Kurukshetra

A JOURNAL ON RURAL DEVELOPMENT

Vol. 62 No.9 Pages 52 July 2014 ₹ 10/-

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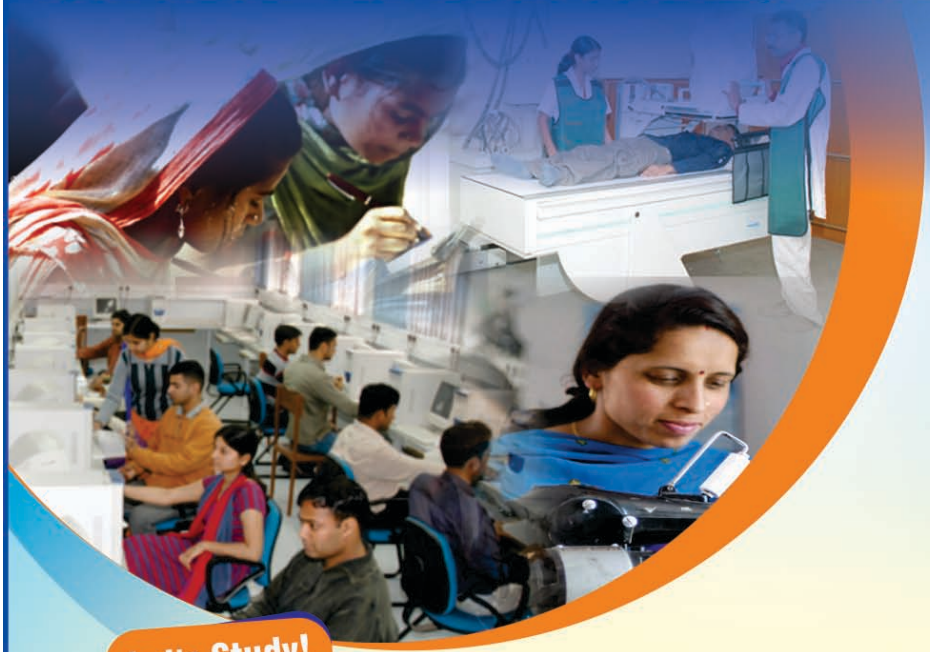

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The Monthly Journal

Kurukshetra

MINISTRY OF RURAL DEVELOPMENT
Vol. 62 No. 9 Pages 52
July 2014

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INSIDE

Rural Development strategies have to include the injection of newer technologies to sustain growth in the long run. Whereas, enough research and development activity is undertaken by our Agricultural Universities, only 30 per cent of the newly developed agricultural technologies are broadcast on the field. As such Research and Development alongwith transfer of technology to the ground are essential in boosting rural development. Agriculture extension remains an important medium to transfer technology to rural areas.

In the last fifteen years Information Communication Technologies (ICTs) has helped in facilitating socio-economic development in rural areas and has brought about a paradigm shift in providing financial services, education, and health facilities in rural areas.

The growth of rural telephony, especially mobile telephony has brought improved connectivity and this would have contributed significantly to socio-political and economic mainstreaming of rural India in the past decade. However, much more needs to be done if the benefits of telecommunications connectivity are to translate into overall rural development.

Technologies are important not only for pre-harvest phase but post harvest phase as well. Newer technologies, based on ICT are helping in marketing of the agricultural produce so that the farmer gets a better price.

Technology is critical to the agro industry in the production, processing and marketing and packaging stage.

Even space based applications are now being used for understanding our water and soil table. Space borne remote sensing data provides timely and reliable information on available water resources and its utilization. Remote sensing inputs have been significantly contributing in water management in rural areas

Scientists say space technology can be used to bring connectivity to several villages across the country that are still without power supply and internet connectivity.

Former Chairman of ISRO says, There are still over 30,000 villages in India without electricity, phones or internet. It is possible to bring connectivity to these villages by using satellite technologies, as has been proved in the past.

Surface water is one of the features most detectable by remote sensing. In a complementary way, its special signature is as typical as that of vegetation because of its great absorption of the spectrum. Therefore the location and delineation of water bodies is one of the most reliable operations that can be done by space imageries and multi spectral data.

To tap the available water newer irrigation technologies have been developed which provides the best insurance against weather induced fluctuations. This is the only way in which we can make our agriculture profitable and sustainable in the coming decades. ❑

NEW RURAL TECHNOLOGIES

Dr. Arpita Sharma

Only with mass production being aided by modern technology and intensive marketing can the agriculturist exploit both the domestic market as well as the international market to the fullest extent. The volume of production depends not only on the capital investments and marketing strategies but also on the technical capacity used during the production and processing stage. In fact, technology has come to play a very significant role even in marketing these days.

Agriculture Technology: It includes wide range of improved techniques, methods, equipments, processes and products by which farmers can increase their production, productivity, input profit and overall quality of life. Generally, technology is used to improve the human condition, the natural environment or to carry out other socio-economic activities. Agriculture technology is a complex blend of materials, processes and knowledge.

Classification of Agricultural Technology: Agricultural technology may be classified into two major categories:

[1] Hardware (Material technology): Where knowledge is embodied into a technological product such as tools, equipments, agrochemicals, seed materials, medicines etc.

[2] Software (Knowledge based technology): It includes technology knowledge, management skills and other processes that farmers and rural people need for better production in their enterprises. The word "technology" can also be used to refer to a collection of techniques. In this context, it is the current state of humanity's knowledge of how to combine resources to produce desired products, to solve problems, fulfill needs, or satisfy wants, it includes technical methods, skills, processes, techniques, tools and raw materials. When combined with another term, such as "medical technology" or "space technology", it refers to the state of the respective field's knowledge and tools.

Technology Development: In the conventional or "central source" view of agricultural research and development, technology emanates from "upstream" activities in the formal research system and is adapted by "downstream" research until it is ready for dissemination to farmers. Some people have used an analogy from home economics rather than hydrology, speaking of quarter-baked (notional), half-baked (preliminary), and fully baked (developed) technology. Others have referred to the development of experimental, prototype and off-the-shelf technologies. All these analogies

imply a linear process of technology development and dissemination, culminating in the adoption of new technologies by farmers. In practice, however, agricultural innovations are derived not only from the laboratories and research stations of the national and international centers but from multiple sources. These sources include research-minded farmers, innovative research practitioners at the local level, research-minded administrators, non-government organizations (NGOs), private corporations and extension agencies. In the "multiple sources" model, technology consists of many old and new components. It evolves and is continually modifies over time. Consequently, in contrast to technology transfer, there is no clear-cut, one-way progression from research to extension to adoption.

New Agricultural Technologies in India:

[1] Ploug: Ploughing is the first preparation for planting. The plough is primarily designed to prepare the ground for cultivation by turning it over, thus burying the weeds and loosening the earth. It is generally agreed by historians that the earliest implement used for cultivation was probably a crude pointed bent stick or tree branch which was used to stir the soil surface. In effect, a hand held hoe was used in which the user scratched at the earth to form a tilth where corn could be sown. Over a period of time, these hand held hoes soon developed into simple ploughs. These primitive ploughs were eventually pulled by animals like oxen, camels and even elephants. Animals enabled the land to be tilled more easily and faster; thus more food was produced. The credit for this innovation goes to the Egyptians. These ploughs had different modifications in different parts of the world. During the period from the 1820s to the 1840s, several innovations occurred in plough production.

[2] Harrow: After ploughing, other implements were used. The harrow was necessary to smoothen the soil in areas where the soil remained rough. It consists of a wooden or metal framework bearing metal disks, teeth or sharp projecting points, called tines, which are dragged over plowed land to crush the clods of earth and level the soil. Harrows are also used to uproot weeds, aerate the soil and cover seeds. In the beginning the harrows were as simple as a tree branch but the harrow became more sophisticated after the Industrial Revolution. By the 1790s, two distinct types of harrows were in use: the square and the triangle or "A" frame. The square harrow was used on old fields that were free of large obstructions, while the triangular frame was used on freshly ploughed fields.

[3] Seed Driller: Seed drill is an innovation that allowed seeds to be easily planted deep into the soil instead of on top where the majority were washed away or otherwise lost. The machine was pulled by horses and consisted of rotating drills or runners that planted seeds at a set depth.

[4] Horse Hoe: It is horse-drawn machine which loosened the soil and killed weeds.

[5] Reaper: The first reapers cut the standing grain and with a revolving reel, sweeping it onto a platform from which it was raked off into piles by a man walking alongside. The reaper could thus harvest more grain than five men using the earlier cradles. The reaper was eventually replaced by the self-propelled combine, operated by one man, which cuts, gathers, threshes and sacks the grain mechanically.

[6] Threshing Machines: Threshing machine is designed for rapidly removing the husk from grain. With improvements in design and efficiency, threshing machines became progressively more common and the hand flail was gradually consigned to history. The machines could be driven by wind or water power or by horses, but the steam powered threshers became the most familiar sight.

[7] Tractor: Tractor is a vehicle particularly crafted to exert traction at slow speeds, for the purpose of hauling a trailer or machinery used in agriculture. The versatility of tractor is with respect to its attachments that it supports. The more the options for connecting attachments to the tractor, the higher is the cost. The most common tractor attachments include front end loaders, mowers, box blades, spreaders, tillers, plows, trailers and backhoes for plowing, tilling, disking, harrowing, planting and similar tasks.

Irrigation Technology: Water is undoubtedly the sine qua non for all irrigation activities, worldwide. Particularly in India, an unpredictable monsoon coupled with an increasing demand for food production (at the self-sustenance as well as commercial levels) has induced an imperative need for irrigation options other than those that are either extremely laborious and time consuming or simply too expensive for small and marginal farmers. Electric and diesel pumps can be used to extract groundwater for irrigating any large acres of land; however, some

cost effective technologies that are being availed by a major section of farmers are as follows:-

[a] Treadle Pump: It is a foot operated water lifting device that can irrigate small plots of land of small holders in regions that have higher water table (not deeper than 25 feet). A treadle pump is a low cost system, simple in design and easily manageable; it appropriately answers the irrigation need for the small farmers.

[b] Drip Irrigation Technology: Drip irrigation is a water-saving technology which enables slow and regular application of water directly to the roots of the plants through a network of economically designed plastic pipes and low discharge emitters. It maximizes crop productivity through increase in the crop yield and also the area for cultivation and protects the environment through conserving soil, water and fertilizer resources, thus increasing the farmer income. Currently, this is being promoted by the Government of India in the form of kits in the water scarce regions in India. They include: [i] Drum Kit [ii] Bucket Kit [iii] Family Nutrition Kit.

Technology dissemination: Is a system in which package of technology and services, which include appropriate technology, relevant media system, credit, input supply system, prices and marketing and trained manpower are put into practice to increase agricultural productivity.

Ways to Technology Dissemination: [1] Government: Extension workers, KVKs, Agri-clinics & plant-clinics, Extension programme like ATMA, NATP, NAIP, NAEP etc**.**

[2] Private: NGOs, Input Agencies, Private Agri-clinics, Kisaan call center, E-choupal, Farmers Organization etc.

Transfer of Agricultural Technology Government Programme in India: First line extension systems: Realizing the scope and importance of integrated working of interrelationship between research, education and extension functions, the ICAR established a section of extension education in its headquarters in 1971, which was later on strengthened and renamed as division of agricultural extension. It was intended to enforce this functional relationship down the line in the research institutes, agricultural universities and allied institutions. There were four main transfers of technology projects of ICAR, namely the: All India Coordinated Projects on National Demonstrations (AICPND), Operational Research Project (ORP), Krishi Vigyan Kendras (KVK) and Lab to Land Project (LLP). All the projects were of mobile type, except the KVKs, which are vocational training institutions.

[1] All India Coordinated Projects on National Demonstrations (AICPND): A nationwide programme of demonstrations, known as National Demonstrations (ND) on major food crops was launched in 1964. The rationale behind the schemes was that unless the scientists could demonstrate what they advocated, their advice might not be heeded by the farmers. It was a nationwide project with a uniform design and pattern.

[2] Operational Research Project (ORP): ORP were initiated in 1974-75, aimed at disseminating the proven technology in a discipline/area among farmers on a watershed basis, covering the whole village or a cluster of villages and concurrently studying constraints (technological, extension or administrative) as barriers to rapid spread of improved technical know-how.

[3] Krishi Vigyan Kendras (KVK) is designed to impart need-based and skill-oriented vocational training to the practicing farmers, in service field level extension workers and to those who wish to go in for self-employment.

[4] Lab to Land Project (LLP) was launched by the ICAR in 1979 as a part of its Golden Jubilee Celebration. The overall objective of the programme was to improve the economic condition of the small and marginal farmers and landless agricultural labourers, scheduled cast and scheduled tribes, by the transfer of improved technology developed by the agricultural universities, research institutes etc.

[5] Lab to Market: The National Development Council envisaged an overall growth rate of 10 percent during the 11th Five Year Plan. But, the fact remains that the agricultural sector has lagged behind pace with other sectors of the economy. To achieve the targeted 10 percent growth, agriculture has to gear up to attain a growth rate of 4.1 per cent as against 1.7 per cent of the 10th plan. Declined Agriculture growth during previous plan upshot serious implications on not only food and rural livelihood security but also resulted in farmers' distress and suicides. Therefore, extension principles, technology content and operational strategy demand earnest contemplation. In other words, a vibrant and dynamic approach for

Agricultural extension is a strategic necessity to make envisaged growth a reality. Indian agriculture has made rapid progress / strides in the last half century by augmenting the annual food grain production from 51 million tonnes in the early fifties to 239.67 million tonnes in 2007-08 and steered the country to a status of self sufficiency. It has been successful in keeping pace with the rising food demand of a growing population. Significantly, the extension system had played its role untiringly in transfer of production technologies from lab to land besides the agricultural scientists, farmers and marketing network.

Information of Agricultural Technologies through Mobile Phone: Farmers all across the nation need not worry about pests and crop diseases as they will soon be able to get all this information on their mobile phones. The pilot project will be implemented in a few villages of Punjab and Uttar Pradesh initially. Agricultural experts in some of the villages are already gathering information from a wireless sensor network spread across the farms, wherein based on soil, weather, rainfall and other parameters diseases in crops are being detected. The new application, known as "mKrishi", to detect the crop diseases has been developed by Tata Consultancy Services. "It took us more than two years to develop this mobile phone application. This sensing technology will be available to farmers through mobile phones network throughout the country," TCS scientist Dr Bhushan Jagyasi said. To cost Rs 100 a month, the service providers will provide application to high-end phone users; TCS will support the low-end users. Once the application is loaded on the phone, agriculture experts will send a set of questions to farmers related to symptoms of diseases in the local language. "Farmers will respond in yes or no. Answers will help experts in detecting the crop disease, who will suggest remedial measures to farmers individually. Also, farmers can receive the images showing a disease- affected crop," added Dr Jagyasi. In Punjab, experts at Punjab Agricultural University will help the farmers through this application.

Kisaan SMS Portal: Kisaan SMS Portal was launched on July 16, 2013 for Farmers. SMSs to be sent to the farmers can be broadly classified into three categories, viz. information, services and advisories. The content may include information about the schemes, advisories from the experts. Market have been grouped based on the State, District, Block and the Crops/Activities selected by a farmer. Officers can send SMS to the farmers belonging to the entire area of their jurisdiction or a part of it. Grouping of farmers based on their location and their preferred crop/activity will help sending relevant messages to the farmers. The system is capable of sending messages in regional languages also. The farmers can register to this service by calling Kisaan Call Center on the toll free number 1800-180-1551 or through the web portal. SMS based registration is also being introduced shortly. Farmers can give upto 8 choices for their preferred crops/activities. This also includes activities under Animal Husbandry, Fisheries & Dairying in addition to Agriculture & Horticulture. Provision for sending Voice messages will also be started in due course for the farmers who are not familiar with SMSing. Existing farmer databases of farmers available to Central as well as State Governments are being integrated with the Portal which has also been linked with the Kisaan Call Centre not only for registering more farmers. Timely receipt of relevant expert advice/information/market information can help the farmers in following ways.

