

Souvenir & Lead Papers

National Seminar

on



Rural Empowerment for the New India: Mission 2022



(August 10, 2018)

Organized at

Convention Centre

Jawaharlal Nehru University, New Delhi



Royal Association for Science-led Socio-cultural Advancement (RASSA)
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Venue

**Convention Centre
Jawaharlal Nehru University
New Delhi**

Organised by:



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National Academy of Agricultural Sciences

Prof. Panjab Singh
President

Message

I am happy to know that Royal Association for Science-led Socio-cultural Advancement (RASSA) is organizing one day National Seminar on 'Rural Empowerment for New India: Mission 2022' at campus of Jawaharlal Nehru University, New Delhi. The collaborators of this seminar are Jawaharlal Nehru University, New Delhi, Grass Root Research & Creation Pvt Ltd, Noida and ASSURE Foundation, New Delhi. The topic selected by RASSA and collaborators are as per the need of hour in the country.

Thought provoking talks by eminent speakers on various major issues in three major themes will certainly help in finding the ways and means to develop rural India in holistic manner by involving various agencies with our farmers. I am also happy to know that organizers have involved various stakeholders including farmers.

On this occasion, I convey my best wishes to organizers and participants for success of one day National Seminar.

(Panjab Singh)
Patron

Message from Organizing Secretaries...

One of our prime minister's new vision to improve the concerns of rural India is the real thought of the day to make a significant impact in overall progress of the country. It seeks to create a sustainable development of rural population. We have to think for solutions to essential services like education, healthcare, nutrition, agriculture, sanitation and most important, livelihood opportunities. At this stage, the aspiration level of the communities begins to rise, something we have experienced firsthand, and soon they begin to explore ways to empower themselves to feed their aspirations. This is the demand of the time for an overall strengthening of India with sustainable development of rural communities. As Prime Minister Modi highlighted, while we have human resources in abundance, what the youth lack are skills, vocational training and confidence. Honing the skills of the young people from the rural populations can help create a strong workforce. If only the government and social sector could work together to empower them and stop their migration to cities ill-equipped to handle the influx, there could be a real achievement in development of healthy and wealthy rural sector and this will be true empowerment in equipping rural India to help itself.

Keeping these emerging issues at present time relevant to sustainable development and empowerment of rural India, RASSA is now organizing one day National Conference on '**Rural Empowerment for New India (Mission-2022)**' is **planned** in collaboration with Jawaharlal Nehru University, Delhi. This conference is set to address different issues related to development of empowerment of rural India through participation of national experts and progressive farmers through meaningful discussion, panel discussion and presentations. The aim of the conference is to bring together policy makers, academicians, developmental agencies, industry leaders and other stakeholders on a common platform, with a view to deliberating on policy issues, strategies and implementation techniques for the sustainable development of rural India.

The main objective of the seminar will be to give an overview of existing approaches to identification of emerging issues for sustainable rural empowerment and development, as well as to provide and demonstrate a possible approach to identify emerging issues for future rural India sustainable development strategies.

We are sure that you all would find the programme of National Conference exciting and deliberations on the discussed subjects meaningful. We are sure that the platform will provide great opportunity to interact and inspire the rural communities to meet the challenges as well as share their knowledge/information among all the experienced participants. We are also looking forward to the recommendations of this conference, which should provide solutions in effective empowerment of rural India.

We hereby thank to lead speakers and convey our best wishes to all members of Organizing Committee and the respected delegates for their valuable participation in the Conference.



(Dr S.P. Singh)



(Dr G.P. Rao)

Organising Secretaries

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Empowering Rural India for Sustainability, Progress, Prosperity and Peace

Awadhesh Kumar Singh

President, RASSA, New Delhi

It is highly encouraging to see this august gathering having vast knowledge and experience coming together to deliberate on the issues concerning rural India in a daylong seminar on “Rural Empowerment for New India”. This day is dedicated to the problems faced by 70% population living in rural areas, engaged mainly in farming and farm related services, to discuss as to how best this segment of society can be empowered to be the master of their own destiny. Deliberations shall take place in the light of problems ailing the villages and their strength and weaknesses to suggest as to how their full cooperation and potential can be utilized in improving their lot for greater contribution to the society and the nation. Seminar at Lucknow in November, 2017 made us to feel that movement of value added products and services from villages to cities and Education, Technology and health services moving from cities to villages seamlessly can make the desired difference. Villages need good education and health services, infrastructure, road & transport, communication, security and appropriate technologies with hand holding to create environment for development of competent, prosperous and satisfied individuals to form a harmonious and peaceful coexistence aiming at realization of ultimate goals of life. Any suggested intervention should maintain and further the goodness of their culture, heritage, tradition and cooperation to progress individually and collectively in sustained manner.

We are all aware that the country has progressed well after independence. Generations might forget that India ever had food shortage and was depending on imports at a time when population was merely 50 crores. Everyone starting from scientists to extension workers to farmers did their best to reach this situation of food self-sufficiency. The country has now come out to be sixth largest economy in the world, thanks to the service sector but any sector survives and thrives well only on strong foundations of research and quality production of goods which is absent in service sector. India with such a huge competent and capable manpower should aim to be head and not the hand and leg for the world. Contribution of agriculture, outside the lenses of GDP, still holds the importance to feed the nation of 135 crores people, being self-sufficient in food and nutritional security as well as exporting agricultural produce to the world market. The importance of this sector can also be gauged from the fact that it gives employment to 50% workforce in the country which no other sector can accommodate. There is therefore reason to look at the fact as to why in spite of substantial progress on Agricultural front, the farmers of the nation have grown poorer individually and also as rural society in terms of infrastructure, support system and social fabric that existed in the land.

