control in these crops which maximizes the use of natural control agents and minimizes pesticide use resulting toxicities, can contribute favourably to conservative agriculture. Integrated pest management programs are now available for a number of crops using a combination of biological, physical, cultural, genetic and chemical control methods to manage pests. In addition, many horticultural crops also utilize rootstocks that are resistant to key soil borne diseases or pests or other abiotic stress. Ensuring planting material that utilizes good quality resistant rootstock is an important step to sustainable production like salt creek rootstock in grape, trifoliate orange in citrus and Malling and Malling - Merton rootstocks in apple. In vegetable crops a large number of disease-resistant varieties now exist in several crops.



Another method of disease control is the use of weather data to predict high-risk conditions and allow growers to take prophylactic measures. These strategies are now available for predicting disease incidence in apple (scab), grape (downy mildew), and mango (powdery mildew). In perennial horticulture, weed management, once a matter of routine spraying or ploughing, is now part of total orchard floor management. In general, growers can use a combination of non-tillage methods such as mowing, selective herbicide application, cover crops and mulching for a healthy and protected orchard floor. Ground with a cover crop is less prone to weed establishment. In view of the above, horticulture systems seem to be among the best systems to achieve the objective in conservation agriculture and consequent environmental protection.

** Source: Dr. K.L. Chaddha, Agricultural Consultant, GOI.*

Success Stories of Farmers

Farmer in the Role of Marketing Guru for Entire Village

Value addition and processing as the mantras for his success, Kailash Chowdhary is a progressive farmer from Kiratpura village, Rajasthan. Despite his education only up to 10th standard, he applied marketing mantras for getting substantial prices for his farming products. His concept of value addition through processing changed his life forever. Now, with the help of the Central Institute of Post Harvest Engineering and Technology (CIPHET), Ludhiana, Kailash is not only earning more, he is also giving almost 70 people direct and indirect employment.

When he started farming years back, his main concern was how to survive with only 20 acres of his ancestral land. Then he got news that wheat is sold at double price in Jaipur than what he was selling to a local commission agent. On visiting the shop, he found that it was the same wheat. The only difference was that it was graded and packaged properly. He did the same and sold it at a better price. After that, he started a food processing plant from a small room in his village with investment of just Rs one lakh in Year 2004. While his sincere efforts kept him moving on the path of progress, technologies and technical know-how from CIPHET has strengthened him to develop international quality products through food processing.

Kailash says that association with CIPHET was a significant turning point in his life. In Year 2006, he got various Amla grading and punching machines designed by the CIPHET. Besides this, he also took consultancy for processing technologies of various food products. This helped him to produce international quality products. At present, Kailash is not only producing products like Amla juice, Amla powder, aloe vera juice, candies, squashes, pickles and sweets, but is also exporting to countries like USA, UK, UAE and Japan under brand name of KS BIO FOODS.

Interestingly, he himself is growing plants of Amla, aloe vera plants from his organically certified fields to be processed and packaged in the processing unit established at his own farm.

His two sons are also finding prosperity in agriculture and food processing. The state awarded farmer has inspired numerous colleagues in his state to take new route in agriculture – food processing and organic farming.

His success is not only confined to his own prosperity; he is committed to bringing revolution in his entire district. He has formed a Jaivic Krishi Utpad Mahila Sahkari Samiti in Kiratpura for women empowerment; he has also formed a group of 1500 farmers actively engaged in organic farming and food processing. "Not only in my village, but all villages in Tehsil Kotputli have stopped flood irrigation. Drip irrigation is used in orchards and sprinklers for other crops. Besides, we harvest rainwater to ensure maximum availability of water," he said proudly.

(Source: NAIP sub project on Mass Media Mobilization, DIPA with inputs from CIPHET, Ludhiana)

Zero Tillage in Wheat Saved Resources and Enhanced Income

Sahab Singh, a farmer of Ramba village, Karnal district of Haryana has a holding of nearly 42 ha in 600 mm rainfall area. He grows cereal crops like wheat and paddy (twice in a season), fodder crops i.e. Trifolium alexandrinum, sorghum, maize, etc. in the sandy loam soil. He was impressed with the gains of zero-tillage technology being adopted by fellow farmers in Pehowa

area in Haryana. He therefore adopted the technology on his farms in 1999, but the gained benefits were not as good as expected. Later on, he got guidance from scientists of Directorate of Wheat Research, Karnal and Haryana Agricultural University. On the advice of scientists, he purchased two zero

tillage machines, each costing Rs 16,000 in the years 2000 and 2001. The machines are fitted with two boxes, one each for fertilizer and seed. Fertilizer is placed below the seed. The tines are fixed at 21 cm with knife points. Before adopting zero tillage, he had to plough the field 8-10 times which consumed 75-88 litres diesel per ha area. There was a lot of pollution due to more fuel burning.