[1] Information on Schemes and Programs of Government of India can help every farmer to reap benefits out of these schemes thus widening the footprint of these schemes.

[2] Weather forecast can help the farmer in planning farm operation effectively on the onset of any adverse weather conditions; advice can be provided to the farmers on effective recourse to be adopted.

[3] Outbreak of disease/pests can be controlled as advisories can be provided immediately to the farmers in and around the area of initial report of the disease/pest.

[4] Crop advisory will lead to the adoption of more appropriate technologies suited to local situations.

[5] Selection of suitable and better variety/breed by the farmer based on the information/advisory can be provided to him/her.

[6] Timely market information will give better bargaining power to the farmer.

[7] Soil test results in his mobile will help in selecting the right fertilizer and the dosage.

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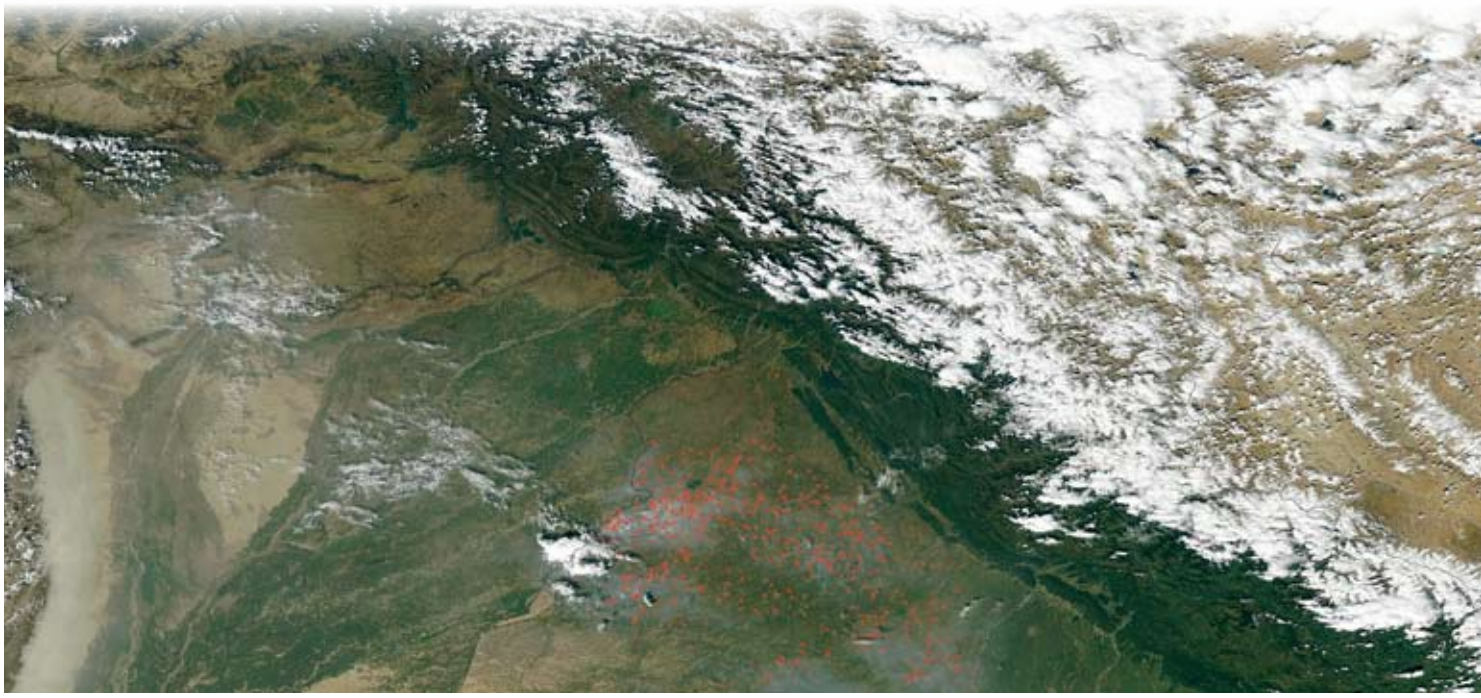
APPLICATION OF REMOTE SENSING IN WATER RESOURCES MANAGEMENT

L. Neelima, A.V. Ramanjaneyulu and S.R. Kumar

The available surface and ground water resources are inadequate to meet all the water requirements for all purpose. So the demand for water has increased over the years. The interpretation of satellite data in conjunction with sufficient ground truth information makes it possible to identify and outline various ground features such as geological structures, geomorphic features and their hydraulic characters that may serve as direct or indirect indicators of the presence of ground and surface water.

Water resources are sources of water that are useful or potentially useful for agriculture, industry, household, recreational and environmental activities. Virtually all of these human uses require fresh water. 97.5 per cent of water on the Earth is salt water, leaving only 2.5 per cent as fresh water of which over two thirds is frozen in glaciers and polar ice caps. The remaining unfrozen freshwater is mainly found as groundwater, with only a small fraction present above ground or in the air. Fresh water is a renewable resource, yet the world's supply of clean, fresh water is steadily declining. Water demand already exceeded supply in many parts of the world, and as world population continues to rise at an unprecedented rate, many more areas are expected to experience this imbalance in near future.

Remote sensing and Geographical Information System (GIS) were accepted as effective tools in water resources development and management to complement and supplement ground data. Space borne remote sensing data provides timely and reliable information on available water resources and its utilization. Remote sensing inputs have been significantly contributing in water management in India, both in its conservation and control aspects. From its modest beginning with surface water inventory, satellite remote sensing technology has progressed to more complex management in the field of snow hydrology, reservoir sedimentation assessment, irrigation



water management, hydrological studies, flood management, interlinking of rivers, snow and glacier studies, hydro power project, command area development, Water Resources Information System (WRIS), Accelerated Irrigation Benefit Programs (AIBP), monitoring of water logging and salinity areas and watershed monitoring etc.

Main advantage of using remote sensing data for hydrological modelling and monitoring is its ability to generate information in spatial and temporal domain. Remote Sensing (RS) data and Geographical Information System (GIS) play a vital role in the field of hydrology and water resources development. Though very few remotely sensed data can be applied in hydrology, such information is of great value, since, many hydrologically relevant data can be derived from remote sensing information. The GIS technology provides suitable alternatives for efficient management of large and complex databases. High resolution imagery from IRS series, Landsat series and SPOT satellites provide basic information for different hydrological regimes and for water resources evaluation.

Water management

The available surface and ground water resources are inadequate to meet all the water requirements for all purpose. So the demand for water has increased over the years. The interpretation of satellite data in conjunction with sufficient ground truth information makes it possible to identify and outline various ground features such as geological structures, geomorphic features and their hydraulic characters that may serve as direct or indirect indicators of the presence of ground and surface water. Remote Sensing and GIS methods permit rapid and cost effective natural resource survey and management. Moreover, remotely sensed data serve as vital tool in generating water resources action plan and also identifying landform features, drainage pattern and geomorphic indicators for location of recharge and discharge area analysis. The geomorphological conditions are an essential prerequisite in understanding water bearing characteristics of hard rooks. Sufficiently thick weathered zone forms groundwater storage in bedrock areas but often may not provide regular supply groundwater. Water resources development and management can be broadly studied under

- Surface water management
- Ground water management

Surface water management

Surface water is one of the features most detectable by remote sensing. In a complementary way, its special signature is as typical as that of vegetation because of its great absorption of the spectrum. Therefore the location and delineation of water bodies is one of the most reliable operations that can be done by space imageries and multispectral data.

In the Indian arid zone, the water bodies locally known as Nadis are the principal source of drinking water and nearly 80% of these are less than 0.9 ha in area. These water bodies cannot be identified and mapped with a reasonable accuracy from the Landsat MSS imagery due to its poor spatial resolution of 80 m. However, they could be easily and accurately identified and mapped from Landsat Thematic Mapper (TM) data due to its higher spectral and spatial resolution of 30 m, pixel size of 0.16 ha, synoptic view and repeated coverage of large area. Landsat Multispectral Scanner (MSS) imagery, particularly using band 7, has been successfully employed to map the occurrence and aerial extent of surface water bodies since the launch of ERTS 1 in 1972 (Xia et al., 1985). However to detect a water body reliably by Landsat MSS, its dimensions should be at least twice the dimensions of a pixel i.e. 0.9 ha. The visual interpretation of enlarged Landsat TM false colour composite and the Survey of India topographical maps in conjunction with ground truth is used for mapping and monitoring of the surface water resources of Jodhpur district, located in the arid environment of India.

The water bodies are distinctly visible in light to dark blue tone with varying size, shape and fine texture on a Landsat TM false colour composite. These could be delineated with maximum accuracy on the Landsat imagery based on their proximity to the settlements. In Jodhpur district, 135 Nadis containing water were identified and mapped from Landsat TM false colour composite (Fig. 1&2, Table 1). In the present case a 1.8 to 2.4 times reduction

in the drainage basin areas over a period of 28 years (1958-1986) had resulted due to biotic interference like reclamation of drainage basin areas for cultivation, construction of houses, factories, etc., (Sharma et al.1989)

Ground water management

Groundwater constitutes an important source of water for various purposes like domestic needs, supply for industries and for agriculture etc. The conventional approaches for groundwater investigation are ground based surveys and exploratory drilling which are time consuming and uneconomical. The traditional methods of searching sites for drilling of borewells, have not only had a poor success rate but even the places where such efforts have succeeded, the borewells are known to have dried up in a short period of time. Hence an integrated approach of remote sensing, geophysics and GIS can help to demarcate groundwater potential zones in hard rock areas more easily and with accuracy. The success case studies are detailed below.

Panchkula district : The Panchkula district is located in the northernmost part of Haryana State. The district is mainly drained by the river Ghaggar and its tributaries and the water resources of this district are under threat due to depleting water table. The advent of Remote Sensing has opened up new vistas in geological, geomorphological and structural mapping for ground water exploration and hydrogeomorphological maps of the Panchkula district on 1:50,000 scale was prepared using satellite images and

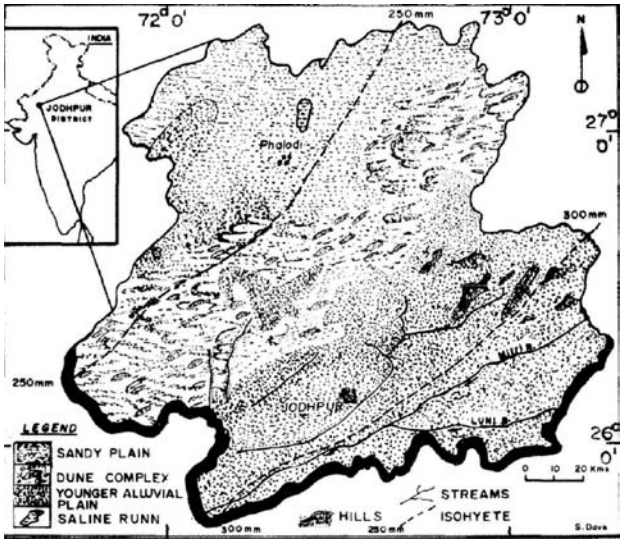


Figure 1. Study area Jodhpur district of Rajasthan

ground water potential zones were delineated. Hydrogeomorphological mapping incorporates relationship of geomorphic units with their groundwater potential as interpreted from the landform characteristics (nature of landform occurrence, lithology, structure, inter-relationship with other units etc.) as well as sub-surface geology.

This district exhibits diverse hydrogeomorphological conditions due to its location, topography and geology. The main hydrogeomorphic units found are alluvial plain, flood plain, denudational hill, piedmont zone, intermountain valley and structural hill. Excellent to good ground water prospect zones cover about 40% area of the district, whereas rests of the area constituted by denudational and structural hills has moderate to poor and nil prospects.

Table 1 Water surface and drainage basin areas of water bodies (Nadis) in different landforms

Landforms	No. of samples	Water surface area (m^2)	Volume of water (ha m)	Drainage basin area (ha)
Older alluvial	91	7163	2.1	72.2
plains		(781-37422)	(0.2-14.9)	(5.0-242.5)
Interdunal	14	4626	1.8	137.5
plains		(2500-9844)	(0.4-3.9)	(27.5-447.5)
Rocky/gravelly	8	9169	3.7	231.9
pediments		(4766-20469)	(1.0-10.9)	(30.5-690.0)
Buried pediments	22	(1719-59844)	(0.3-39.9)	(20.0-225.0)

Figures in parentheses are range values

The level of groundwater in this district is still to reach its optimum level. The potential aquifers can be exploited with shallow and deep tube wells. The Piedmont zone should be considered for further exploitation of groundwater through deeper tube wells.

Dhaulpur district: Dhaulpur block is located in the central part of the district, which is bounded by Bharatpur district in the north and Madhya Pradesh in south. Physiographically the area is characterised by a dissected plateau and alluvial plain region. Water resources action plan 1:50,000 was prepared by integration of all thematic maps like - Base map, Drainage map, Hydrogeomorphological map, and Ground water prospect map using satellite data and GIS techniques. The suitable sites for groundwater as well as surface water harvesting structures are suggested in consideration with physical and cultural parameters of the area to mitigate the increasing demands of water for irrigation and drinking purposes. Based on Groundwater prospect zones and geomorphic units of the block, water-harvesting structures are suggested on suitable sites.

> In the Indian arid zone, the water bodies locally known as Nadis are the principal source of drinking water and nearly 80% of these are less than 0.9 ha in area

The major geomorphic units identifying in this block are alluvial plains, river terraces, river channel, buried pediplain, denudational hills and upper plateau. Alluvial plains cover the maximum part of the block, which is a major geomorphic unit in the area. About 64.26 per cent of the block has very good groundwater prospect. Deep ravenous alluvial plain and moderately deep alluvial plain occupy 16.60 per cent area of the block, which is highly dissected. The ground water prospect in this zone is moderate to good.

To prevent further depletion of groundwater and its future development the first priority is for recouping it by artificial recharge. Thus remote sensing technology aided in preparation of water resource development action plan.

Patan Branch Canal Command Area: Patan Branch Canal (PBC) is a part of Bargi dam built on river Narmada. It has geographical area of 84632ha. Methodology adopted for the study involved digitization of available information, use of digitized information for generating the thematic maps, integration of theme maps and finally generation water resource plan (Nitin and Nema, 2000). The satellite data of IRS-1C, LISS-III and Survey of India toposheets were used to prepare thematic maps. The 'Integrated Land and Water Information System' (ILWIS 2.0) software was employed to generate desired maps and for their interpretation. Seven thematic maps generated are geomorphology, soil, ground water potential, water table fluctuation, depth to water table map, canal water availability and land use map. These maps were integrated and based on the pre-decided decision rules, actions to be taken were decided

An area of 54490 ha which has sufficient water is proposed to be double cropped. An area of 13612 ha has been proposed for single cropped area, looking to less availability of water. The area proposed for agro-horticulture is about 2812 ha. A part of the area is at a slope of 3 to 10% or more comprising 4126 ha is kept under silvipasture. The areas falling under wasteland and where the water availability for irrigation was very poor; were reserved for future extension of settlement areas. The water bodies in the area of 346 ha are proposed to be used as water resources

Sustainable water resources development and management necessarily depends on proper planning, implementation, operation and maintenance. As Remote Sensing and GIS data can be considered as an efficient tool for delineation and assessing water bodies, which presents an important technique for a temporal-analysis as a method of controlling the dynamic process and fast changes on water bodies. Thus, these techniques have to be effectively used to replace, complement and supplement ground data collection in various facets of different kinds of water resources projects.