We are also aware that only with 2.4 % (3.28 million Square km) of land area and 4% of water share, the very same farming sector is supporting 17 % of world population for food, feed and clothing. With more than 50% of the geographical area and 78% of available water already deployed in Agriculture, there is hardly any possibility for increasing either of the two while still leaving more than 50% of the cropped area

dependent on rains, which is going erratic frequently. Water availability Regional inequity is another big issue making programs like “**Water to every field**” and “**per drop more crop**” coupled with linking of rivers, charging underground aquifers, and optimizing cropping systems for water use efficiency more relevant in days to come. Simultaneously, we also need to consider that in spite of five times increase in food grain production, from 50 million ton in 1952 to 275 million tons in 2017, the contribution of agriculture in GDP has reduced from 52 % in 1952 to 17 % in 2017, making 67% people survive on this meagre share. With this entire situation, last three decades have witnessed large scale migration of rural people to urban areas for low end jobs for additional income and also partially for want of good education for children which is not available in villages. Gap in income and wealth formation in cities and rural area is widening. We all know that Production activities in Agriculture are open to uncertainties of weather, quality of inputs and MSP regime having several extraneous pressures but still farmers are doing their great service with pride of being **Annadata** at the cost of remaining poor financially.

In the home of 135 crore people (90.5 crores in cities and 44.5 crores in 6.50 lakh villages), the management of land and Agriculture is handled in democratic federal structure through 29 States and 7 union territories, 712 districts, 2.50 lakh Gram-panchayats and about 14 crores operational holdings with rights on land practicing a System of “**Production by Masses**”. Health, education, food and nutritional security are basic needs which still need to be fulfilled. Availability of transport, domain knowledge and environment that encourages entrepreneurship is also missing. With this entire put in place, people will be at their jobs. Right to work and right to food are even more important than freedom of speech. In fact, the great architects of nation granted the freedom of speech only with the confidence that one day all this will be available and people will have to say everything good and good alone for themselves, their fellow citizen, their neighbours, their village, their state, their country and their Governments and negativity shall have no place in the society. Systems of education and health services in rural areas are in poor shape in terms of infrastructure, quality, control and seriousness. Everything cannot be done by Government alone. Government, through its policies can be facilitator, motivator and controller but then how to do? This day is dedicated to these issues for deliberation with following three theme topics as follows;

- I. Sustainable system for quality education and health management for rural India.
- II. Entrepreneurship development, value addition and supply chain for income and job creation.
- III. Self-sustaining market linked agri-eco development

We need to touch areas where we have gone wrong and what is the way out? I feel, GDP alone as criteria to measure development and contribution does not suit to agriculture. Something more important for the nation is peace of mind of the people and peace in the society to realize the progress. Caring for educational and health needs and looking for opportunity for work in rural areas is expected to create the peaceful environment needed for development of competence and confidence for progress and prosperity for a happy, healthy living and contributing in nation building and that is the basic line of thought of RASSA.

Royal Association for Science-led Socio-cultural Advancement (RASSA) is an all India non-profit multi-disciplinary society formed by scientists, doctors, engineers, industrialists and farmers and other likeminded

people who believe that this goal can be realized by faster transfer of scientific and technological advancement to the end users through motivational and demonstrative approaches. The society believes that the developments can take place with the cooperation and participation of people involved in the process. As such it works as facilitator in rural areas motivating them to make best use of technology and associate in Government schemes and plans in the developmental process for betterment. RASSA also believes that Agricultural advancements cannot be successfully accomplished as stand-alone activity for it has impact on life, growth and happiness of individuals, families and peace and prosperity in the society. Availability of Food may be critical for survival, but the matter of food and nutritional security goes further to the level individual's economic capacity to access it. Hence economic activities for income generation are equally important. Simultaneously, the technological advancement has, though, resulted in the increase of yields but has increased pressure on soil, water, environment and other resources and as such the planning for sustainable agricultural development shall have to look at totality for sustainability with synergy in food, energy, water and other resources with thorough understanding of their potential interactive merits as against trying to realize their isolated short-lived advantages. And last but not the least that all these developments should simultaneously aim at enhancing and strengthening the social bondage protecting cultural heritage, customs, traditions and cooperation of each other in the society to make people live a lively life with peace of mind.

Sustainable System for Quality Education

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Agriculture sector has given the status of priority to the Indian economy because directly or indirectly more than 50% of the total work force is employed in this sector. Agriculture contributes about 14% in national GDP and responsible for about 12% export. Agricultural education provides couple of educational activities with the primary aim of achieving human resource development for the rural economies of nation. India has acquired status of first green revolution by increasing about 5 times grain production, 9 times horticultural production, about 9.5 times milk production and 12 times fish production. Perhaps it is because of deep rooted agriculture education in this country. Education should lead to development of skilled human resource, basic research for knowledge generation, applied research for development of technology, system and package of practices and SMART livelihood by integration of Science, Management, Agriculture, Research and Technology tools. The government's initiative to double farmers' incomes by 2022 is welcome step as it is important in dealing with the agrarian crisis in the country. Various mechanisms for increasing farmers' incomes from the perspective of small farmers and farm workers are very important and need right attention as its orientation is dynamic in nature There is need to focus on increasing agriculture input use efficiency, articulating new technologies and devices, agro processing and value addition, agriculture market, propagation of high-value crops and increasing efficiency of rain-fed areas, non-farm occupations, agro-industrialisation and strengthening and innovating producer and worker institutions and finally federating farmers in to agri business.