He observed that sowing wheat in full paddy residue is somewhat problematic; therefore, he also tried rotary disc drill. With slight modifications, it can be a fancy machine for the farmers. At times, he had to use reaper to remove residue in fields but he found that crops under residue are better than removal with high moisture content.

Zero tillage has saved a lot of labour. He uses clodinafop once in three years so that there is no build up of seed bank of Phalaris minor, whereas, the other farmers have to use it every year due to which it has developed resistance against some molecules. During 2007-08, the average wheat yield at his farm was 6.0 ton per ha using zero tillage, which is at par with conventional practices. Wheat was sold as seed @ Rs 11,200 per ton to seed growing companies. The operational expenditure was Rs 10000 per ha. Therefore his net profit was Rs 5,72,00 per ha. Without compromising on wheat yield, he saves at least Rs 2500 to Rs 2900 on account of ploughing. A minimum saving of Rs 2,50,000 is simply due to adoption of zero tillage technology.

(Source: NAIP sub project on Mass Media Mobilization, DIPA)

Precision Farming Yielded High Profits in Tamil Nadu

Rajamani, a young farmer of Pullagoundan Pudur village, Coimbatore district, Tamil Nadu practiced conventional farming in growing vegetable crops like onion, chilli and turmeric in the red sandy loam soil. But the gained benefits were not as good as expected. He participated in a course on precision farming organized by Directorate of Extension Education, Tamil Nadu Agricultural University (TNAU) and approached Horticulture Department for further advice. The Department suggested that he follow the precision farming as a group to get high profit. He planned to cultivate onion, tomato, brinjal, cauliflower, chilies and turmeric. Then, he prepared his land under the supervision of scientists of Horticulture Department, TNAU.

He started the cultivation of turmeric in his own field in an area of 1.5 hectare. He ploughed the land four times and applied farmyard manure @ 25 t/ha and 300 kg of DAP and 150 kg of potash as a basal dose. Then he formed raised beds of 120 cm with at an interval of 60 cm for sowing and placed the laterals on the centre of each bed at the rate of 1 lateral pipe per 5 feet. The beds are wetted through drip irrigation. Then sowing was done in the month of June @ 2000 kg/ha following the methods as suggested by Dharmapuri and Krishnagiri farmers.

He broadcasted the coriander seeds @ 500g /ha in between the turmeric crop and irrigated the field through drip system. He also planted the small onion bulb @ 1000 kg/ha in two lines as the intercrop with six lines of turmeric at a spacing of 120 cm. He sprayed Oxygold weedicide @ 2ml/lit on the second day after sowing. After one week of sowing, he transplanted 1000

chilly seedlings in between the lines with a spacing of 80 cm and he also sowed red gram as a border crop @ 200g/ha. He applied 5 kg potassium nitrate and 5 g urea at five day intervals by the fertigation method throughout the cropping period.

He irrigated the field two days once as per the need of the soil. First hand weeding was done with a maximum of ten female labourers/ha 30 days after sowing. He placed 200 kg of DAP, 200 kg of Potash and 100 kg of Urea mixture evenly to turmeric and onion crops as top dressing on the 60th day after planting and irrigated near the placement of fertilizers through the lateral pipes. The raised beds are earthed up twice on 60th and 120th days after planting. Then he followed hand weeding with ten female labourers at the interval of 80, 140, 200 and 240 days after sowing. He sprayed fungicide like Thiodan and Dithane Z78 @ 2ml /lit of water 20 days after sowing for the control of leaf spots. He sprayed Malathion @ 2ml/lit of water to turmeric on the 40th and 70th day after sowing for controlling shoot borer pests. He sprayed Monocrotophous pesticide @ 2ml/lit to onion crop on the 30th day after sowing for controlling thrips. He drenched the soil with Ridomil gold fungicide @ 2ml/lit to control rhizome rot in turmeric on the 50th day after sowing.