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GIS-BASED DECISION SUPPORT SYSTEM-SOLUTION FOR RURAL DEVELOPMENT

Rakesh Kumar, Dasharath Prasad and R.K. Pannu

India is on a path of progress and growth. With a population of 1.2 billion, the nation has achieved sustained growth all-round. Looking even ahead, it is possible that Indian GDP would approach $9-10 trillion by 2025. These could be sustained growth of the economy and would still be powered largely by domestic demand and the transformation to a highly industrialized and technologically advanced economy. India will have to be significantly different–significantly transforming its process of planning, implementation and development. With large amount of socially-powered development, governance and public delivery systems will have to be more based on a scientific mapping of the needs/aspirations/desires and limitations of the beneficiaries and society.

Geographic Information Systems (GIS) will be an arena of technological and developmental edge. In the transforming world, nations that will possess a sound and progressive system of geographical information management will lead and chart ways in their own national and international arena far ahead of those that would use more traditional forms of information management. GIS and Decision Support Systems (DSS) are mechanisms that can be used to provide managers with information needed to make sound resource management decisions.

Geographical Information Systems:

India maintains a pre-eminent position in the use of multi-resolution spatial imagery. The capabilities in the development of high-resolution satellites and extensive network of associated infrastructure have contributed to the growing interest in the application of GIS for a variety of India's development needs. Indications are that these applications will continue to grow even more rapidly in the coming years. Since, the spatial imagery is becoming easier to use and more affordable, the user base for GIS is expanding in several directions in seeking holistic solutions beyond image processing capabilities.

Thus, GIS has considerable impact on the economies of local, regional, and national governance and development - by creating greater efficiency, more visual communication, and better decision making with the "integration" of maps, images and attribute data.

Decision Support Systems:

A DSS is an interactive, computer-based system designed to support a user or group of users in achieving a higher effectiveness of decision making while solving a semi-structured spatial problem. It is designed to assist the spatial planner with guidance in making land use decisions. For example, when deciding where to build a new airport many contrasting criteria, such as noise pollution vs. employment prospects or

the knock on effect on transportation links, which make the decision difficult. A system which models decisions could be used to help identify the most effective decision path.

A spatial decision support system typically consists of the following components *(GIS+DSS=SDSS).*

- Decision support system (DSS)
- Geographic information system (GIS)

DSS is a well-established area of information systems (IS) application. GIS modeling was used to support decision-making on agricultural product development and distribution, natural resource management, environmental rehabilitation, and institutionalization of indigenous environmental knowledge.

Current advances in computational speed, storage, World Wide Web (WWW) and software provide great opportunities to develop Decision Support Systems (DSS) with the advantage of information dissemination for decision-makers and program integration

Applications:

GIS applications are critical to many aspects of governance and nation building and can power more open-government methods and, thereby, leverage economic and social development more effectively; help in reaching the gains of development to the most needy and the right places and also bring in accountability and responsibility of public and national development activities.

As India lives in its villages and as Indian Constitution has empowered people to take decisions for themselves, there is need to reengineer Gram Panchayat (Village Level Self Government) planning efforts on a real time basis and in a cost effective manner and yet integrating all fabric of rural economy and life. And GIS is going to give this canvas and make it possible for credible, achievable and sustainable Gram Panchayat level planning and live up to "Gram Swarajya (Sustained Village Economy)", the dream of the father of Indian Nation, Mahatma Gandhi.

GIS tools are now commonly used in DSS for hydrologic model operation and data preparation, and GIS have become an essential tool to develop watershed management Spatial Decision Support Systems (SDSS).

Groundwater is an important water resource and artificial groundwater recharge is a strategy for water resources management. Ground waters are usually managed for extension of resources and obtaining suitable quality by underground water storage in times of water surplus and withdrawal of water to meet water demands in times of water shortage

Flooding is one of the most prevalent natural disasters. Artificial recharge of aquifers by floodwater spreading is an inexpensive method for flood mitigation. For artificial recharge by flood spreading was investigated using GIS and DSS.

A set of GIS-DSS applications supporting National Planning and Plan Monitoring functions are as follows:

Conclusion

Development should be sustainable, ie. Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. For sustainable development we need to make decisions that do not have long term negative effects, and assess the long term effects and impacts as well as the short term benefits. Because predictions can only be approximate, we cannot make decisions once and for all time, they need to be revised as the real consequences of decisions are revealed in practice. We describe geographic information systems (GIS) as an important recent approach to support decisions in sustainable development.

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LASER LAND LEVELING FOR CONSERVING NATURAL RESOURCES

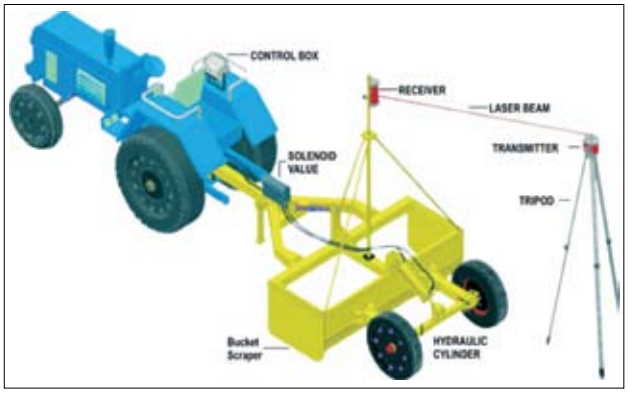
Ratneswar Poddar

The human population is increasing day by day but the land is fixed. Degradation of soil health and water table declining are the major constraints for agricultural development in current India. Water is the precious resource of agriculture for crop production. Thus proper emphasis should be given on the management of irrigation water usage for adequate crop production. The enhancement of water use efficiency and farm productivity at field level is one of the best options to redress the problem of declining water level. Unevenness of the soil surface has a major impact on the germination, crop stand and yield of crops through nutrient water interaction and salt and soil moisture distribution pattern. Land leveling is a precursor to good agronomic, soil and crop management practices. Resource conserving technologies perform better on well leveled and laid-out fields. Studies have indicated that a significant (20-25%) amount of irrigation water is lost during its application at the farm due to poor farm designing and unevenness of the fields. Laser Land leveling is a modern technology for using water efficiently as it reduces irrigation time and enhances productivity not only of water but also of other non-water farm inputs. In the advanced countries it has been found that this technology saves water to the tune of 25-30% and time by 30% and also improves the productivity by 10-15%. It helps in a quick crop establishment and crop management, and increases the yield and product quality also. In areas with excess water, the land leveling provides an appropriate runoff of excess water, thus ensuring a better water management practices.

What is Laser Land Leveling

Laser land-leveling is laser-controlled land-leveling. It is generally used for achieving very fine leveling with desired grade on the agricultural field. Laser leveling uses a laser transmitter unit that constantly emits 360° rotating single, very thin, high energy beam about 2 to 3 meter above ground level. This beam is received by a laser receiver (receiving unit) fitted on a mast on the scraper unit.

The signal received is converted into cut and fill level adjustments and the corresponding changes in scrapper level are carried out automatically by a two way hydraulic control valve.



Scope and Schedule

Generally land leveling is used on mildly sloping land. Land leveling is primarily used by agricultural producers using surface irrigation methods (furrow, border, basin, or flood) or by those wishing to improve surface drainage of their non-irrigated field.

Land leveling work falls into two general categories:

1. Large scale land shaping prior to cultivating newly irrigated land or land that has never been graded; or
2. Floating of a field prior to preparation of seed beds or borders.

The time required to grade a field depends on the size and type of land grading equipment, the quantity of soil to be moved, and the complexity of the existing field surface.

Benefits of Land Leveling

Effective land leveling reduces the work in crop establishment & crop management, and increases the yield and quality. Level land improves water coverage that improves crop establishment, reduces weed problems, improves uniformity of crop maturity, decreases the time to complete tasks and reduces the amount of water required for land preparation.

Laser land leveling systems provide benefit to the farmers by precisely leveling the farm lands which leads to the following benefits:

- Optimization of water use efficiency
- Better crop establishment
- Less Time and Water required in Irrigation
- Less effort in crop management
- Less weed problems
- Uniformity in crop maturity
- Time efficiency in completion of task
- Easy land preparation
- Less water requirement for land preparation
- Reduced consumption of seeds, fertilizers, chemicals and fuel
- Increase in farming area
- Assist top soil management
- Saves fuel / electricity used in irrigation
- More uniform moisture environment for crops
- Good germination and growth of crop
- Improved field traffic ability for the subsequent field operations

CONCLUSION:

Water is a precious resource for agriculture. That's why more and more producers are turning to precision land-leveling to help preserve and expand their water resources. In areas with water excess, the land leveling provides an appropriate water runoff, ensuring a better water management. Laser land-leveling in itself can improve irrigation efficiency by reducing high spots in a field that back up water, or filling low spots that contribute to excess irrigation. But if you are going to spend the money for laser land leveling, make sure you are installing the best irrigation gradients. So, the modern technique laser land leveling can act as an key component in the field condition to save the natural resources (water) and ultimately boost up crop productivity too.

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ICT INFRASTRUCTURE & SERVICES FOR RURAL INDIA

Archana G. Gulati

The lack of higher education facilities in the vicinity of their homes makes rural India the ideal market for distance education services

Information Communication Technologies (ICTs) are facilitators of socio-economic development. In rural India with its obvious lack of basic facilities by way of health, education, financial services and employment avenues etc., ICTs can help bridge gaps by providing access to internet and mobile enabled 'e' and 'm' services. ICTs can make knowledge and employment opportunities, education, health, financial and government services etc. available to rural Indians. Certainly, the notable growth of rural telephony, especially mobile telephony has brought improved connectivity and this would have contributed significantly to socio-political and economic mainstreaming of rural India in the past decade. However, much more needs to be done if the benefits of telecommunications connectivity are to translate into overall rural development.

Improving broadband penetration is a key focus area for the Government and this is being addressed actively by the Department of Telecommunications (DoT) and the Department of IT (DIT). The National Telecom Policy 2012 lists the use of mobiles as an instrument of socio-economic empowerment for citizens as a mission statement. It sets targets of 70% and 100% rural teledensity by 2017 and 2020 respectively. It lays special emphasis on providing reliable and affordable broadband access to rural areas. It also targets provision of high speed and high quality broadband accesses to all village panchayatsthrough a combination of technologies by the year 2014 and progressively to all villages and habitations by 2020.

DoT's Universal Service Obligation Fund (USOF) already launched a Wire line Broadband scheme in 2009. Under this scheme, 360,000 connections had been provided till April 2012. With the auction of 3G spectrum, it is expected that the rollout of broadband facilities in rural India would follow over the next

five years as prescribed under winning operators' agreements with DoT. For uncovered areas, USOF would put in place a Rural Wireless Broadband scheme. USOF is also to fund the National Optic Fibre Network (NOFN) now christened Bharat Broadband Network Ltd (BBNL) which shall soon connect 2,50,000 village panchayats and co-located Bharat NirmanKendras) with Optic Fibre thereby providing high speed broadband facilities. Bandwidth from NOFN will be available to eligible service providers to provide broadband and broadband enabled services in rural areas. Even as connectivity improves steadily, what rural India needs urgently is electronically delivered information, knowledge and urban quality services. This translates into a huge market opportunity for providers of ICT enabled access to information, education, health, financial services, commerce and employment opportunities etc.

Mobile Value Added Services

A good example of mobile services is the USOF pilot project scheme for mobile value added service (m-VAS) for rural women's Self Help Groups (SHGs). This is a part of USOF's Sanchar Shakti programme. In this scheme, SHGs' information needs are identified based upon their main entrepreneurial/income generation activities and relevant information is then delivered in local language through mobile phones. It could be through SMS (if the women are literate) or otherwise though Outbound Dialers (OBDs) and Integrated Voice Response Systems (IVRS).The focus is on skill building and income enhancing information (training, market opportunities, input and output prices, weather, crop/livestock care etc), but information is also provided on health, education, women's empowerment and local government schemes. Even in its early days this scheme has demonstrated thatrural women areextremely responsive to information. They were able to vocally and precisely demand pertinent information/data. In Uttaranchal, SHGs wanted to know how to obtain a license to sell forest produce (which they gather and process) rather than depend on intermediaries. They are very keen on information about market prices and women's health. In Rajasthan's Ajmer district rural mothers wanted to information on educational and job opportunities for their daughters. SHG members from Kanyakumari, (Tamil Nadu) villages were very keen on improving profit margins from the sale of their cottage industry products and wanted appropriate SMS inputs. Many women who had earlier studied till class five or six were reviving their long forgotten reading skills thanks to their eagerness to read the mVAS content. Across the board, women farmers were extremely receptive to and interested in crop related information (sowing techniques and timings, disease prevention etc).

It is perhaps not widely known but 80% of economically active women in India are involved in agriculture. Information on government schemes was valued highly and acted upon promptly. MNREGA related information too was in high demand. As of now rural women hardly constitute a target segment for rural mVAS and this project was designed not only to cater to the needs of rural women but to demonstrate the demand for such women-specific content to mobile services and content providers. It must be mentioned that there are other such examples of mVAS initiatives such as those of Self Employed Women's Association (SEWA) and Barefoot College in Ajmer. Ministries such as Women and Child Development and agencies like UN Women are actively considering m-VAS for target groups like Anganwadi workers and women Sarpanches respectively. The fact that even this unexpected market segment responds so positively to information, demonstrates the tremendous potential of relevant, knowledge based content and hence the market potential for sale of relevant rural mVAS in local language. While many government agencies and private agencies such as Reuters Market Light and IFFCO are already providing mVAS to farmers, it is felt that a much broader spectrum of inform VASmational/service needs of rural population can be successfully met through creative use of. Cases in point are Operation Asha's Complaince programme of biometric based e-tracking of tuberculosis treatment and mobile text based follow up and Andhra Pradesh's mFoods Programme to track food delivery and nutrient related activities for service of anganwadis(day care centres) and Child Development Project Offices (CDPOs). Examples abound and need only to be replicated and scaled up.

The lack of higher education facilities in the vicinity of their homes makes rural India the ideal market for distance education services. The Sanchar Shakti scheme in Rajasthan demonstrates that in spite of the family's desire to educate its daughters, a rural girl can only study beyond the secondary school level if higher education facilities or distance education

opportunities are available in the village itself. In the present context of rural educational infrastructure, this translates into the need for e-enabled study centres which the Bharat NirmanKendra can provide. It also points to the need for public access to broadband facilities in every Indian village. Apart from education and medical facilities, employment opportunities and government services etc. can be made accessible too. For example, Naukri SMS brings together prospective employers, blue collar employees and skill trainers. The utility of ICT-enabled services to provide a feedback mechanism to rural Indians is often overlooked. MeraSwasthya-MeriAwaz is one such m-governance programme where women in Azamgarh and Mirzapur can now complain if they are wrongly charged for government mandated free services by Public Health Centres. Such feedback is critical for successful governance and would be a great pull factor leading to demand for ICTs. Mobile banking is another are where ICTs can overcome deficient infrastructure. Only 31% of bank branches are located in rural India. The success of mobile banking for the poor has been already been demonstrated by Kenya's M-Pesa of Kenya and Philipines G-Cash initiatives.