Today we need high quality agricultural graduates equipped with problem solving and creative skills and ability to think and improve productivity of agricultural sector. Apart from the technical and generic skills, our graduates need leadership and entrepreneurial skills to build leading teams, and put innovations into practice and respond to competitive environments. There is need to articulate four T's *i.e.* Tradition, Technology, Talent and Trade to make agriculture as alternative field for livelihood and sustainable development. Traditional means what is our status as far as agriculture is concerned in our country, technology means what is present state of art of devices, system, process and package of practices available indigenously and internationally. The concept of talent is how to use innovation and creativity among all stakeholders of agriculture to make this profession remunerative and finally there is need to introduce concept of trading in agriculture field *i.e.* how to federate farmers into business group.

Agricultural Education in India

Agriculture Education is not only responsible for human resource development but also for basic research for knowledge generation and applied research for development of technology and device etc. Agricultural Education is the teaching of agriculture, natural resources and land management. At higher levels,

agricultural education is primarily undertaken to prepare students for employment in the agricultural sector. Classes taught in an agricultural education curriculum may include horticulture, land management, good agriculture practice management, agricultural science, small animal care, machine and shop classes, health and nutrition, livestock management and biology. College agriculture involves training of people to teach or conduct research in order to advance the fields of agriculture and food science. General education informs the public about food and agriculture.

It is observed that education must include knowledge (basics, fundamental, theory, practices) to know what to do, skill to know how to do, ability to make work simple & convenient, experience for increasing efficiency and finally attitude & resources for doing work in actual. Thus we need updated Syllabus with proper articulation of quality and reform. Quality assurance in higher agricultural education in the country has been achieved through policy support, accreditation, framing of minimum standards for higher agricultural education, academic regulation, personnel policies, review of course curricula and delivery systems, development support for creating/strengthening infrastructure and facilities, improvement of faculty competence and admission of students through All India competitions. As first and most important step for quality improvement of education, the Indian Council of Agricultural Research has been periodically appointing Deans Committees for revision of course curriculum. In the series, recommendation of Fifth Deans Committee had been made considering contemporary challenges for employability of passing out graduates and to adopt a holistic approach for quality assurance in agricultural education and declaring Agriculture as professional degree. The committee has recommended that in first year of each sub sector of Agriculture courses related to traditional, in second year courses related to technology, in third year courses related to increase in talent of students and in final year courses related to trade or federating students into business group should be planned. Further, the Committee has also recommended to introduce ICAR funded 'Student READY programme (Rural Entrepreneurship Awareness Development Yojana) in each UG courses for one complete year period to promote skill development in the graduating students for specialized jobs in view of market needs and demands.

Number of innovative steps has been taken by ICAR in order to attract talented students and creating visibility of Agriculture Education in India.

It is expected that Agriculture education in India will produce competent human resource for research and forever green revolution in society, for adequate Employment and Entrepreneurship, for inducting World class IT capability in different practices and for ultimate increasing efficiency in inputs & thus higher productivity, enhanced income and environmental protection. Quality education for global competitiveness and creating models to play a key role in 'Digital Initiative', 'Skill Initiative' and 'Make in Initiative' of Govt of India will be motto of ICAR.

Growing Health Consciousness – Role of an Individual, Community and State

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Community Health

A community has been defined as a group of inhabitants living in a somewhat localized area under the same general regulations and having common norms, values, and organizations (Green and Ottoson, 1999). Community Health refers to the health status of a defined group of people and the actions and conditions, both private and public (governmental), to promote, protect, and preserve their health (McKenzie *et al.*, 2005). Academically-centered texts and other information sources defining community health largely have not been positioned to frame the expanding field of community health in public health practice and the importance of community engagement (Goodman *et al.*, 2014). The combination of sciences, skills and beliefs directed towards the maintenance and improvement of the health of all the people through collective or social actions. The field of community health is anchored in a rich history of innovations in public health methods and programs directed at reducing risk factor prevalence, decreasing acute and chronic disease burden and injury occurrence, and promoting health (Goodman *et al.*, 2014). The program, services and institutions involved emphasize the prevention of disease and the health needs of the population as a whole. Community health activities change with changing technology and social values, but the goals remain the same.

Community Medicine

The study of health and disease in the population of a defined community or group and the practice of medicine concerned with groups or populations rather than individual patients. The knowledge of evolution of community medicine and public health is important in order to understand the differences between the two. The first use of the term “community medicine” was in the context of United States in 1920 (Meyer, 1920). It defined it in opposition to individualistic practice into a group/co-operative medicine with the aim to increase access to care and promote equity. On the other hand, the move towards community medicine occurred in 1974 in United Kingdom with almost the same objectives (Br Med, 1974). Public health approach is concerned with the health of the community as a whole. The three core public health functions are: the assessment and monitoring of the health of communities and populations at risk to identify health problems and priorities; the formulation of public policies designed to solve identified local and national health problems and priorities; and ensuring that all populations have access to appropriate and cost-effective care, including health promotion and disease prevention services, and evaluation of the effectiveness of that care. The evolution of Public Health has gone through the two main nineteenth-century phases, (i) environmental sanitation phase lasting from around 1840 to 1890, and (ii) the scientific control of communicable diseases,

based on bacteriological discoveries and the germ theory, from 1890 to 1910 (Beaglehole and Bonita, 2004). Then followed by using legislation as a tool for public health, whether it was to protect factory workers or to use quarantine to prevent the spread of diseases. While the initial advances in public health occurred outside the medical sector, as medicine advanced, the focus of prevention and public health moved from governments to individuals and accordingly, the emphasis on clinical medicine became stronger (Krishnan, 2016).

Curative Medicine versus Public Health & Social/Community Medicine

The primary objective of curative medicine is to ensure removal of the disease from the body of the patient (i.e. the individual rather than from the population). It employs various modalities to accomplish this objective, e.g., diagnostic techniques and treatment. Over the years, the tools of diagnosis have become refined, sophisticated and with multiple options for treatment. Curative medicine/ allopathic medicine, over the years, has accumulated a vast body of scientific knowledge, technical skills, medicaments and machinery - highly organized not merely to treat disease but to preserve life itself as far as it could be possible.