He harvested the coriander in 30-35 days after sowing, onion 70 days after sowing, chillies on the 90th day after planting and red gram on the 250th day after planting. Then turmeric fingers were harvested 275 days after sowing. He got yields of 7 tonnes of turmeric fingers and 13 tonnes of onion, 2 tonnes of green and dry chillies and 50 kg red gram in one hectare of land. He sold turmeric fingers at the rate of Rs. 135/kg, onion at Rs. 20/ kg, chillies at Rs. 12/kg, red gram at Rs. 100/kg, tender coriander leaves Rs.4/kg and coriander seed at Rs. 15/kg.

He got high yield and quality farm produce by using sufficient water and fertilizers at regular intervals. Particularly onion fetched a high price in market because of same size and good quality. Retailers came to the field to take the produce directly. He spent Rs. 3,35,400 for cultivation practices and got a high profit of Rs. 9,66,000 per hectare from turmeric, onion, chillies, coriander and red gram. He got this huge profit since he shifted from conventional farming to precision farming. Now, Rajamani is one of the happiest farmers in the region. He is enjoying precision farming with his family. He is stimulating other farmers in his village to follow precision farming.

(Source: NAIP Sub-Project on Mass Media Mobilization, DIPA with inputs from Directorate of Extension Education, Tamil Nadu Agricultural University, Coimbatore)

AGRI NEWS

VAMNICOM (Vaikunth Mehta National Institute of Cooperative Management), Pune receives the prestigious "19th Dewang Mehta Business School Award"

VAMNICOM, Vaikunth Mehta National Institute of Cooperative Management, Pune received the prestigious "19th Dewang Mehta Business School Award" for "B-School Leadership Award" on 26th November 2011 at Taj Lands End Hotel, Mumbai. Business School Affaire (BSA) has been organizing this award ceremony for the past 19 years. It is an effort from the Industry to recognize talent in education that is helping shape a future for the industry. The awards are supported by Shaila Mehta – Director, Onward Foundation for Dewang Mehta Awards, Chairman of the jury Dr. Prasad Medury (partner, Amrop International) and the patron Harish Mehta, Chairman and Managing Director, Onward Technologies. About 19 Vice Chancellors were present on this award ceremony.

VAMNICOM, Vaikunth Mehta National Institute of Co-operative Management, Pune is conceived as an intellectual nerve centre for the Cooperative Movement and it is financed by the Ministry of Agriculture, Government of India. The Institute acts as apex body for imparting training in Cooperative and Agribusiness Management in India. **VAMNICOM** is one among the top sectoral B-School of India in Agribusiness. **The Institute has been offering flag ship Programmes in Post Graduate Diploma in Management from 1993**. The restructured Post Graduate Diploma in Management – Agri Business Management (PGDM-ABM) has been offered since 2004. The programme is recognised by All India Council for Technical Education (AICTE) and Association of Indian Universities (AIU).

Source: Vaikunth Mehta National Institute of Cooperative Management

AGRI NEWS

Time to Rethink on Food Production, Research Methods: ICAR Chief

Director General of Indian Council of Agriculture and Research (ICAR) S. Ayappan has underscored the importance of scientific research in the field of agriculture and the challenges it is facing presently. While speaking on 'Feeding Crores for Ever' during the 99th Science Congress at the KIIT University, Ayappan said that the work of the scientists in the areas spanning pesticides, agricultural machines, rural development, renewable energy sources, materials technology, molecular plant breeding and genetically improved grains is changing our agriculture and spearheading a remarkable silent revolution which is shaping our country's progress through this decade of innovation.

"We need to look differently at our priorities in food and this is an opportune time to rethink the food production and research methods. Also, the maintenance of the system can be carried out within the village and information systems as Kisan Mobile Sandesh and Agropedia need to be developed more, thereby creating indirect employment," he said.

Ayappan expressed concerns about natural resource base, impact of climate change on production, ground depletion and imbalance in food grain. "We have to act as clearing house of research and general information relating to agriculture, animal husbandry, home science and fisheries and to institute and promote transfer of technology programmes," he said. Further elaborating on the issue, he said that we have to undertake and promote consultancy services in the fields of education, research, training and dissemination of information in agriculture, agro-forestry, animal husbandry, fisheries, home science and allied sciences. "It will help us to look into problems relating to broader areas of rural development. However, in this endeavour, the generation of ideas is critical. Central to the ideation process is 'Right to Food' and the Science Policy has to be people- participatory," Ayappan pointed out.