Rural India already accounts for about 50% of sale of FMCGs, consumer durables and services and it may be assumed that broadband enabled e-commerce would be a bigger hit in villages where media exposure is at par but shopping options are limited

Rural India and Broadband enabled National Growth

Contrary to the commonly held notion there is a fair demand for broadband in rural areas. Already there are more internet users in small towns than the top eight metros put together. Interestingly more than 20% users are school children and 10% users belong to lowest socio-economic strata. While only a minority of rural Indians may be able to afford individual access to broadband on account lack of computing devices and power, this does not imply a lack of demand for broadband enabled services. In interactions during the verification of USOF's wire line broadband scheme, it has clearly emerged that better off rural families across the country do buy computers for the same reasons as urban families do, i.e. children's education, knowledge and entertainment or as an aid to their incomes/ businesses.

Rural India attracts e-Commerce

Going by the current success of e-tailing and anticipating the tripling of Indian internet users to 230 million odd by 2015, India is slated to be a very attractive e-commerce market. Rural India already accounts for about 50% of sale of FMCGs, consumer durables and services and it may be assumed that broadband enabled e-commerce would be a bigger hit in villages where media exposure is at par but shopping options are limited. It is a fact that rural India accounts for 40-60% of the sales of online retailing portals such as eBay.in, Snapdeal.com and Naptol.com. The latent potential of rural BPOs has been adequately demonstrated by successful examples such as Rural Shores, Desi Crew, Nextwealth, Xchanging etc. Given the rising salaries and high attrition rates of urban BPOs and in the context of improving rural connectivity, rural business and knowledge process outsourcing has huge potential as a business opportunity and as an employment opportunity for our youthful rural population including rural women (for whom migration to urban areas is not an option).

Conclusion

While the Government is rightly concentrating on encouraging rural ICT infrastructure, ultimately it is the services that ride on this network that rural India needs. These compensates for the lack of other infrastructure and services such as health, education, employment opportunities. Both Government and Private sector need to tap into ICT's tremendous potential as a mode of delivery for rural services. ICT based development for Rural India is not just a national obligation but poses a huge and attractive business opportunity and a source of national economic growth. The healthy growth of both rural ICT Infrastructure and services would complement each other to revolutionise and mainstream rural India.

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GREEN HOUSE FARMING- AN INNOVATIVE TECHONOLOGY FOR FOOD SECURITY AND RURAL DEVELOPMENT

K. Baby

Agriculture is the backbone of India's economic activity and our experience during the last 50 years has demonstrated the strong correlation between agricultural growth and economic prosperity. The present agricultural scenario is a mix of outstanding achievements and missed opportunities. If India has to emerge as an economic power in the world, our agricultural productivity should equal those countries, which are currently rated as economic power of the world. We need a new and effective innovative technology which can improve continuously the productivity, profitability, sustainability of our major farming systems. One such technology is the green house technology. Although it is centuries old, it is new to India.

While greenhouses have existed for more than one and a half centuries in various parts of the world, in India use of greenhouse technology started only during 1980's and it was mainly used for research activities. This may be because of our emphasis, so far had been on achieving self-sufficiency in food grain production. However, in recent years in view of the globalization of international market and tremendous boost and fillip that is being given for export of agricultural produce, there has been a spurt in the demand for greenhouse technology. The National Committee on the use of Plastics in Agriculture (NCPA 1982) has recommended location specific trials of greenhouse technology for adoption in various regions of the country.

Challenges of Indian Farmers

Indian farmers face several challenges such as small land holding, poor yields due to reliance on inefficient methods of farming, too much reliance on natural phenomena such as rainfall and lack of knowledge of modern methods of agriculture. Green house farming or Poly house farming is an alternative new technique in agriculture, gaining

Vegetable Security

foothold in rural India. It reduces dependency on rainfall and makes the optimum use of land and water resources due to assured system. A typical, traditional farm of 4000 square meters (1 Acre) would generate an estimated annual income from Rs. 20,000 to 150,000, (Depending upon type of cultivation i.e. Cereals, Vegetables, and Fruits) whereas estimated annual income from similar sized poly house is Rs. 1,00,000 to 5,00,000. Potentially, playhouse farming can help the farmer generate income around the year growing multiple crops and fetching premium pricing for off-season vegetables.

Need for a New Technology

Growing plants is both an art and a science. About 95% of plants, either food crops or cash crops are grown in open field. Since time immemorial, man has learnt how to grow plants under natural environmental conditions. In some of the temperate regions where the climatic conditions are extremely adverse and no crops can be grown, man has developed methods of growing some high value crop continuously by providing protection from the excessive cold, which is called as Greenhouse Technology. So, Greenhouse Technology is the technique of providing favourable environment condition to the plants. It is rather used to protect the plants from the adverse climatic conditions such as wind, cold, precipitation, excessive radiation, extreme temperature, insects and diseases. It is also of vital importance to create an ideal micro climate around the plants. This is possible by erecting a greenhouse or glass house, where the environmental conditions are so modified that one can grow any plant in any place at any time by providing suitable environmental conditions with minimum labour cost. Greenhouses are framed or inflated structures covered with transparent or translucent material large enough to grow crops under partial or fully controlled environmental conditions to get optimum growth and productivity.

Environmental Parameters

Greenhouse cultivation as well as other modes of controlled environment cultivation has been evolved to create favorable micro-climates, which favours the crop production could be possible all through the year or part of the year as required. Greenhouses and other technologies

Growing plants in a Green house

for controlled environment plant production are associated with the off-season production of vegetables and foods of high value in cold climate areas where outdoor production is not possible. The primary environmental parameter traditionally controlled is temperature, usually providing heat to overcome extreme cold conditions. However, environmental control can also include cooling to mitigate excessive temperatures, light control either shading or adding supplemental light, carbon dioxide levels, relative humidity, water, plant nutrients and pest control. In conventional agronomical practices, the crops are being grown or cultivated in the open field under natural conditions where the crops are more susceptible to sudden changes in climate i.e. temperature, humidity, light intensity, photo period and other conditions due to which the quality, yield of a particular crop can get affected and may be decreased.

Supply Security

green house farming can mitigate supply crisis of vegetables in cities if the new farming technology is deployed on a large scale in surrounding regions. In poly house farming method, cultivation of vegetables is done in a controlled atmosphere,

Supply Security

under ultraviolet film roofing and nets to keep pests out. The water-soluble fertilisers and micro-managed irrigation used for this farming helps in saving on water, labour and pesticides among others. A new farming technology like poly house farming are today proving to be game changers and ensures supply security for our customers with strong backend linkage. Green farming techniques could placate all supply related issues of vegetables in big cities, provided these techniques are used on large scale near consumptions hubs. Seasonal vegetables like tomato, capsicum has favoured for such practice. The poly-house condition permits better crop production which reduces dependence on rainfall and makes optimum use of land and water resources. Poly house farming can help farmers raise yield substantially and generate income round-the-year by growing multiple crops in the same land.

Advantages of Greenhouse Technology

Greenhouse technology allows growers several advantages over those who grow their plants outdoors in the natural environment and weather. Greenhouses are climate controlled year-round and can be customized to for the needs of the particular crop of plants choose to include. Greenhouses have some advantages over traditional outdoor growing that make them popular for those who place a great deal of importance on the success and quality of their plants.

- Advantages
- Yield increases by 5 - 10 times or even more.
- Uniform and better quality
- Reduction in labour cost
- Less fertilizer requirement, thus reduction in fertilizer cost.
- Low water requirement thus saving in water.

Large Scale Farm Operations

- Less chances of disease attack, thus reduction in disease control cost.
- Higher Efficiency of Water & Fertilizer Use.
- Cultivation in problematic topography.
- Cultivation in problematic soil conditions.
- Cultivation in problematic climate conditions.
- Requires less area to get maximum yield and benefits.
- Easy to operate, maintain & control.
- Multiple Crops and Blooms

Plants are seasonal in most cases. Those that produce fruits, vegetables or flowers typically do so only during certain times of the year. The timing varies depending on the climate where the plants grow. In warmer weather climates, for example, flowers can continue to bloom for several months longer than they would in a place with short summers. Since the user controls the greenhouse climate, the climate can be adjusted to the needs of the plants. This maximizes the length of the growing season and helps produce multiple crops or blooms of the plants kept inside the greenhouse. This can have a major impact on the availability of products that gardeners and florists have for use or sale.

High Quality Produce

Control over the conditions inside a greenhouse allows the grower to set up an

Green House Horticulture

environment that is ideal for the particular species being grown. With ideal weather, produce tends to grow healthier and larger than it would in unpredictable conditions. At the very least, the results are fairly predictable. Growers who know what conditions make for the very best produce can set up their greenhouses to allow for the highest quality plants possible.

Weather Control

Extreme temperatures such as a heat wave or freeze, as well as an overabundance of rain or a drought, can seriously affect the growing season and might even stop it in its tracks prematurely. Perhaps the biggest advantage of growing in a greenhouse is the ability to ignore the weather since it will have no real affect on the crop.

Pest and Disease Control

Growers who use greenhouses have fewer concerns about plant diseases and pests. Diseases are harder to spread from plant to plant inside a greenhouse because they do not usually share the same soil, and the enclosed nature of a greenhouse will keep many outside pests at bay. Treat plants before bringing them into the greenhouse to keep outside biological threats from becoming a problem. Problems are easily spotted inside the greenhouse, and infected plants or pests can be more easily removed or eradicated in this controlled environment.

Suitability

- Production of vegetable crops.
- Production of flowers.
- Production of Herbs.
- Nursery.
- Secondary hardening nursery of Tissue cultured plant.
- Growth /Production of rare plants, orchids / herbs, medicinal plants.

Drawbacks

One of the drawbacks of the poly house method of cultivation is that only non-pollinated varieties can be grown because the plants are insulated from insects. This effectively confines the utility of the greenhouse to the production of certain high value crops like tomato, salad cucumber, capsicum, and cowpea which have limited market demand.

Conclusion

The demand for food requirement is continuously increasing with rising population amidst the production constraints such as shrinking natural resources, unpredictable climatic conditions, low productivity, and pest attack and increasing farm operation costs. The present food production has been achieved through productivity enhancement by keeping a balance between environmental and agricultural sustainability, where research and innovations are essential ingredients. In these circumstances new agricultural strategies supported by technological innovations is the need of the hour.

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SUSTAINABLE DEVELOPMENT OF MOUNTAINOUS REGIONS THROUGH TECHNOLOGY TRANSFER AND INNOVATIONS

Rekha Dhanai

Hill state Uttarakhand is well known for its natural wealth viz. forest, meadows, rivers, valleys endowed with rich cultural and religious heritage. This wealth can be utilized for the benefit of local poor people. But poor access to appropriate technologies due to difficult topographies and tough mountain conditions are major causes of poverty, drudgery and natural resources degradation in this Himalayan region. Regional imbalances in socio-economic development exist in Himalayan region; these imbalances are caused by the availability of resources, level of government development intervention and the variation in physical environment. Sustainable livelihood is important for regional development, poverty alleviation, rural agriculture development and rural resource management. So, technological intervention and innovations in farm and non-farm sector are needed to sustain the mountain economy.

The Himalayan ecosystem are however considered rich in natural resources and revered for goods and services they provide for sustenance of upland and lowland communities. The issue is how to strike a balance between two contradictory facets so as to achieve goal of sustainable development. In this context, several approaches are being conceptualized and implemented. One among these is to acknowledge potential of location specific, appropriate and cost-effective technologies, which hold greater potential for sustainable rural development. This approach, on one hand, would be able to diversify livelihood options for local communities and on the other help to conserve natural resources. This mountainous region needed immediate attention for technological interventions which not only improve agricultural productivity, minimize human drudgery but also provide a good means of value addition of wild and cultivated local resources.

The approach of pushing new technologies, drawn from their success not only in lowlands but also in high hilly areas, without transfer of adequate knowledge and building capacities of local communities has, by and large, failed to achieve the desired objectives in

the past. Learning lessons from the past experiences, mountain specificities, such as diversity in livelihood strategies, economic marginalization, isolation, difficult topography, cultural diversity and ecological fragility, were taken into account in identifying appropriate technologies. In addition, a technology was considered simple and appropriate when there were no socio–cultural–economic-policy barriers to its adoption. The technological interventions aimed to improve agricultural productivity through protected cultivation, improved composting and soil/water management practices, value addition to forest/farm products and improved product storage devices.

So, to minimize migration, introduction of promising technologies to the rural economy is required, which would not only provide livelihood and food security locally but also contribute towards minimizing existing pressure on natural resources.

Farm Based Technologies for Enhancing Rural Livelihood

(A) Yield Increasing Technologies

In the Himalayan region limited land is available for agriculture due to steep slope and rugged nature of the terrain. Lack of irrigation facilities and poor economic condition of marginalized families does not allow expensive inputs viz. chemical fertilizer, pesticides or adoption of costly agro technological packages. Additionally, cold and frosty winter have a large impact on overall productivity of the farming system in the region. Some potential technologies that are cost effective and enhance soil fertility are as follows:

Protected cultivation

Polyhouse: It is very useful in high-altitude areas for vegetable cultivation throughout the year. Particularly useful for farmers with small landholdings in which multi-tier cultivation in trays is possible. The size of the polyhouse depends on need and resources available to the farmer. Cultivation inside polyhouse enhances production and yield of vegetables, flowers and ornamental plants, and protects crops from frost, cold and diseases.

Polythene sheet (150 gm thick) used in construction prevents entry of ultraviolet light, conserves CO2, and enhances plant growth and development. Temperature and moisture inside the polyhouse is higher than the outside environment, which enhances photosynthesis and uniform plant growth.

About 16 people of the Kapniya, Bajira, Dhankurali, and Jakhwadi used protected cultivation for vegetable production, seedling growing and nursery raising purposes. People increase their income 25-30% from vegetable and seedling selling and continuously increase the number of polyhouse.

Shadenet House: This protects crops from harmful ultraviolet and some infrared radiation. Thus it protects plants from extreme summer temperatures and helps maintain air and soil moisture.

Advantage

Useful for smallholdings, with similar properties to a polyhouse. Better for production of off-season vegetables and medicinal plants.

This technique of cultivation is not widely used in the region. Some people used shadenet during summer to protect the seedlings only. So, need to provide proper awareness about this technology among the masses.

Polypit: Used for cultivation of off-season vegetables, trees and other crops. The trench helps in buffering temperature, increasing CO2 and minimizing water requirements.

Advantage

Simple, low cost, practicable and effective for raising and protecting plants from severe winter temperatures. It is equally beneficial to a polyhouse.

This technology is not used in the region but there is a huge potential to adopt this by the local inhabitants due to low cost and cold and frosty climate in high altitudes.

(B) Organic compost and biofertiliser

Biocomposting: Traditional compost usually takes 8–10 months to fully decompose. Compost is prepared by mixing weeds/dry leaves with cow dung in a pit covered with a polythene sheet over a bamboo frame to check entry of rainwater and reduce heat loss during decomposition. This compost is ready for use in 30–45 days.

Advantage

Compost contains more nutrients. The decomposing time as well as loss of nutrients is minimized.

Vermicomposting: Biodegradable wastes, i.e. agricultural and vegetable residues, weeds, manure, converted into organic manure with the help of earthworms (Eisenia foetidas used mostly).

Advantage

Provides nutrients necessary for optimum plant growth, replenishes soil fertility quickly by improving physico-chemical and biological properties of less fertile soils and reduces the use of pesticides.