Social medicine focuses on the health of the community as a whole. It draws its roots from European countries which seem to imply the function of social factors in the origin of the causes of disease. Social medicine also emphasis on why the areas of disease prevention and medical care needed government intervention. The concept of community/ social medicine defines public health as a part of medicine. Due to a marginal understanding of public health there were various issues: the secondary and tertiary care services were given relatively more emphasis rather than primary care. The government officials that were assigned to work on public policies are mostly from biomedical background with little understanding in the practice of public health. Thus, medical rehabilitation services, health promotion services were sidelined. Also, community medicine has given less emphasis on the multi-disciplinary nature of the subject. Since, the training of community medicine has been restricted to medical schools, it has weaknesses that are lack of access to people as well as shortage of expertise in many critical aspects of public health like policies, legislations etc. Also, the fact that anybody can become a public health specialist reduces its status as compared to other clinical disciplines (Krishnan 2016).

The clinicians and public health experts are taking in developing their disciplines further in different directions. While clinical disciplines are moving into more and more narrow confines (from eye to retina or from orthopedics to knee replacement surgery), public health is increasingly recognizing the global nature of health (pandemics, multinational marketing, etc.) and is defining the community as a global village (Krishnan *et al.*, 2014).

General Health Problems and Common Diseases: Current Status

University of Rochester Medical Center describes top ten most common health issues as physical activity and nutrition, overweight and obesity, tobacco, substance abuse, HIV/AIDS, mental health, injury and violence, environmental quality, immunization and access to health care. According to Global Health Observatory (GHO) data of WHO heart disease, stroke, cancer, chronic respiratory diseases and diabetes

are the major non-communicable diseases (NCDs) and are leading cause of mortality in the world. These are under-appreciated cause of poverty in developing countries as well as hinder the economic development of many countries. The number of people, families and communities afflicted is increasing day by day. Common, modifiable risk factors underlie the major NCDs include tobacco, harmful use of alcohol, unhealthy diet, insufficient physical activity, overweight/obesity, raised blood pressure, raised blood sugar and raised cholesterol. NCD threat can be overcome using existing knowledge. The solutions are highly cost-effective. These can be overcome by the existing knowledge and comprehensive and integrated action at country level, led by governments, is the means to achieve success.

According to recent report of WHO, the age standardized prevalence of tobacco smoking among persons of 15 years and older is 11.3 in India. Whereas the South-East Asia regional average is found to be 24.8 and global average is reported to be 21.9. Worldwide more than 1.1 billion people aged 15 years or older smoked tobacco comprising 34% of all males and 6% of all females in this age group. Tobacco smoking is the major factor responsible for oral and lung cancer worldwide. Along with that tobacco use is a major risk factor for cardiovascular disease (CVD), chronic respiratory disease (CRD), and has negative social, environmental and economic consequences. According to world health statistics 2018 by WHO, an estimated 41 million deaths occurred due to NCDs, accounting for 71% of the overall total of 57 million deaths in 2016. The majority of such deaths were caused by cardiovascular disease (44% of all NCD deaths), cancer (22%), chronic respiratory disease (9%) and diabetes (4%) which were 17.9 million, 9.0 million, 3.8 million and 1.6 million deaths, respectively. Sex specific trend is also reflected as in 2016, a 30-year-old man had a higher risk of dying before reaching the age of 70 than a 30-year-old woman from one of the four main NCDs (22% compared to 15%, respectively).

Alcohol consumption in the South-East Asia region has increased by almost 30% since 2010, while that of the European region decreased by 12%, but remaining the highest in the world in 2016 at 9.8 liters of pure alcohol per person aged 15 years or older. Globally, more than ten-fold increase is found in the number of obese children and adolescents aged 5-19 years in the past four decades from just 11 million in 1975 to 124 million in 2016. Almost 340 million children and adolescents or almost one in every five (18.4%) were found overweight or obese globally in 2016. On the contrary, in case of communicable diseases the trends are not such alarming and are improving constantly. Globally, HIV incidence has declined from 0.40 per 1000 uninfected population in 2005 to 0.26 per 1000 uninfected population in 2016. Again in case of tuberculosis global TB incidence declined from 173 new and relapse cases per 100,000 population in 2000 to 140 in 2016 i.e. a 19% decline over the 16-year period.

Clinical and Epidemiological Investigations Lead to Paradigms for Community Medicine

Epidemiological studies often results in scientific conclusions that can further help in the betterment of interventions of community medicine discipline. Such type of studies generally considers lifestyle, dietary, socioeconomic and mental wellness and compare them with the susceptibility of disease in general population and disease outcome and therapy response in patients. Such discoveries are much needed in case of complex disorders like diabetes, cancer, arthritis etc. In Indian scenario, one of such example is

the esophageal cancer study done in high risk northeast population, which has concluded that consumption of dried fish in diet increased the risk of esophageal cancer in people (Singh *et al.*, 2015). The outcome of such study could be further included in the community medicine/public health disciplines to increase the awareness in the general population.

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Role of Alternative Dispute Resolution (ADR) in Promoting Peace and Harmony in Rural India

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“Discourage litigation; persuade your neighbours to compromise whatever you can. Point out to them how the normal winner is often a loser in fees, expenses, cost and time” - Abraham Lincoln

All countries, societies, communities, business organization and individuals face conflicts at one time or the other. Any conflict leads to another conflict, therefore, this cycle must be curbed. It is essential to resolve a dispute, the moment it raises its head. Instead of allowing conflicts to take a negative course, they are required to be diverted towards growth and positive solutions benefiting all the disputing parties by adopting cooperative methods to solve problems so as to eradicate distrust and animosity among the parties and promote peace and harmony. Adopting a method, agreeable to both the parties and resolving the dispute as early as possible with participation of both the parties will definitely achieve the goals of alternative dispute resolution (ADR) programme. Alternative dispute resolution, as a tool refers to several different methods of resolving disputes outside traditional legal and administrative forms.