On the strengths of India, he said that the nation has drought-accessing monitoring system which will have to be upgraded for drought- proofing agriculture. He also informed the audience about improved productivity in dry-land farming, bio-engineering measures for soil-conservation, integrated nutrient management, integrated farming system and water budgeting. "These strengths need to be harnessed to address the basic needs of the people and to transform India into a food-secured nation," Ayappan suggested.

Source: India Education Diary

Growth of Small Farm-Based Agriculture

Indian agriculture is predominantly small land holder agriculture. This feature of land holding is kept in view while developing various kinds of technologies. Researchers are also sensitized about need for developing technologies that are appropriate for small and marginal farmers.

Indian Council of Agricultural Research (ICAR) addresses research needs of farmers, including small and marginal farmers, through All India Coordinated Research Projects conducted in its centres spread across the country. To promote decentralized, farmer-driven and farmer-accountable extension system, a Centrally Sponsored Scheme "Support to State Extension Programme for Extension Reforms" popularly known as Agricultural Technology Management Agency (ATMA) Scheme is being implemented in 604 districts covering 31 States/UTs.

To provide better marketing infrastructure/ facilities to all categories of farmers, Scheme for Development/Strengthening of Agricultural Marketing Infrastructure, Grading and Standardization is being implemented in 26 States/UTs. To galvanize institutional credit system to make it more responsive to needs of farmers, limit of collateral-free farm loans has been raised from Rs. 50,000/- to Rs. 100,000/-, interest subvention is provided for timely repayment of crop loans. Initiative has been taken to provide Kisan Credit Cards to all eligible and willing farmers in a time bound manner. Under National Agriculture Insurance Scheme (NAIS), 10 percent subsidy in premium amount is provided to small and marginal farmers.

To incentivize States to allocate more funds for agriculture and allied sector, Rashtriya Krishi Vikas Yojana (RKVY) has been launched. Government also provides assistance to farmers, including small and marginal farmers, through various schemes such as National Horticulture Mission (NHM), Revised Macro Management of Agriculture (MMA), National Mission on Micro Irrigation etc.

This information was given by Shri Harish Rawat, Minister of State for Agriculture and Food Processing Industries in written reply to a question in the Rajya Sabha.

Source: Press Information Bureau, Government of India

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- Implementation of DFID funded Western Orissa Rural Livelihood Project (WORLP) – Watershed Development Mission, Govt. Of Orissa – 2005-2010
- Comprehensive Watershed Development Project in Karnataka - Watershed Development Department (WDD)-Government of Karnataka – 2006-07
- Madhya Pradesh Tribal Development Project - The International Fund for Agriculture Development (IFAD), Rome – 1997

Grass Roots level Livelihood Implementation

AFC has undertaken large scale Agricultural Extension Programme in 820 Blocks covering all 71 districts of Uttar Pradesh.

The mission of the implementation project is to increase the farm productivity, profitability and sustainability of farming systems, efficient use of natural resources and agricultural inputs etc., by customised farmers' trainings at village cluster level and to provide online information on weather parameters, demand and use of agricultural inputs and market intelligence.

Organic Farming

This project involves the adoption and certification of Organic Farming in 22000 hectares.

Watershed Development

AFC is implementing Livelihood Development Programme based on Watershed Development with funding by DFID, and NABARD.

Panchayati Raj Institutions

AFC has set up an independent division for providing support services in terms of grass roots level planning, training of various stakeholders in UP, Bihar and Jharkhand. AFC has prepared Perspective District Plans in 25 districts of Uttar Pradesh under Backward Region Grant Fund (BRGF).AFC has also conducted TNA and prepared Training Manual for PRIs in Jharkhand.

The PRI division will also provide the following services:

- Organise training programmes for the senior & middle level executives of the NGOs.
- Capacity building of the ERs and various stakeholders.
- Conduct research studies, develop learning material for each level on local self governance, organise seminars and workshops, promote exchange of academic expertise on various aspects related to local planning & DPCs, disseminate specialised information and provide expert advice to all concerned.
- Take up advocacy role to strengthen democratic process, particularly grassroots level democracy through decentralised institutions.
- Lay special emphasis on involving the poor, marginalised and weaker sections of the society in the democratic governance.

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