Bio/vermin composting technology is used by 23 peoples of 4 villages and they observe the benefits of the composting. According to villagers Bio/vermin composting not only improves the crop yield but also reduce the workload to fetch the manure in the agricultural fields.

Vermiwash: A liquid biocompost applied to vegetables and horticultural crops. Contains all necessary nutrients for plant growth and development and can also be used as pesticide on leafy vegetables.

Advantage

Increases macro- and microorganisms and essential elements in soil, acts as a pesticide and improves soil fertility.

Vermiwash were not used by anyone in the region. So, need to aware people in proper way about this practice.

Azolla culture: Azolla is a nitrogen-fixing aquatic fern found on the surface of flooded rice fields, small ponds and canals. It can fix 3–5 kg N/ha/day, is highly productive, doubling its biomass in every 7 days.

Advantage

Fixes nitrogen, grows rapidly and ensures quick coverage of areas and suppresses weeds. Accumulates nutrients from water and returns them on decomposition.

People are not aware about this practice and need to provide information through training/ meeting.

(C) Off-farm technologies

Honeybee rearing

Because of rich flora, the mountains of Uttarakhand are suitable for bee keeping. Most flowering plants require insects for cross-pollination (Maikhuri et al. 2007b).

Advantage

Honey is used as a medicine; bees are good pollinators and improve agricultural production.

About 8 people of 4 villages are rear honeybee for self consumption as well as commercial purposes and sell the produce with the price of 300Rs. /Kg. This region is rich in floral diversity and honeybee rearing can make a major source of income for local people only need to awareness and technical guidance.

Mushroom cultivation

Oyster mushroom (Pleurotus sp.) contains protein, can be grown at 10–30^{0}C to an altitude of 2600 m. It is grown on straw (wheat/paddy), first soaked in water at 70–80^{0}C for about 1 h then excess water removed before adding spawn (mushroom spore).

Advantage

Good substitute/source or income source for landless farmers and the unemployed. Production can be started at little cost. Considered the best food for diabetics and heart patients.

Mushroom cultivation not observed in the region. But it can be made a source of income for local people.

(D) Other supporting technologies

Improved water mill: Gharat

Western himalaya are dotted with rivers, rivulets, streams etc. are tamed for electricity generation through large hydro projects, Micro-hydro projects and small Gharats (Traditional water mills). Garhwal region of Himalaya is rich in having Gharats developed by local inhabitants many years ago using simple techniques.

Study carried out by author revealed that the Gharats can become functional using appropriate technology and improved in terms of output/ efficiency. The costs recovered or income from this technology is locally considered in terms of bhagwari i.e. the part of the flour paid by the customer to the owner for their service.

At present many Gharats operates in various villages of the region among them 3 Gharat observed in village Dharkudi and 2 Gharat in village Bajira in working condition during month May 2014.

Water Harvesting Tank (WHT)

Low cost water harvesting tank to store rainwater, spring or wastewater for irrigation and

other purposes. This tank is valuable for areas lacking water for livestock and minor irrigation.

Advantage

Can retain water for a year in areas lacking water for minor irrigation, and thus saves time and minimizes labour.

Jakhwadi, Kapniya etc. villages used water harvesting tank for minor irrigation and other purposes.

Zero energy cool chamber

Cost-effective, simple, eco-friendly and easily adoptable technique that works on the principle of evaporative cooling. The chamber can maintain a temperature 10–12^{0}C less than the outside temperature.

Advantage

No need for electricity. Small farmers can keep agro-products and vegetables fresh for longer. May be used to preserve domestic food, e.g. milk, curd, ghee, water.

Briquetting of Biomass

Fuel scarcity for domestic and commercial use in rural areas has become a chronic and severe problem today. Rural people, especially women spent most of time collecting fuelwood from the forest and often dangerous areas in the hill region. Fuelwood extraction from forests also causing depletion of forest resources.

Though, biobriquet is an improved traditional practice for conversion of weeds and waste biomass into low cost, energy efficient, nonhazardous fuel.

Advantage

Used in winter for warmth and room heating. It is smokeless and can be prepared very easily. May help in forest conservation.

Zero energy cool chamber and Bio-briquetting are technologies not used by any household.

Conclusions

Technological intervention in the region through different Govt. agencies, NGOs has made a significant impact in this region. However, poor communication and coordination among policy makers, Government agencies, NGOs, researcher and farmers continue to be a major barrier in meeting the challenges of sustainable mountain development.

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BIODIESEL-THE NEW POWER

Dr Manas Ranjan Senapati

Fossil Fuels have been the prime source of energy of power for domestic, transportation and industrial sector for more than a century. The rapidly increasing consumption and consequent depletion of these reserves clearly show that the end of the fossil fuel era is not very far. For developing countries like India, rising world prices of crude oil and petroleum is a serious cause for concern. We import almost 70% of our requirement of crude oil and in future it is likely to increase to 85%. This is high time to ponder over and to find an alternative to the fossil fuel. The green fuel Bio diesel is one such alternative to partly replace the petroleum crude and be the fuel of the future. Rudolf Diesel's prime model, a single 10 ft(3m) iron cylinder with a fly wheel at its base, ran on its own power for the first time in Augsburg, Germany, on August 10, 1893. In remembrance of this event, August 10 has been declared "International Biodiesel Day". Rudolf Diesel demonstrated a diesel engine run on peanut oil (vegetable oil) at the world fair in Paris, France in 1900.

Bio diesel is a non-toxic; biodegradable diesel fuel made from vegetable oils, animal fats and used or recycled oils and fats. Biodiesel could be an excellent renewable fuel for diesel engines. It is derived from vegetable oils that are chemically converted into bio diesel. The chemical process is called Transesterification. The process was developed as early as 1853 by scientists E. Duffy and J.Patrick. Transesterification is the process of using methyl alcohol in the presence of a catalyst such as sodium hydroxide or potassium hydroxide to chemically break the molecule of the raw renewable oil into methyl ester(BIODIESEL) of the renewable oil with glycerol as a by- product. Biodiesel when used as a pure fuel it is known as B100. However, it is often blended with petroleum-based diesel fuel and when this is done, the blend is designated "BXX" where XX is the percentage of biodiesel in the blend. For example, B20 is a blend of 20% biodiesel and 80% petroleum diesel fuel. Biodiesel can be used in the pure form, or blended in any amount with diesel fuel for use in compression ignition engines.

Fig. Money Plant Jatropha

Biodiesel buses are in use in Europe and in the mid western United States. In India successful test run drives have been done by using biodiesel produced from Jatropha Curcas (Ratanjyot in Hindi & Baigaba in Oriya). Shatabdi train was run from Delhi to Amritsar using B5 (5% biodiesel) blend and no problem was observed during the run. Other non-edible oils like Karanja, Mahula, Neem, Kusum etc can also be converted into biodiesel. In India it is usual practice to produce biodiesel from non-edible oils. Rapeseed and soybean oils are mostly used to produce biodiesel in USA.

Mercedes Benz C 220 CDI vehicle was run in various states of the country using 100% biodiesel by CSMCRI, Bhavnagar without any problem with a mileage of 13.5 Km. per litre which is comparable with fossil fuel.

In July 2002, The Planning Commission constituted a Committee for the development of biofuels, which recommended the creation of Biodiesel Mission to coordinate the initiative and enterprise of individuals, communities, oil companies, industries, businessmen as well as Government. In Oct. 2005, the Union Ministry of Petroleum and Natural Gas (MPNG) announced the biodiesel policy from Jan.2006. A cell has been created as the Biodiesel Board to coordinate Jatropha cultivation & biodiesel production with target up to 500,000 tons of biodiesel per year.

There is an urgent demand for the plantation of Jatropha Curcas which can not only mitigate the unemployment problem but also solve fuel crisis in future.

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Advantages of Biodiesel

- Higher flash point of biodiesel makes it safer to store and transport.
- The Higher cetane number, thus the greater the probability of ignition and combustion process being initiated thus higher engine performance.
- Regular petrodiesel fuel particulates are carcinogenic. Using biodiesel fuel or blending it with regular diesel fuel can reduce the production of these carcinogenic emissions. It reduces CO, sulphates, unburnt hydrocarbons, polycyclic aromatic hydrocarbons (PAH s), particulates & NOx emissions as compared to diesel emissions.
- Biodiesel can even make engines smell better. An engine powered by biodiesel actually smells like French fries!
- Biodiesel fuel is a good lubricant, which helps engines to last longer.
- Biodiesel is a renewable and environment friendly fuel.
- Biodiesel use helps to reduce greenhouse gases. The overall ozone forming potential of bio diesel is 50% less than the diesel fuel.
- Biodiesel has the highest energy balance of any transportation fuel.
- Biodiesel degrades in the environment as fast as sugar and is 10 times less toxic than table salt.

NEW IRRIGATION TECHNOLOGIES

Dr. Yashbir Singh Shivay and Dr. Anshu Rahal

Efficient use of water resource is basic to survival of the ever increasing population of a country, this is especially very crucial for India, where we are having less than 5% of the world's water resources and more than 18% world's population. Irrigation is one of the most important inputs required at different critical stages of plant growth of various crops for optimum production. The Government of India has taken up augmentation of irrigation potential through public funding and is assisting farmers to create potential on their own farms. Substantial irrigation potential has been created through major and medium irrigation schemes. In arid and semi-arid climatic conditions, the timing and amount of rainfall are not adequate to meet the moisture requirement of crops. Therefore, supplementary irrigation is essential to raise the crops, necessary to meet the needs of food and fiber for the growing population. Scientific irrigation water management provides the best insurance against weather induced fluctuations. This is the only way in which we can make our agriculture profitable and sustainable in the coming decades. The on farming irrigation management for different crops including efficient use of poor quality waters is an essential component of water management in irrigation command areas. It is felt necessary to include complete information on surface and sub-surface drainage.

Rainfall and Reservoir Levels in India

Rainfall continues to influence crop production and productivity in a substantial way. Around 75 per cent of annual rainfall is received during the southwest monsoon season (June-September). During the south-west monsoon season 2011, the country as a whole received 1 per cent more rainfall than the long period average (LPA). Central India and north-west India experienced excess rainfall over the LPA by 10 per cent and 7 per cent respectively. The southern peninsula received normal rainfall. North-east India received 14 per cent less rainfall than the LPA. At district level, 24 per cent of districts received excess rainfall, 52 per cent normal rainfall, 23 per cent deficient rainfall, and 1 per cent scanty rainfall. Out of 36 Subdivisions, 3 recorded deficient rainfall during the south-west Monsoon in 2011. Out of the 33 remaining subdivisions, 7 recorded excess rainfall and the remaining 26 recorded normal rainfall. The total designed storage capacity at full reservoir level (FRL) of 81 major reservoirs in the country monitored

by the Central Water Commission (CWC) is 151.77 billion cubic meters (BCM)

Irrigation potential

The total ultimate potential was earlier estimated at 113.8 million hectares, which has now been received to 140 million hectares. The share of major and medium schemes that are surface water based is 58.5 million hectares, whereas that of minor schemes, based on surface water is 17.4 million hectares. The ground water based minor irrigation schemes are expected to contribute 64 million hectares compared with the earlier estimates of 40 million hectares.

Total surface water resources of the country (yearly average streams flow) are about 1,869 km.^{3} Due to uneven distribution of rainfall, both spatial and temporal, only 37% (690 km^3) of the surface renewable water resources are estimated to be potentially utilizable. This low proportion is primarily due to low potentially utilizable water resources in the Meghna – Brahamputra river basins. The Brahamputra River covers only 7.6% of the geographical area, accounting of 31% of the total renewable water resources. According to Central water Commission, potential utilizable for India are 690 km^3 of the surface water and 432 km^3 of the ground water (total 1,122 km^3 or BCM).

Irrigation demand

Irrigation demand of a region depends upon the areas irrigated with surface water and ground water, different crop water requirements and irrigation application efficiency. Irrigation demands may be worked out as:

The irrigation demand ranges from 193 m^3 per person in Brahamputra basin to 1,617 m^3 per person in Indus basin. Irrigation efficiencies range from a low of 31% whereas most of the area is surface irrigated to a high of 62% (where most of the area is irrigated from ground water). Irrigation is the largest sector of water demand and irrigated agriculture shall further be called upon to produce a sizable portion of the food grains requirements for the growing population. Considering the rapid changes in the dietary habits and standard of living of the Indian population, it may be difficult to make correct estimates for future food grain requirements.

Irrigation

Irrigation is the artificial application of water to partially meet the crop evapo-transpiration requirements. It is essential for sustaining crop productivity in many regions of the country mainly because the rainfall is inadequate and unevenly distributed to meet crop water demands. Irrigation water is a costly and scare input, and it is becoming more difficult to increase the area under irrigation to meet the demand for food, fodder and fiber for growing human and livestock population. The competing demands of water for other uses viz. urbanization and industrialization are also restricting the availability of water for crop production. Therefore, it is essential to optimize the use of water according to availability on sustainable basis in the decline water table areas, and to allow minimum loss of water by efficient water management techniques in areas where water table is continuously rising.

Irrigation requirements of some important crops

Irrigation requirement at the field level refers to the amount of water, exclusive of precipitation, required to mature the crops. It is usually expressed in depth at the given time. It thus, includes the amount of water needed to meet the losses through evaporation and transpiration, both occurring simultaneously and hence termed evapo-transpiration (ET), application losses and the special needs. It does not include transit losses.

Future food grains and water demands for irrigation under different scenarios

Year	Low demand scenario (Mt)	Water requirement (BCM)	Medium demand scenario (Mt)	Water requirement (BCM)	High demand scenario (Mt)	Water demand (BCM)
2010	249	489	265	536	271	556
2025	322	619	349	686	365	734
2050	469	830	539	1,008	605	1,191

Irrigation requirements of some important crops

S. No.	Crops (*Kharif*)	Crop duration (days)	Irrigation requirement (mm)
1.	Rice	130-140	700-800
2.	Sorghu	110	150
3.	Maize	110	150
4.	Sugarcane	330	700
5.	Summer pulses	70	210
6.	Pearl millet	90	150
7.	Sunflower	110	210
8.	Cotton	180	280
S. No.	**Crops (*Rabi*)**	**Crop duration (days)**	**Irrigation requirement (mm)**
10.	Wheat	135	350
11.	Berseem	200	800
12.	Potato	110	450
13.	Lentil	135	150
14.	Mustard	150	150
15.	Barley	125	210
16.	Soybean	90	350
17.	Chickpea	150	150

Types of irrigation

Various types of irrigation techniques differ in how the water obtained from the source is distributed within the field. In general, the goal is to supply the entire field uniformly with water, so that each plant has the amount of water it needs, neither too much nor too little.

Surface irrigation

In surface irrigation systems water moves over and across the land by simple gravity flow in order to wet it and to infiltrate into the soil. Surface irrigation can be subdivided into furrow, border-strip or basin irrigation. It is often called flood irrigation when the irrigation results in flooding or near flooding of the cultivated land. Historically, this has been the most common method of irrigating agricultural land.

Where water levels from the irrigation source permit, the levels are controlled by dikes, usually plugged by soil. This is often seen in terraced rice fields (rice paddies), where the method is used to flood or control the level of water in each distinct field. In some cases, the water is pumped, or lifted by human or animal power to the level of the land.

Localized irrigation

Localized irrigation is a system where water is distributed under low pressure through a piped network, in a pre-determined pattern, and applied as a small discharge to each plant or adjacent to it. Drip irrigation, spray or micro-sprinkler irrigation and bubbler irrigation belong to this category of irrigation methods.