Adversarial litigation does not end in a harmony. It creates more bitterness between the parties that manifests itself in more litigation between them or even their successors. However, judges and lawyers of developed countries found that the alternative is not to do away altogether with the adversarial system as it also plays a positive role. It settles complicated and disputed questions of fact and law. The law that superior courts lay down to be followed by subordinate courts and tribunals can never be arrived at without following the adversarial procedure. Every court cannot lay down any law by way of compromise, consent or consensus of parties to litigation. But beyond the territory of complicated questions of fact and law, there lies a vast area of litigation where the consensual type of dispute resolution is required which is essentially a process of dispute resolution that requires judges, lawyers and the litigant public to change their mind-set and adjust gradually to play a combined and co-operative role in the resolution of disputes.

The informal settlement or resolution of local disputes has been seen throughout India from ancient times and *panchayats* have played an important role in village level dispute resolution. Elders resolve the disputes in the village by using their influence and relation with the people as well as by taking into consideration the local conditions, habits, customs and practices. The informal local governance system of the past has now given way to a formal local governance system. Mediation, negotiation and facilitated problem solving systems are practical and desirable means to face a conflicting situation and to create peace and harmony in our communities and neighbourhoods.

Concept of ADR

The concept of ADR is not a new phenomenon. For centuries, societies have been adopting informal and non-adversarial processes for resolving disputes. In fact, archaeologists have discovered evidence of the use of ADR processes in the ancient civilizations of Egypt and Mesopotamia etc. In the late 1980s and early 1990s, it was a great concern for traditional method of resolving legal disputes through conventional litigation as it was too expensive, too slow, and too cumbersome for many civil lawsuits. Therefore, in the early 2000s, ADR techniques became very popular, as litigants, lawyers and courts realized that these techniques often help them resolve legal disputes quickly and cheaply and more privately than court process. The ADR approaches were also found to be more creative and more focused on problem solving with mutual consent than litigation through court.

Genesis and Development of ADR in India

In informal dispute resolution, referring matters to a panch (neutral facilitator) was one of the natural ways of deciding a variety of disputes which was an informal way of mediation. In some cases the panch was acting like a judicial court because he could intervene on the complaint of one party and necessarily on the agreement of both and arbitral award was made by an agreement between the parties. In the absence of some serious flows of bias or misconduct by and large, the courts had given recognition and confirmation to the awards of the Panchayats. In *Sitanna V. Viranna*, the Privy Council affirmed an award of the Panchayat in a family dispute challenged after about 42 years. Sir John Wallis observed that the reference to a village panchayat was an honoured method of deciding disputes. It avoids protracted litigation and is based on the ground realities verified in person by the adjudicators and the award is fair and honest settlement of doubtful claims based on legal and moral grounds.

Panchayats used to enforce customary rules, fixed body of law and sometimes created new rules for situation in hand. The process was formal and quick. The sanctions imposed were in the nature of putting the wrongdoers out of the community which forced the wrongdoers to abide by the decision. Several efforts were made for re-organisation of rural self-government through village panchayat in British era. Some states were having Nyaya-Panchayat system at the time of adoption of the Constitution. In introducing the Nyaya-panchayat system, State made an attempt to replace the existing disputes processing institution like caste institutions and other secular or special institutions by some social working like Rangpur People's Court. However with the change in social and economic requirements, such arbitral bodies become inadequate. But even today such arbitral bodies are prevalent in some rural and tribal areas in India.

In order to provide for Alternative Dispute Resolution Mechanism, A new section 89 was inserted in the code of Civil Procedure 1882. Section 89, provides for the settlement of disputes outside the court. The reason for inserting Sec.89 was to try and see that all the cases which are filed in the court need not necessarily be decided by the court itself. Keeping in mind the delays and the limited number of judges, it has now become imperative to resort to ADR Mechanism as contemplated by Sec.89. There is a requirement that the parties to the suit must indicate the form of ADR, which they would like to resort to

during the pendency of the trial of the suit. If the parties agree to arbitration, then the provisions of the Arbitration and Conciliation Act 1996 will apply and that will go outside the stream of the court.

The apex court has recognised the alternate forum in its various decisions. For effective implementation of provisions relating to Alternative Dispute resolution system in various enactments, Supreme Court has taken further steps. Supreme Court started issuing various directions as so as to see that the public sector undertakings of the central government and their counter parts in the states should not fight their litigation in court by spending money on fees on counsel, court fees, procedural expenses and waiting public time.

A wide range of dispute prevention and resolution procedures exist in India that allow the participants to develop a fair, cost-effective, and private forum to resolve disputes. The models for ADR on national level are: 1. Tribunals, commissions, boards, etc. 2. Lok Adalats 3. Nyaya Panchayats 4. Arbitration 5. Conciliation 6. Ombudsman and 7. Fast Track Courts. Arbitration and mediation have emerged as the most common modes of ADR, though conciliation and negotiation also comprise of ADR, they are however seldom used.

Nyay Panchayats

In India Panchayats, an institution of local self-governance in rural areas, are in existence since ancient times. In villages, the administration was carried out by a Panchayat headed by village headman which among others, were deciding petty civil, criminal and revenue cases. The respectable members of the village community formed the Panchayat, where the five preferred ones amongst them used to resolve the disputes by a process of conciliation and mediation. Panchayat's decisions were generally honoured and accepted by the village community.