Drip Irrigation

Drip irrigation, also known as trickle irrigation, functions as its name suggests. Water is delivered at or near the root zone of plants, drop by drop. This method can be the most water-efficient method of irrigation, if managed properly, since evaporation and runoff are minimized. In modern agriculture, drip irrigation is often combined with plastic mulch, further reducing evaporation, and is also the means of delivery of fertilizer. The process is known as fertigation.

Deep percolation, where water moves below the root zone, can occur if a drip system is operated for too long of a duration or if the delivery rate is too high. Drip irrigation methods range from very high-tech and computerized to low-tech and labor-intensive. Lower water pressures are usually needed than for most other types of systems, with the exception of low energy center pivot systems and surface irrigation systems, and the system can be designed for uniformity throughout a field or for precise water delivery to individual plants in a landscape containing a mix of plant species. Although it is difficult to regulate pressure on steep slopes, pressure compensating emitters are available, so the field does not have to be level. High-tech solutions involve precisely calibrated emitters located along lines of tubing that extend from a computerized set of valves. Both pressure regulation and filtration to remove particles are important. The tubes are usually black (or buried under soil or mulch) to prevent the growth of algae and to protect the polyethylene from degradation due to ultraviolet light. But drip irrigation can also be as low-tech as a porous clay vessel sunk into the soil and occasionally filled from a hose or bucket. Subsurface drip irrigation has been used successfully on lawns, but it is more expensive than a more traditional sprinkler system. Surface drip systems are not cost-effective (or aesthetically pleasing) for lawns and golf courses. In the past one of the main disadvantages of the subsurface drip irrigation (SDI) systems, when used for turf, was the fact of having to install the plastic lines very close to each other in the ground, therefore disrupting the turf-grass area. Recent technology developments on drip installers

like the drip installer at New Mexico State University Arrow Head Center, places the line underground and covers the slit leaving no soil exposed.

Sprinkler irrigation

In sprinkler or overhead irrigation, water is piped to one or more central locations within the field and distributed by overhead high-pressure sprinklers or guns. A system utilizing sprinklers, sprays, or guns mounted overhead on permanently installed risers is often referred to as a *solid-set* irrigation system. Higher pressure sprinklers that rotate are called *rotors* and are driven by a ball drive, gear drive, or impact mechanism. Rotors can be designed to rotate in a full or partial circle. Guns are similar to rotors, except that they generally operate at very high pressures of 40 to 130 lbf/in² (275 to 900 kPa) and flows of 50 to 1200 US gal/min (3 to 76 L/s), usually with nozzle diameters in the range of 0.5 to 1.9 inches (10 to 50 mm). Guns are used not only for irrigation, but also for industrial applications such as dust suppression and logging.

Sprinklers may also be mounted on moving platforms connected to the water source by a hose. Automatically moving wheeled systems known as *traveling sprinklers* may irrigate areas such as small farms, sports fields, parks, pastures, and cemeteries unattended. Most of these utilize a length of polyethylene tubing wound on a steel drum. As the tubing is wound on the drum powered by the irrigation water or a small gas engine, the sprinkler is pulled across the field. When the sprinkler arrives back at the reel the system shuts off. This type of system is known to most people as a "water-reel" traveling irrigation sprinkler and they are used extensively for dust suppression, irrigation, and land application of waste water. Other travelers use a flat rubber hose that is dragged along behind while the sprinkler platform is pulled by a cable. These cable-type travelers are definitely old technology and their use is limited in today's modern irrigation projects.

Center pivot irrigation

Center pivot irrigation is a form of sprinkler irrigation consisting of several segments of pipe (usually galvanized steel or aluminum) joined together and supported by trusses, mounted on wheeled towers with sprinklers positioned along its length. The system moves in a circular pattern and is fed with water from the pivot point at the center of the arc. These systems are common in parts of the United States where terrain is flat.

Most center pivot systems now have drops hanging from a u-shaped pipe called a *gooseneck* attached at the top of the pipe with sprinkler heads that are positioned a few feet (at most) above the crop, thus limiting evaporative losses. Drops can also be used with drag hoses or bubblers that deposit the water directly on the ground between crops. The crops are planted in a circle to conform to the center pivot. This type of system is known as LEPA (Low Energy Precision Application). Originally, most center pivots were water powered. These were replaced by hydraulic systems (*T-L Irrigation*) and electric motor driven systems (*Lindsay*, *Reinke*, *Valley*, *Zimmatic*, *Pierce*, *Grupo Chamartin*. Most systems today are driven by an electric motor mounted low on each span. This drives a reduction gearbox and transverse driveshafts transmit power to another reduction gearbox mounted behind each wheel. Precision controls, some with GPS location and remote computer monitoring, are now available.

Lateral move (side roll, wheel line) irrigation

A series of pipes, each with a wheel of about 1.5 m diameter permanently affixed to its midpoint and sprinklers along its length, are coupled together at one edge of a field. Water is supplied at one end using a large hose. After sufficient water has been applied, the hose is removed and the remaining assembly rotated either by hand or with a purpose-built mechanism, so that the sprinklers move 10 m across the field. The hose is reconnected. The process is repeated until the opposite edge of the field is reached. This system is less expensive to install than a center pivot, but much more labor intensive to operate, and it is limited in the amount of water it can carry. Most systems utilize 4 or 5-inch (130 mm) diameter aluminum pipe. One feature of a lateral move system is that it consists of sections that can be easily disconnected. They are most often used for small or oddly-shaped fields, such as those found in hilly or mountainous regions, or in regions where labor are inexpensive.

Sub-irrigation

Sub-irrigation also sometimes called *seepage irrigation* has been used for many years in field crops in areas with high water tables. It is a method of artificially raising the water table to allow the soil to be moistened from below the plants' root zone. Often those systems are located on permanent grasslands in lowlands or river valleys and combined with drainage infrastructure. A system of pumping stations, canals, weirs and gates allows it to increase or decrease the

water level in a network of ditches and thereby control the water table.

Sub-irrigation is also used in commercial greenhouse production, usually for potted plants. Water is delivered from below, absorbed upwards, and the excess collected for recycling. Typically, a solution of water and nutrients floods a container or flows through a trough for a short period of time, 10-20 minutes, and is then pumped back into a holding tank for reuse. Sub-irrigation in greenhouses requires fairly sophisticated, expensive equipment and management. Advantages are water and nutrient conservation, and labor-saving through lowered system maintenance and automation. It is similar in principle and action to subsurface drip irrigation.

Manual irrigation using buckets or watering cans

These systems have low requirements for infrastructure and technical equipment but need high labor inputs. Irrigation using watering cans is to be found for example in peri-urban agriculture around large cities in some African countries.

Automatic, non-electric irrigation using buckets and ropes

Besides the common manual watering by bucket, an automated, natural version of this also exist. Using plain polyester ropes combined with a prepared ground mixture can be used to water plants from a vessel filled with water. The ground mixture would need to be made depending on the plant itself, yet would mostly consist of black potting soil, vermiculite and perlite. This system would (with certain crops) allow you to save expenses as it does not consume any electricity and only little water (unlike sprinklers, water timers,). However, it may only be used with certain crops (probably mostly larger crops that do not need a humid environment; perhaps e.g. paprika's).

Irrigation using stones to catch water from humid air

In countries where at night, humid air sweeps the countryside, stones are used to catch water from the humid air by condensation. This is for example practiced in the vineyards at Lanzarote.

Dry terraces for irrigation and water distribution

In subtropical countries as Mali and Senegal, a special type of terracing (without flood irrigation or intent to flatten farming ground) is used. Here, a 'stairs' is made through the use of ground level differences which helps to decrease water evaporation and also distributes the water to all patches (sort of irrigation).

Sources of irrigation water

Sources of irrigation water can be groundwater extracted from springs or by using wells, surface water withdrawn from rivers, lakes or reservoirs or non-conventional sources like treated wastewater, desalinated water or drainage water. A special form of irrigation using surface water is spate irrigation, also called floodwater harvesting. In case of a flood (spate) water is diverted to normally dry river beds (*wadi's*) using a network of dams, gates and channels and spread over large areas. The moisture stored in the soil will be used thereafter to grow crops. Spate irrigation areas are in particular located in semi-arid or arid, mountainous regions. While floodwater harvesting belongs to the accepted irrigation methods, rainwater harvesting is usually not considered as a form of irrigation. Rainwater harvesting is the collection of runoff water from roofs or unused land and the concentration of this water on cultivated land. Therefore this method is considered as a water concentration method.

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Condolences

Publications Division deeply mourns the death of Ms. R. Anuradha, Editor who passed away. An able officer, author, activist for cancer survivors, she made outstanding contribution to her professional area of work. Along with a large number of her admirers, the officers and employees of Publications Division will miss her presence in our midst, though she will continue to inspire her friends, colleagues and many others whose life she touched with her work. The Publications Division extends its heartfelt condolences to the family of Ms. Anuradha.

DIMENSIONS OF TECHNOLOGICAL TRANSFORMATION

Subasish Mohanty and Dr. B.K. Mohanty

It has been realized that a farmer plays the role of a multi-purpose entrepreneur. A farmer produces verities of seasonal crops with a limited availability of land and sells the produce in the market to fulfill his own demand. From the limited acres of land, only 25-40 percent of the products fetch him money where as major portion, 60 to 70% of the product is totally wasted. Sometimes, he has to burn such waste products in his fields. If, the waste is taken into consideration one can find that the productivity of agriculture remained abnormally low as compared to the productivity of industry where we find a minimum wastage between 5 to 10%. It is the wastage that has made farming non-remunerative. No doubt to help the farmers government provides agricultural subsidies to farmers in the form of minimum support price (MSP) but the subsidies provided by the government are not enough to counter balance the loss of the wastage. If no subsidy will be given by the government the farmer still can get a profitable price if he can well manage the wastage for agricultural residues. This can be possible only when the residues can be used to produce energy for powering India. In another situation, if there will be a crop failure due to some natural calamity no doubt the waste produce if, sold in the market a farmer can get an extra income of Rs. 3,000 to Rs. 5,000 per acre. This price will be of great help at the time of distress sale of crop by a farmer. Government is making a slogan for green revolution and bio-tech revolution for increasing the agricultural productivity but not taking any steps to reduce the crop wastage and to recycle the waste products which can be used for many productive purposes. A farmer can get a handsome of income if the wastages can be used for any alternative uses such as producing energy with the help of technology. Three types of energies can be produced from these residues: (i) Liquid fuel such as Ethanol (ii) Gaseous fuels like bio-gas (methane) and (iii) Electricity.

Ethanol, which is used as transport fuel can be produced from the residues of sugar cane. Extensive R&D is being done to optimize this technology. A few large plants in Canada, Japan and US have already been set up with this technology. Theoretically, residues in India can produce 156 billion liters of ethanol which can take care of 42% of India's oil demand for the year 2012.

Energy crops like sugarcane for ethanol production or Jatropha for producing bio diesel may affect food production. These effects are being felt in U where huge acreage under corn has been diverted for ethanol production. Similarly, a large track of land in Brazil is being diverted from food production to growing sugar cane for ethanol production. When farms produce both food and fuel, their utility becomes manifold. 65% of India's population depends on farming for its livelihood. If, energy from agriculture emerges as an area of interest India can emerge as a high Tech farming community.

Organic farming:

The advantage of adopting organic farming is two fold as it reduces cost and raises production. The experts said the Indian apple must be produced organically instead of chemically on a large scale to compete in the International market. This would not only fetch higher returns but help greatly in restoring the ecological damage done due to the use of harmful chemical fertilizers and pesticides. China the World's largest producer of apples has already started producing the fruit with the help of organic farming in a big way. During the first three years yield will remain low compared to inorganic farming. However, it will help enrich the soil. Pricing of organic products will be 10-20% higher than inorganic products.

Contract Farming:

Contract farming allows corporate, retailers and food processing companies to enter into an agreement directly with the farmers to procure their produce. This ensures a steady supply of commodities. The system will boost the food industry and retail chain industry. No title or rights in or ownership or possession of agriculture land of the contract farming producer shall be vested in the name of the contract buyers' companies. The companies can only buy the agricultural produce but at no cost will they be allowed to buy land. Contract farming provides good frame work for the flow of credit to marginal and small farmers at a reduced transaction cost. Now a days contract farming is widely been accepted and to spread it widely it is better that Self-Help Groups (SHGs) should be involved.

The share of India in World agriculture, which is measured in terms of value of net agricultural production, has remained nearly stagnant between 9-11% for the period 1991-2010. While India has the largest area of arable land next to only US in the world, it has not been able to show its big strength to increase its agricultural productivity to the level of other economies. India is the second largest producer of wheat and paddy in the world, but the yield of wheat in China and France are around 1.7 and 2.4 times that of India, respectively. Similarly, India's paddy yield is less than half of China and the US. Availability of food grains in India has increased by just 11% in the past 60 years; the population has more than tripled in the same period. This has serious implications on the per capita consumption of food by people in India, which is estimated to be five times lower than that of advanced countries like US. There is an urgent need to stream line the whole agriculture value chain and liberalise the price policy and exports of agriculture products. Agriculture should be made more profitable and be seen as a business rather than as a source of livelihood. India needs to boost both public and private investments to improve the conditions of the supporting infrastructure for the agriculture sector, like irrigation facilities,

Total and Indebted Farm Households and their source of Debt by Landholding size, 2003

Size class of land possessed (Hectares)	Total Households in (%)	Total Indebted Households in (%)	Loans from Institutional Agencies (%)	Loans from Non-Institutional Agencies (%)
<0.01	1.4	1.3	22.6	77.4
0.01-0.40	32.8	30.0	43.3	56.7
0.41-1.00	31.7	29.8	52.8	47.2
1.01-2.00	18.0	18.9	57.6	42.3
Up to2.00	**83.9**	**79.9**	**51.3**	**49.7**
2.01-4.00	10.5	12.5	65.1	35.0
4.01-10.00	4.8	6.4	68.8	31.3
10.00+	0.9	1.2	67.6	32.4
All Sizes	100.0	100.0	57.7	42.4

Source- Economic and political weekly (March, 2008)

reliable power supply and construction of roads in villages to revive the agriculture sector.

From the table it has been revealed that scheduled commercial (SCBs) and other formal lending institution severely curtailed credit flow to the farm sector and thus push farmers into the clutches of money lenders. Households holding, 0.01 hectares have received only 22.6% of agricultural loan from institutional source where as major portion 77.4% of credit has been received by them from the non-institutional source. Similarly, it has been seen that when the land holding is increasing institutional source of financing is also increasing which clearly says that financial institutions remained very conservative in sanctioning loans towards the farmers having lesser hectares of land holding. It is due to this reason the poor farmers have been trapped by the money lenders to borrow the loan from them at an exorbitant high interest.

Recommendations And Policy Suggestions

Farm Mechanization

Indian food consumption is rising and farmers are under pressure to produce more, faster and cheaper. Yet, Indian farmers traditionally use fewer farm machines than their peer nations, partly because their acreage is so small. For example, India is one of the largest markets for tractors but their use is limited. Mostly tractors are used at construction sites or for ferrying people and things. That is due to the fact that farm sizes remain very small to utilize the service of a tractor with the full capacity. The farms are less than 2 hectare per capita which is far below the global average of 3.7 hectare. Therefore, it is better that the small sized tractors can be used in place of big ones. Another advantage of using the small tractors is that they are more cost-efficient than the traditional bullocks. A pair of bullocks costs Rs. 100,000 and can be used only during the agricultural season. But one has to take care of the bullocks for the entire year as a result the cost of agricultural production increases. On the other hand if one will have a tractor and if there is no work it can be used for some other non- agricultural activities or if at all if there is no other alternative and if a tractor remains idle the farmer will not have to bear a large amount of maintenance cost as required for maintaining the bullocks for the whole year.

Water Shed Management

60% of our net sown area still remains at the mercy of the rain. While large tracks of the irrigation canals may exit only on paper most of the canals are running dry with silt, garbage and sewage chocking them. More than 58% of irrigation is now taking place with the help of ground water drawn from wells and tube wells hiring an estimated 6.5 million diesel pumps and 11 million electric pumps. This results into making farming very costly and unviable for small farmers .Scientific watershed management programme, consisting of a number of measures like diversion drains, graded bunds and check dams can be utilized to use canal water with minimum loss to irrigate agricultural land. The concept of water shed management is a single window approach to harmonise the use of natural resources of land, water, vegetation, livestock, fisheries and human resources.

Dematerialization of land Records

We have significantly strong IT and financial sectors, the benefit of which has not really reached the farmers. The initiative rests upon the idea of dematerializing landholding for the farmer with a satellite imagery of the farmers land imprinted against his ownership. In the dematerialized form the ownership of land always remains with the farmer and no exploiter can take his land away in hurry. However, he may leave his land through the demat form to corporate for a specific period. In return the corporate may – (a) pay the farmer a fixed quarterly lease rental per acre (b) take him as a shareholder with a certain number of shares allotted against each acre of land and (c) provide employment to one member of the family per acre to discourage urban migration on labour. The suggested measure has a potential to increase the earnings to 2.5 to 3 times.

Adoption of Genetically Modified (GM) Crops

To increase the agricultural productivity, we must also be more open and receptive to the idea of experimenting with genetically modified crops like Bt cotton and Bt Brinjal. Many countries have tackled food security in the past with the introduction of conventionally bred, although gene altered high yielding crops.

Balanced Application of several Nutrients

The enrichment of soil and the enhancement of agricultural productivity require the balanced infusion of several nutrients. Excessive and exclusive dependence on nitrogeneous and phosphatic fertilizers is very harmful to the soil. As a result, overall agricultural productivity is bound to decline. A national agricultural sustainability mission must be established to devise best practices, restore critical nutrients and manage water usage.

Encourage private investment

An intelligent subsidy and tax structure can encourage private investments, resulting in more efficient deployment of inputs and greater technology use.

Develop Food Processing Industries

Food processing and exports are the natural route for farm produce, raising incomes and creating jobs along with supply chain. Despite incentives for supply chain infrastructure, investment in cold storages, warehousing and refrigerated transport etc. have not been forthcoming because of market fragmentation and lack of assured supplies. To address these challenges, initiatives such as food parks, training and standard certification institutions and relevant transport connectivity would need to be accelerated so that private sector role can be enlarged.

Promote Eco-Technologies for sustainability

Eco technology is based on 3Es- Economics, Ecology, and Equity. This is to be achieved by adopting integrated crop management (ICM) Integrated Nutrient Management (INM), Integrated Water Management (IWM) and Integrated Pest Management (IPM). These are the different areas which are coming under "Green Agriculture"

Provide adequate institutional support to the needy borrowers

The flow of credit particularly to the small and marginal farmers should be made speedier and hassle free. The weather based insurance for agricultural risk should be promoted to increase the coverage which is very low. Effectiveness of the various food supply should be given prime importance and the present PDS (PDS) should be modified and same may be handed over to the village panchayat levels or if possible to SHGs working in the remote rural areas.

Post harvest Management

There is a need to develop cold chains and establishment of large cold storages in strategic locations for long storage of fruits and vegetables .There is also the need for a large number of refrigerated vehicles and containers to carry the perishable produce. Particularly, to carry high quality diary products milk value chain is extremely helpful.

Develop Agro Based Industries

World wide, agro processing industry has been recognized as a strong economic activity in view of development of new technological capabilities in processing, storage etc. There is a need to extend term loan facilities to the existing units to upgrade themselves for conforming to the international standards.

Price Risk Mitigation Products

Commodity exchange of India is now spreading far and wide covering a large number of commodities. It is a time to make available the benefits of commodity markets available to farmers. Banks in India with a wide network of branches in rural areas can act as an intermediary between the exchanges and farmers and thus make available the benefits of price risk insurance to large sections of farmers through put option contract.

Adoption of Bio-technology in agriculture

Improvements in agricultural technology are a critical component of meeting the challenges of a sustainable agriculture. Bio-technology crops are already making a contribution. Insect protected crops and herbicide tolerant crops allow farmers to achieve high yields even while using fewer pesticides. Now drought tolerant crops which will grow and survive even when the rainfall is not optional are being developed through bio-technology. The development of crops that can be used as bio-fuels is another development.

Conclusion:

India needs a big revolution driven by market demand and market needs. Every demand needs investment and without investment improvement can not take place. The investment can be properly utilized through a good forward thinking, good policies and investment in modern technology. If we want inclusive growth both central and state governments have to focus more on the agriculture sector. Government should also have the political will to implement policies effectively and help the farmers to increase the productivity of the farm land through innovative approaches. The government really needs to do is to set up some mechanism to assure the farmer that even when his crop fail, he should not lose his assets. We need a new growth model to improve the agricultural production we must launch technology mission to deal with all these challenges. The model should be from urban migration to rural migration.

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BIO METRICS ATM – RECENT TRENDS

R.Srinivasan

Deploying ATM for rural masses depends largely on banks stepping forward to take the requisite initiatives. The recent directive from the government on financial inclusion is key driver for the growth of such solutions in India.

Automated Teller Machines (ATMs) are now the heart of banking. Usages of ATMs have substantially increased in India and it is not uncommon to see huge queues of people in ATMs, especially during off business hours and holidays. ATM have brought down the work pressure substantially from cash tellers in bank branches, and many a branches may have deserted looks due to increasing usage of ATMs.

The latest on the techno-biological front is called biometrics. Biometrics is digitized retinal scans; fingerprints, and voiceprints, unique characteristics that many aren't will provide greater identity security or pose more of a threat to losing our anonymity. Regardless, the industry is becoming so big that there is talk of developing standards for biometric hardware and software. Biometrics is also catching the attention of government.

Biometrics

What better way than using Biometrics, which has successfully been applied for identification purpose to validate passport and travel documents, entry into secured areas, and in authenticating or securing transactions, especially in developed nations. Biometrics can be applied to uniquely identify an individual, based on his/her physical or physiological or behavioral traits, features or attributes, which include facial recognition (visage is such an example),DNA, fingerprint, voice recognition etc.,

There is still the issue of fingerprint spoofing or cloning (fake biometrics), but it is certainly easier to clone a card number, as it is currently practiced. In different counties, biometrics technology (fingerprint authentication to be precise) has been successfully used to combat ATM fraud by financial institutions such as the Western Bank in the USA, Banco Flabella in Chile, Groupo Financiero Banotre in Mexico, to mention a few. In developing countries such as Nilgera,according to reports, ATM fraud seem to be committed by mostly individuals linked to bank officers who are able to provide pin numbers and other relevant information required to commit such crimes.

With ATMs supported by biometric solutions, banks having a presence across the country are leveraging on this technology. The ATMs are networked and connected to a centralized computer (Switch), which controls the ATMs.

History of ATM & Biometrics

ATM or Cash points, first introduced in 1961 by city bank of New York on a trial basis, allowed financial institutions provide their customers with a convenient way, round the clock, to carry out varying transactions which included withdrawal of funds, made deposits, check account balance, and later on included features to allow customers pay bills etc., There was no need for a cashier to be present or for a customer to physically ATM technology allows customers carry out the above-mentioned transactions using an ATM card, which could be a debit or a credit card. An ATM machine authenticates the card by reading and verifying the magnetic strip, card number, expiration date, and an already provided or pre-selected PIN number.

The concept of using the iris for biometry was developed in 1981, before the technology to implement the idea was available. Leonard Flom, MD, and Aran Safir, MD, two ophthalmologists were discussing the possibility of using the distinct patterns of the iris for identification.

Developments

With the development of biometric solutions for the ATMs there is no need to remember PIN numbers. Software vendors are coming up the finger print solutions for the rural masses. Chennai based Financial Software and System (FSS) has recently launched its biometric ATM Interface Solution (BASIS) that enables connectivity of ATMs with biometric support to Electronic Financial Transaction (EFT) switches elaborating on the working of the biometric solutions. Customers opting for biometric authentication can visit a nearby.

Benefits

Since biometric technology can used in the place of PIN codes in ATMs, its benefits mostly accrues to rural and illiterate masses who find it difficult to use the keypad of ATMs. Such people can easily pt their thumbs on the pad available at ATMs machines and proceed for their transactions.

- Provide strong authentication.
- Can be used instead of a PIN
- Hidden costs of ATM card management like card personalisation, delivery, management, re-issuance, PIN generation, help-desk, and re-issuance can be avoided.
- Ideal for Indian rural masses.
- It is accurate.
- Flexible account access allows clients to access their accounts at their convenience.
- Low operational cost of the ATMs will ultimately reduce TCO.

How does it works

With ATMs supported by biometric solutions, banks having a presence across the country are leveraging on this technology. The ATMs are networked and connected to a centralized computer (Switch), which controls the ATMs. The use of biometrics identification is possible at on ATM. The information can be stored at a bank branch. ATMs are so prevalent and you have so many people using ATM that it becomes easy to use biometrics as replacement for an ATM PIN. The typical ATM has two input devices (a card reader and keypad) and four output devices (display, screen, cash dispenser, receipt printer, and speaker). Invisible to the client in a

communications mechanism that links the ATM directly to ATM host network. The ATM function s much like a PC, it comes with an operating system (usually OS/2) and application software for the user interface and communications.

Rural India

To reach the rural masses, banks are going all out in providing a user-friendly banking experience. To boost micro financing initiatives, banks are deploying biometric solutions with ATMs. Establishing the identity of a rural depositor through biometrics makes it possible for illiterate or barely literate folks to become part of the banking user community. In recent years the importance of biometrics has grown tremendously with an increasing demand of security in accordance of unique identification of individuals. It uses for identification in applications other than policing is on the rise. In view of the rapidly increasing applications, the scope of biometrics is also increasing, be it identification via face, retina, or iris. Fingerprinting, however, has the advantage of being a familiar concept worldwide.

Some Indian banks have started implementing biometric applications in retail branch applications for officer authentication. Elsewhere in the world, efforts are on enabling payments through kiosks based on fingerprints (non-card based). ATM enhancements with biometric envisaged by vendors eliminate the need for PIN entry, and authenticate customer transactions by thumb-impressions. A simplified menu on ATMs coupled with possible audio guidance in local language enable easy use for rural masses. So far bank ATMs are dependent on PIN verification. The fingerprint authentication method is non- Pin based, and this requires enhancements to the standard Switch environment.

Conclusion

Deploying ATM for rural masses depends largely on banks stepping forward to take the requisite initiatives. The recent directive from the government on financial inclusion is key driver for the growth of such solutions in India. Banks are quite aware of the untapped potential in the rural sector. The telecom industry is witnessing a blistering growth pace, and so is the Internet. The National Rural Employment Guarantee Program that guarantees employment and payment in the rural sector requires robust solutions. Using thumbprint and voice guidance in ATMs reduces literacy requirements to a considerable extent. However, the technology is not restricted to rural masses.

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RURAL INNOVATIONS

Stored grains are prone to several pest infestations some carried over from the field, some air-borne. Dr S Mohan of Tamil Nadu Agricultural University, Coimbatore has developed a simple device called 'Insect Trap'. The trap can be inserted in containers, bags of stored cereals and pulses and left for 10 days for best results. Insects have a tendency to move towards air. Hence the wandering insects enter into the perforations in the gadget and get caught in the trapping tube at the bottom. The trapping tube can be unscrewed and the insects can be destroyed.

The trap is environment friendly as it does not need any chemicals for stored grains, no battery or electricity required, no side effects and absolutely no maintenance required. The technology has won awards at both the State and the Central level. The technology has been licensed to KSNM Marketing, Coimbatore for manufacturing and marketing throughout India. Mr. C V Madeswaran is the Managing Director of KSNM Marketing.

RIN is adding value to the enterprise by developing channel to promote insect trap at the retail and institutional level.

JS MILKER (Manual Milking Device)

The JS Milker is a manual milking device that has the potential to play a pivotal role in contributing to the rural income. It is manufactured and marketed by J Support Industries, a Kerala-based company headed by Mr. Joy John. The JS Milker is a simple vacuum driven device, which can be used to effortlessly draw milk from cows. This portable machine has a vacuum handle, which is used to create the necessary suction power to draw milk out of the udder in the most hygienic and easy manner. The device is also fitted with a vacuum meter to monitor vacuum built. This helps in preventing any damage to the milk nodes of the cows and makes the whole process of milking absolutely simple and safe for the cattle

RIN has provided market development services in Tamilnadu. It is planned to tap the Gujarat market as well. In the course of providing these services, RIN has handheld the sales personnel. Also, RIN has supported product refinement undertaken in response to specific market feedback.

VARSHA RAIN GUN

The Varsha Rain Gun was innovated by Sri Anna Saheb, a 70-year old sugarcane farmer of Sadalga village in Belgaum district of Karnataka.

The Rain Gun offers attractive savings of 40-50 per cent in water used for irrigation. Given the nature of the water crisis prevailing in the country, this is the single most important feature of the rain gun technology. Additionally, farmers realize savings in irrigation time, power consumed for irrigation, and labor needed for managing irrigation. Attractive as these savings are, many other benefits add to the technology's merit. Irrigation with the rain gun helps fix atmospheric nitrogen, supports trash mulching and preserves soil health. All this leads to more efficient, profitable and sustainable agriculture. In recognition of its value, the raingun was awarded by the National Innovation Foundation (NIF). RIN provided a range of services to incubate the rain gun. The efforts culminated in the facilitation of a technology transfer agreement between Anna Saheb and Servals Automation Pvt. Ltd., a Chennai-based company that makes and markets the Venus kerosene stove burner. Significantly, the rain gun is also part of the portfolio that attracted the first ever-micro venture investment in India

COCONUT DEHUSKER

Mr. Karrupaiah, of Process Ekuipment, Coimbatore, has developed the coconut-dehusking machine. The machine can dehusk 500-coconuts/hour of size of dia 120 mm to 250 mm. The machine requires 3 semi-skilled people to operate and achieve the above efficiency. The machine operates on a 1.5 HP single-phase motor, weighs 175 kg and is provided with forward and reverse switch. The machine has set of rollers supported with anti-friction non-corrosive bearings, strippers and is coated to prevent rusting. The dehusked coconut will fall on the left side and the husk on the right side of the operator. The machine's design has been registered with the Patent Office, Chennai.

RIN will offer services for Technology Transfer and convert prospects into customers for Coconut Dehuking machine.

SOLAR ENERGY-THE NEED OF THE HOUR

M. Mary Anbumathy and D.P.Jesudoss Manohar

Today we use energy faster than we can make it and eventually we are going to run out. Inadequacy of energy supply would obviously affect very adversely the vital and essential requirements of any society. There is, therefore, an urgent need to enhance substantially the energy availability at a rapid pace so that aspirations of those who have remained insulated from such important inputs and services are fulfilled and they are enabled to have a reasonable alternative source of energy.

With the forecast of faster growth of the economy in the near future, the demand for the energy will surely increase from all the sectors. India will continue to experience an energy supply shortfall through the forecast applied.