In the pre-British period, the Panchayat formed the key-stone of the village arch. However, during the British rule Panchayat were not permitted to function as autonomous and self-sufficient bodies. After India became independent Panchayats were revived and it began to function in all states. The functions of Panchayats cover a wide sphere of activities including judicial functions such as resolution of petty civil, criminal and revenue cases. The historic 73rd Constitutional Amendment Act, 1992 was made with the objective to improve the participation of people in the process of their development and to transform Panchayati Raj institutions into vibrant institutions performing necessary development, regulatory and general administrative functions. One of the highlights of the 73rd Amendment is the Gram Sabha (village assembly) for every Panchayat. When Panchayat dispense justice it acts as Nyaya Panchayat using an indigenous system of participatory justice at the village level. It exists to resolve the disputes by a process of conciliation and mediation at the village level. Their decisions are generally honoured and accepted by the village community. As of today, Nyay Panchayats continue to be popular in India and the system is adopted in almost every state in the country by suitable legislation or schemes to ensure that opportunities for securing justice are not denied to any citizen on the grounds of economic or other disabilities. The method followed by these fora resembles more closely to mediation. It encourages the parties to discuss their positions with greater openness and reach a compromise.

The states are responsible to set up Nyaya Panchayats at district level, block-level, etc. in the villages. However, there is no official statistics available indicating the number of cases handled by the Nyaya Panchayats set-up all over the country. They meet as and when required. Their decisions are mostly informal and no data is kept about them. The disputes decided by the Nyaya Panchayats have no finality and the courts can be approached for the same dispute.

Article 40 of the Indian Constitution directs the State to take steps to organize village panchayats and endow them with such powers and authority as may be necessary to enable them to function as units of self-government, has to be appreciated afresh in the light of the mandate of the new article 39A. The effective rationale for the implementation of a Panchayati system of justice was that of increasing access to justice for all the citizens of India and 'mere extension of the existing court system to the village level, without a corresponding simplification of procedure and change in judicial approach' would be insufficient. Many initiatives were taken in this regard including Lok Adalats as an informal dispute settlement system at local level.

Lok Adalats

Along with the common tradition of local customary practices of dispute resolution, some exemplary mechanisms were seen in the rural landscape of India. Among this, the People's Court of sarvodaya social worker Harivallah Parikh was the most impressive one which is a precursor to Lok Adalat movement in India. Lok Adalat is an alternative dispute resolution (ADR) forum which has the potential of increasing access to justice. They are informal, flexible, participatory forums which have as their purpose the encouragement of settlements, compromises and the avoidance of litigation. Lok Adalats serve as mediatory and conciliatory forums which are voluntarily utilised by parties to a dispute as a means of understanding their rights and obligations under the 'rule of law' and of facilitating the settlement or compromise of their disputes. Lok Adalats have no legal authority to impose their decisions. Lok Adalat judges, who are usually retired judges of the courts, advocates or social workers act only as mediators or conciliators.

The Lok Adalat (Peoples' Court) concept and philosophy is an innovative Indian contribution to the world of jurisprudence. It has very deep roots in the recorded history of India. It has been proved to be a very effective alternative to litigation. The system has received honours from the parties involved in disputes as well as public and the legal functionaries. It also helps in emergence of jurisprudence of peace and harmony in the larger interest of justice and wider sections of society.

While Arbitration and Conciliation Act, 1996 is a fairly standard western approach towards ADR, the Lok Adalat system constituted under National Legal Services Authority Act, 1987 is a uniquely Indian approach. The true basis of settlement of dispute by the Lok Adalat is the principle of mutual consent and voluntary acceptance of the solutions with the help of a conciliator. The basic purpose of Lok Adalats is not merely to give justice based on evidence, law and legal know-how, but adopt a humane approach. Lok Adalat is a voluntary institution and is the direct outcome of an activist approach to judiciary and litigants. There is no compulsion to settle the disputes. If parties agree to decide their disputes, only then Lok Adalats comes in

to the picture. The process of negotiations usually starts when both the parties come before the Lok Adalats. The negotiation is assisted by the volunteers, advocates of both the parties and judges of the Adalat. They interact with the parties and assess the scope of settlement acceptable to them. Parties can directly interact with the judge, which is not possible in regular courts. Once the settlement is arrived at, it is reduced to black and white on the spot and parties voluntarily agree to be bound by the decision of the Lok Adalat and the signatures of the parties are obtained. Finally, this agreement is ratified by the respective judges of the local courts where the case was pending and accordingly a consent decree is passed. However, if a compromise is reached, an award is made that is binding on the parties. It is enforced as a decree of a civil court. An important aspect is that the award is final and cannot be appealed, not even under Article 226 of the Constitution because it is a judgement by consent.

One of the distinct advantages of the Lok Adalat strategy is that it can invent new prospects for resolution of disputes which is not possible under the conventional justice delivery system. The Lok Adalats can invent new device under which both parties to the dispute can be accommodated. The Lok Adalat contemplates a place of justice at the door of a common man, to settle his dispute at the earliest opportunity and without any delay and costs. The Lok Adalat is based on the principles of honesty and moral character as embodied in Indian culture and civilization, with a view to restore mutual peace and harmony and the confidence of a common man in the judicial system.

The Gram Nyayalayas

The Gram Nyayalayas Act, 2008 has been enacted to provide a forum for inexpensive justice to people in rural areas at Panchayat level and dispose the work by going to the villages. The judges who preside the Grama Nyayalaya are strictly judicial officers work under High Courts. A Grama Nyayalaya is a mobile court and exercises the powers of both Criminal and Civil Courts. A Gram Nyayalaya is not bound by the rules of evidence provided in the Indian Evidence Act, 1872 but it is guided by the principles of natural justice and subject to any rule made by the High Court. An appeal against a judgement of the Gram Nyayalaya can be made Session Courts in case of criminal case and District courts in case of civil cases. By March 2015, a total of 194 Gram Nyayalayas have been notified in 10 States of India including 12 in State of Uttar Pradesh. The primary focus of the Gram Nyayalaya is to bring about conciliation between the disputing parties.