Hydro energy: It is a renewable energy resource because it uses the Earth's water cycle to generate electricity. Water evaporates from the earth's surface, forms clouds precipitates back to earth, and flows towards the ocean. The movement of water as it flows downstream creates kinetic energy that can be converted into electricity. Hydropower is by far the single largest renewable energy source in India, accounting for over 10% of total electricity generation. The energy of running water has been exploited for very many years. However this resource has suffered disadvantages due to the following environmental factors. For example

- Building a dam across a river floods the land that would otherwise be available for use, alters the landscape, affects the local community that would have lived and worked on the flooded land, alters the character of the river, and prevents the free movement of fish
- Diverting a river affects the nature of the countryside and does not lend itself to use on a large scale
- Building large-scale hydro power plants can be polluting and damaging to surrounding human communities, agriculture and ecosystems.
- Hydro projects can also be unreliable during prolonged droughts and dry seasons when rivers dry up or reduce in volume.

Wind Energy: Wind power is the conversion of wind energy into a useful form of energy, such as electricity, using wind turbines Defects:

- The level of required subsidies, the small amount of energy needs met, the expense of

transmission lines to connect the wind farms to population centres, and the uncertain financial returns to wind projects make it inferior to other energy sources.

- Intermittency and other characteristics of wind energy also have costs that may rise with higher levels of penetration, and may change the cost-benefit ratio.

Nuclear Energy generates less than 3 percent of India's total electricity consumption. Nuclear energy is generated in a nuclear reactor when nuclear fuel(uranium 235) kept in the reactor core is split up, releasing huge amounts of heat. The heat is used to produce steam, which in turn is used to drive a turbine to generate electricity. It is suffered from the following defects

- Nuclear power is not the answer to energy shortage.
- Nuclear power is dirty and dangerous
- Nuclear power plant contains an amount of long lived radiation equivalent to that released by 1000 Hiroshima bombs.
- Many of these radioactive elements will continue to emit radiation for thousands of years.
- Impact of these radiations on the human body is deathly. It mutates the genes in the cells, causing cancer; it also mutates the reproductive genes, causing all kinds of diseases and birth deformities in future generations.

Biomass energy is the utilization of energy stored in organic matter. Examples of biomass include wood, leaves, animal waste, crops, bones and scales. The abundant plant life in our planet is nature's store house of solar energy and chemical resources. Whether cultivated by man or growing wild, plant matter represents a massive quantity of a renewable resource that we call biomass. It includes the following defects.

- Burning method of biomass in not clean
- It is similar to the burning of fossil fuels and produces large amounts of carbon dioxide.

Tidal and ocean energy Tidal electricity generation involves the construction of a barrage across an estuary to block the incoming and outgoing tide. The head of the water is then used to drive turbines to generate electricity from the elevated water in the basin as in hydroelectric dams.

- They are economical only if the installed capacities are high
- Investments required are considerably high.

Thermal power Thermal power is one of the oldest methods of generating power. The reasons identified for poor performance of thermal stations includes the following

- Design deficiencies, manufacturing and generic defects
- The quality of coal being supplied had deteriorated as compared to the deigned quality. Besides the coal had high ash content and contained stones, boulders, shale and sand.

Alternative source of energy: Solar energy the super natural energy

Solar energy is the most readily available and free source of energy since prehistoric times. It is estimated that solar energy equivalent to over 15,000 times the world's annual commercial energy consumption reaches the earth everywhere.

Yearly solar fluxes

Solar	3,850,000 EJ
Wind	2,250EJ
Biomass	3,000EJ
Primary energy use	487EJ
Electricity	56.7EJ

Source Bureau of Energy efficiency

The total energy absorbed by Earth's atmosphere, oceans and land masses is approximately 3,850,000 exajoules per year. The amount of solar energy reaching the surface of the planet is about twice as much as will ever be obtained from all of the Earth's non-renewable resources of coal, oil, natural gas, and mined uranium combined.

There are several advantages of solar energy ranging from money saving to saving the planet. When we decide to harness the energy from the sun, and use it to create energy from its solar rays we are making a commitment to not only

ourselves, but a commitment to our family, friends, community and to our planet. We are committing to use natural energy resources provided for free, and cost us or our planet anything. By using solar power we are prolonging the life of our planet, and ensuring that it will be here for future generations is to enjoy.

Solar technologies Solar technologies are broadly characterized as either passive or active depending on the way they capture convert and distribute sunlight. **Active solar techniques** use photovoltaic panels, pumps, and fans to convert sunlight into useful outputs. Active solar technologies increase the supply of energy and are considered supply side technologies.

Passive solar techniques include selecting materials with favourable thermal properties, designing spaces that naturally circulate air, and referencing the position of a building to the sun. This technology reduces the need for alternate resources and are generally considered demand side technologies.

How our community can benefit from solar energy

Solar water heating

Solar hot water system use sunlight to heat water. In low geographical latitudes (below 40 degrees) from 60% to 70% of the domestic hot water use with temperatures up to 60 degree Celsius can be provided by solar heating systems. The most common type of solar water heaters are evacuated tube collectors and glazed flat plate collectors generally used for domestic hot water and unglazed plastic collectors used mainly to heat swimming pools. Israel and Cyprus are the leaders in the use of solar hot water systems with 90% of homes using them. In United States, Canada and Australia, heating swimming pools is the dominant application of solar hot water.

Water treatment

Solar distillation can be used to make saline or brackish water portable. The first instance of this was recorded by Arab chemists. A large scale solar distillation project was first constructed in 1872 in Las Salinas.

Solar water disinfection involves exposing water-filled plastic polyethylene bottles to sunlight for several hours. Exposure time vary depending on weather and climate from a minimum of six hours to two days. This method is recommended by World Health Organisation as a viable method for household water treatment and safe storage.

Solar cooker

Solar cookers are using sunlight for cooking, drying and pasteurization. They can be grouped into three broad categories namely box cookers, panel cookers and Reflector cookers.

Box cookers are the simplest solar cookers. A basic box cooker consists of an insulated container with a transparent lid.

Panel cookers use a reflective panel to direct sunlight onto an insulated container and reach temperatures comparable to box cookers.

Reflector cookers use various concentrating geometries dish, trough, Fresnel mirrors to focus light on a cooking container. These cookers reach temperature of 315 degree Celsius and above but require direct light to function properly and must be repositioned to track the sun.

Solar water pumps

In solar water pumping system, the pump is driven by motor run by solar electricity instead of conventional electricity drawn from utility grid. Solar water pumping system consists of a photovoltaic array mounted on a stand and a motor-pump set compatible with the photovoltaic array. It converts the solar energy into electricity, which is used for running the motor pump set. The pumping system draws water from the open well, bore well, stream, pond canal etc.,

Solar vehicle

Some vehicles use solar panels for auxiliary power, such as for air conditioning, to keep the interior cool, thus reducing fuel consumption. In 1975 the first practical solar boat was constructed in England. By 1995, passenger boats incorporating PV panels began appearing and are now used extensively.

Astro Flight Sunrise plane was the first solar flight. It was solar powered, fully controlled; man

carrying flying machine, reaching an altitude of 40 feet.

A solar balloon is a black balloon that is filled with ordinary air. As sunlight shines on the balloon, the air inside is heated and expands causing an upward buoyancy force, much like an artificially heated hot air balloon. Some solar balloons are large enough for human flight, but usage is generally limited to the toy market as the surface-area to payload weight ratio is relatively high.

Solar sails are a proposed form of spacecraft propulsion using large membrane mirrors to exploit radiation pressure from the sun. Unlike rockets, solar sails require no fuel. Although the thrust is small compared to rockets, it continues as long as the shines onto the deployed sail and in the vacuum of space significant speeds can eventually be achieved.

Solar chemical

Solar chemical processes use solar energy to drive chemical reactions. These processes offset energy that would otherwise come from an alternative source and can convert solar energy into storable and transportable fuels.

Solar lighting system

Some applications for PV systems are lighting for commercial buildings, outdoor street lighting, rural and village lighting etc., Solar electric power systems can offer independence from the utility grid and offer protection during extended power failures. Solar PV systems are found to be economical especially in the hilly and far flung areas where conventional grid power supply will be expensive to reach.

Advantages of solar energy system

The ecological benefits of using solar energy are just too many to enumerate. First and foremost there is tremendous environment edge that comes from its clean, renewable, non fossil fuel oriented and sustainable nature. Solar power system helps in keeping the environmental balance of the world in tact. Solar energy avoids usage and release of gases. It remains eco-friendly does not brings risk of global warming. The harmful smog or acid rain generated by fossil fuel sources is used is also not an issue when solar energy is used. Most of the world's energy sources are derived from conventional sources- fossil fuels such as coal, oil, and natural gases. These fuels are often termed non- renewable energy sources. Although the available quantity of these fuels are extremely large they are nevertheless finite and so will in principle "run out" at sometime in the future. Most forms of energy production create some form of negative externality. These costs are not paid by the producer or consumer of the good. For electric production, the most significant externality is pollution, which imposes social costs in increased health expenses, reduced agricultural productivity and other problems. In addition, carbon-di-oxide, a green house gas produced when fossil fuels are burned, may impose even greater costs in the form of Global warming.

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SWEET CHERRY-PRIDE OF KASHMIR

Altaf Hussain Teli

The state of Jammu and Kashmir is blessed with the richness in biodiversity of mighty Himalayas and the nature has been kind enough in providing unique agro-climatic conditions. The horticulture sector is a major contributor to the economy of Jammu and Kashmir as it is the most remunerative for hilly areas than field crops. Kashmir is the home of large varieties of temperate fruit crops and among these commercial fruit crops sweet cherry play a vital role in grooming economy of the state. Sweet cherry (*Prunus avium* L) is one of the important stone fruit crop cultivated throughout the temperate regions of world. Sweet cherry belongs to family Rosaceae of genus Prunus. Kashmiri sweet cherries are always in high demand and enjoy a virtual monopoly, as the fruits from the state are preferred across the country for their taste and quality. So, if cultivated on commercial scale can improve the livelihood of the farmers of this hilly temperate region.

Origin and Distribution

The sweet cherry is thought to have originated from Greece around 300 B.C (Hedrick, 1915) and from where it spread to Italy, England, Germany, Belgium, Portugal and then America. Sweet cherry is distributed worldwide between 35° N and 55° S latitudes which is favourable for its cultivation. In our country, sweet cherry is confined to Jammu & Kashmir, Himachal Pradesh and hills of Uttar Pradesh. As area under sweet cherry is increasing day by day due to its higher demand in domestic market, efforts are being made by the state government to boost its productivity and quality, so that the fruit can fetch valuable returns to the farmers of this state.

Area and Production

The leading sweet cherry producing countries are USSR, USA, West Germany, Italy, France and Turkey. The total production of sweet cherry in world is about 1872.00 thousand tons (Anonymous, 2008). The state of Jammu & Kashmir accounts for about 95 per cent of the total sweet cherry production in India and occupies an area of 3465 hectares with an annual production of about 11445 metric tons (Anonymous, 2010).

Soil and climate

Sweet cherries are grown on elevated lands as the blossoms of such trees are less vulnerable to spring frost injury as compared to low land orchards. Well-drained deep sandy loam soils rich in O.M. having pH from 6.5-7.0 and which

Flowering stage

Fruiting stage

Ripening stage

Harvesting stage

can hold enough moisture during summer are most suitable. Sweet cherry is successfully grown in areas located between 2100 to 2700 metres above mean sea level and requires 1000 to 1500 hours of chilling period below 7°C. A well-distributed annual rainfall of 100-120 cm throughout the year is desirable for sweet cherry production.

Varieties

The important sweet cherry varieties grown in plains, foothills and upland areas of Jammu and Kashmir are: Awal Number (*Guigne Pourpearaprece*), Siyah Gole (*Black Heart*), Tontal (*Guigne Noir Gross Lucenta*), Makhmali (*Guigne Noir Hative*), Double (*Bigarreau Nepolean*), Misri (*Bigarreau Noir Grossa*). Among these varieties Awal Number (*Guigne Pourpearaprece*), Double (*Bigarreau Nepolean*) and Misri (*Bigarreau Noir Grossa*) are preferred by the farmers and cover most of the cultivated area.

Nutritive value and utility

Sweet cherry is a rich source of carbohydrates, proteins, minerals and vitamins having more caloric value than apple. The carotene and folic acid contents are also high. Sweet cherry is delicious fruit mostly consumed as fresh, besides being used in ice-creams, bakery, confectionery, jam making and other purposes.

In Jammu and Kashmir, sweet cherry is the season's first fruit crop which comes to market as it matures in about 60 to 70 days after full bloom and fetch's a good price. Through the combined efforts of SAU's and liberal financial support of state government considerable progress has been achieved in transforming the horticulture sector of this hilly region from resource based to technology based system.

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TIPS TO SAVE ENERGY

At home

- Turn off lights when not in use
- Clean the dust accumulated on tube lights and bulbs and its fixtures regularly.
- Use ISI marked electrical appliances and equipments
- Place your tube lights and bulbs in positions where the light is not obstructed.
- Use CFLs to save energy

Why CFLs

Compact fluorescent bulbs (CFLs) use about two-thirds less energy than incandescent bulbs with no reduction in quality of light. Compact fluorescent bulbs will give an incandescent bulb's warm, soft light, while using up to 75 percent less electricity

CFLs are slightly costlier but are worth investing as they are smaller, cheaper, brighter, and offer improved color quality. Typically, a 23-watt compact fluorescent bulb can replace a 90 - or 100-watt incandescent bulb

Use compact fluorescent bulbs in fixtures that are on for more than four hours a day. By replacing only two 75 Watt light bulbs that are on four hours a day by two 15 watt energy-saving lamps, you can save almost 18 Kilo Watt hours per year.

Less Energy More Light

Cooking

- Use energy efficient chulas
- Keeping the vessels closed with a lid while cooking reduces cooking time and energy use.

- Soak the food ahead of cooking

Recycle Paper

Recycled paper uses less natural resources and less toxic chemicals in paper making process. It has been reported that One Tonne of paper made from 100% wastepaper

- Saves about 15 trees
- Saves about 2,500 Kwh of energy
- Saves about 20,000 liters of water
- Reduces about 25 kilograms of air pollutants

Saving Energy in Agricultural Activities

- Irrigation
- Pumping out water

There is a potential of about 25% to 35% improvement in the efficiency of these pump sets by affecting minor / major rectification and shifting to ISI marked pumps.

- The larger valve helps to save electricity / diesel because less fuel and power is needed to draw water from the well.
- The fewer the no. of bends and fittings in a pipe, more the electricity saves.
- Sharp bends in the pipe leads 70% more frictional loss than standard bends.
- A farmer can save 15 liters of diesel every month simply by reducing the pipe height by 2 m. The pump works more efficiently when it is not more than 10 feet above the water level of the well.
- Use good quality PVC suction pipe to save energy and save electricity up to 20%.
- Apply oil and grease to pump set regularly as recommended by the manufacture.
- To improve the power factor and voltage use ISI marked shunt capacitor of right capacity with motor. This will also save the electricity.
- Switch off the light of well in the day time.

(Source: Energy Conservation Mission, Hyderabad

Licensed U (DN) 52/2012-14 to post without pre-payment
At RMS, Delhi ISSN-0021-5660
Date of Publish : 30, 31 of every month
Date of Dispatch: 1st, 2nd of every month

Reg. Number DL(S)-05-3232/2012-14
RN 702/57-Delhi Postal

Printed and Published by Ira Joshi, Additional Director General and Head, Publications Division, Ministry of I&B, Govt. of India
Soochna Bhawan, New Delhi-110 003 on behalf of Ministry of Rural Development, Govt. of India, New Delhi-110 011,
Printed at Chandu Press D-97, Shakarpur, Delhi-110092 and Published from Soochna Bhawan, New Delhi-110003. Editor : Kapil Kumar