Conclusions

ADR process enables the poor to meet the better off opponents on an equal footing to negotiate a settlement. When a person is called upon to abstain from exploiting the weakness of the other person, the foundation of human dignity will be laid. In cases of contract and property disputes, medical claims, motor accident claims conflicts over land and water, religious rights, family matters, environmental disputes, employer – employee disputes etc. ADR mechanism provides satisfactory help. Thus, Indian forms of dispute resolution, which were lost during British colonial rule is now being rediscovered with global innovations in the contemporary context of ADR system.

ADR gives people an involvement in the process of resolving their dispute that is not possible in a public, formal and adversarial justice system with cumbersome procedures and complex language of the law. It offers a wide range of choices in method, procedure, cost, representation and location. It is often quicker than judicial proceedings and helps to ease burdens on the courts. The mediation, conciliation and negotiation adopted by various ADR providing for as preserves important social relationships between disputing parties. All this has led to increase in the number of filing of suits and complaints before ADR for as. Parties can go directly and plead before ADR for as which are more sensitive to the concerns of the disputing parties. They dispense better justice, result in less distancing between the parties and satisfy their desire to retain a certain degree of control over the process of resolution. The Government is also focusing on legal aid for improving the range of options available to people for resolving disputes without a formal court adjudication process.

The time that is wasted in litigation is nothing but wasting more of the social energies in the wasteful expenditure, which does not contribute to the wealth of the country. Any effort in reduction in wastage of one's time in ordinary and unproductive litigation is definitely a contributing factor for the efficiency and growth of an individual and the State. Thus, ADR processes can serve as useful vehicles for promoting rule of law and other development objectives. Properly designed ADR programs, undertaken under appropriate conditions, can support court reform, improve access to justice, increase disputant's satisfaction with outcomes, reduce delay, and reduce the cost of resolving disputes.

Alternate Dispute Resolution is an appreciable step if taken, with serious concern and proper management. A common man can enjoy number of its advantages, from speedy justice, less expenses, deserved justice to secured confidentiality and final satisfaction. However, there is need for increased awareness about ADR through seminars and workshops in Rural Areas and Alternate dispute Resolution can be made a compulsory subject in schools. Awareness camps will help to change the mind-set of the people. Arbitrators, Mediators, Conciliators and all those forming a part of this process must be provided with expert training to deal efficiently with any kind of problems.

The alternative dispute resolution mechanism has become a sine quo non for the present judicial system to deal with pendency of the cases in all courts in India as well as to preserve future relations there should bring peace and harmony in the society. In the words of Peter Durker, the best way to predict the future is to create it. So, instead of blaming darkness, light a candle where ever you can and that a journey of 1000 miles always starts with the first step. Thus, ADR will definitely light a candle in the darkness of arrears of litigations and serves as first step to bring a 'win win' situation in dispute resolution. Moreover, ADR programs help to prepare community leaders, increase civic engagement, reduce the level of community tension and resolve conflicts which consequently promote peace and harmony in the society and help in the development of the country.

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Entrepreneurs and Scientists Doubling Farmers' Income Together – Challenges Faced by Start Ups

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“Necessity is the mother of invention”. It is this necessity of the human civilization that has been taken up as priority by the scientists – towards solving the problems of humanity, and it is this same necessity that entrepreneurs seek to fulfill with their industry and enterprise. Scientists and entrepreneurs have time and again come together to solve various national and societal problems and this collaboration has primarily been visible in defense or health sector – during World War 2, Cold War between USA and USSR, during AIDS epidemic, in development of vaccines for various diseases, in development of medical equipment *etc.*, where the issues become emergent and therefore high priority for the governments to direct the resources and focus. It shall be noted that the global industrial revolution which started in the early 18th century in Europe was a direct consequence of the Renaissance in Europe from 14th–17th centuries and the scientific temper thereupon. The Europe and allied economies had realized the importance of collaboration between academia and industry, marking a major turning point in human history.

Some of the agrarian economies that missed the boat of industrial revolution embraced contemporary technologies and modelled around becoming agri-business based economies, *viz.* New Zealand and Argentina. Their strong focus on agriculture, strengthening of agricultural infrastructure, support to agri-business entities led to growth and development in these countries which supported the manufacturing sector further. US, Canada and Japan alternatively, replicated the success of their early industrial rise to develop their agriculture and agriculture based businesses and became balanced economies and rich nations.

India post liberalization that was initiated in 1991 focused on advancing manufacturing and services sectors and increasing agriculture output to meet requirement of rising population. With the country well placed in agriculture production today, with it meeting the requirement of rising Indian population and further projected growth in agricultural production, India is well poised to turn into an agri-business based economy. This will, in addition to other policy and strategic measures, require active collaboration between the scientists and budding entrepreneurs.

The current elected government of the country has laid strong emphasis on doubling farmers' income by 2022 and providing support to budding entrepreneurs. The Prime Minister exhorted the corporate houses to invest in agribusiness sector in his recent speech of July the 29th and pointed that corporate investment

in Indian agri-business is the lowest in the world – at abysmal 1 percent. The low investment in agri-business can be attributed to a complex set of issues faced by the business fraternity. Yet, the medium and small startups suffer from their own woes in India -ranging from monetary, access to government, access to information, to various other corporate issues. Another important aspect that decides the success or failure of any startup is the technological innovation that sets it apart from other competitors in the market. Technological innovations and scientific research are therefore important components of industrial advancement. The collaboration between scientists and entrepreneurs is required to promote the agri-business startup ecosystem, as a strategy towards doubling farmers' income and towards national prosperity.

Horticulture Prospects for Rural India

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Horticulture deals with food (fruits, vegetables, spices, condiments, honey mushroom, tea, coffee, cocoa and others), non-food (fiber, bamboo), medicinal and aesthetic crops production and their post-harvest management including value addition. Horticulture crops particularly fruits and vegetables are rich in human nutrition, have very short (month) to very long duration (years) crops yielding not only high biomass but high economic return too in several forms related to food, nutrition, medicine, beverages and others.

Horticulture is significant to our day-to-day life. One starts his/her day very first in the morning from horticultural produce by taking a sip of tea, coffee, chocolate, cocoa, and others. Brushing teeth with toothpaste made of neem and other plants, herbal soaps, shampoos, shikakai, aonla, coconut oil, lotions, deodorants, oils, perfumery to be ready for the day. If he/she goes for pooja, it is dhoop, agarbatti and poojasamagri made from the horticultural produce. In breakfast, one enjoys juices, jams, jellies, fruits, wafers, nuts, berries etc. Vegetables, salads, herbs, condiments and spices, make his/her lunch and dinner very nutritious and palatable. Ice-cream, betel, betel nut, fennel etc. are enjoyed as essential items after meal. Above listed are horticultural produce.

Food, nutrition and livelihood security have been a cause of concern across the globe and can be achieved by switching adequately to horticultural crops. Being heavily populated with enormous bulge in numbers India is much more concerned with these. By default (not because of policy - no concrete resource rich planning or target for horticultural crops) Indian horticulture production has historically crossed 300 million tonnes marks dominated by vegetables, more than half of this, from mere over 250 million hectare. Hence horticulture is going to play a significant role in providing food, nutrition and livelihood security not only to the farmers but to the nation.

Rural India is chronically infested with poverty and poor economic condition of farmers. Agriculture, main occupation in rural India both for landholders and sizeable population of no farm land holders. **Despite so many promotional programmes and incentives, in the past and present, by state and central Governments, agriculture/horticulture is no more a preferred profession at least with the youths. Youths in rural areas of the country are no more interested to be agriculturists/horticulturists.** This is obviously because of our faulty policies. Fragmentation of land holdings and their continuously decreasing size is making farming of grain, oilseeds, pulses etc uneconomical. Large acreage of farms/fields are still rainfed which may and may not yield depending on normal rains. In areas with irrigation facilities food crops like wheat, paddy, sugarcane and other non-horticultural commercial crops are grown barring few belts in some states where horticulture crops are dominating.

It has been observed, no data on the subject, that horticulture farmers are by and large better off than cereal farmers irrespective of land holding. Small land holdings are suitable for certain horticulture crops

(vegetables, flowers, and herbs) to provide enough employment and economic return to a family on regular intervals throughout the year in rural India. The research and development are concentrated on cereal, oil seeds and pulses with inadequate emphasis on horticulture mainly in terms of resource. To improve economic condition of rural people or doubling farmer's income by 2022 due emphasis rather more emphasis need to be given on rural horticulture and animal husbandry through government policies and allocation of more resources. In this context here we are deliberating prospects of horticulture in rural India under heads listed below.

Horticulture nursery in soilless medium

The horticulture crops nurseries are now gradually being multiplied in substrates other than soil eliminating possibilities of spread of soil borne pathogens from infested soils, making transport of planting materials easy and its use at ease and convenience as the short shelf factor of uprooted seedlings has been taken care off. Micro propagated plants and grafts do better in substrates other than soil preferably under semi or fully controlled climate. Biodegradable nursery bags/plugs have also been innovated and being perfected and popularised. Farmers should demand nurseries of horticulture crops in soilless medium facilitating adoption of soilless nursery production by horticulture nurseries. Accreditations of horticulture nurseries should be made mandatory to have health true to type planting material which is must for better crop yield and return. Farmers in the business of horticulture nurseries can have FPOs/co-operatives/federation for supply or sale of plants/nursery. Modern nurseries fetch better profit.

Vegetable and flower seed production

Vegetable seed production is paying proposition. Depending upon the geographical and climatic conditions farmers in rural areas in collaboration with horticulture seed companies can have seed production of improved varieties and hybrids. Okra/bhindi, garden pea, number of flowers and medicinal plants seed production is easy for which there is a vast market. This can give more income per unit area and employment to rural people both landholders and landless. Hybrid seed production is much more paying which can be taken up by undergoing training at KVKs, Agri. Universities and private seed companies.

Vegetable Grafts

As in case of fruit crops grafted seedlings in vegetable crops , where resistant root stock of same or other vegetables is used, are in demand to overcome stress (bio & abiotic) in production and reduction in use of chemical pesticides. Needless to emphasize that vegetable grafts multiplication is paying profession being practiced by certain private companies. (Photo below-VNR, Raipur)s



Adoption of innovative horticulture production systems:

Horticultural crops by and large are grown under irrigated condition. Water for irrigation is becoming an important input which in coming years would be a scarce resource but essential. It is, therefore, essential to increase water use efficiency. There is an important slogan and national objective in agriculture “More crop per drop”. To achieve this luckily Government is aware of it and rightly popularising micro irrigation (drip and sprinkler) and discouraging flood and furrow irrigation by extending financial support. To minimize quantity of chemical fertilizers by checking leaching etc their application with irrigation water popularly known as fertigation is becoming popular. With Government supports drip/sprinkler irrigation and fertigation be adopted in production of horticulture crops.

There are several new and innovative systems coming up in horticulture crops production and post-production besides using high yielding hybrids/varieties. Climate change has disturbed agriculture production systems, Horticulture is no exception. Among the horticulture crops certain crops are amenable to protected cultivation. **The protected cultivation systems are: plastic mulch, plastic/nonwoven fabric tunnel, walk in tunnel, high roof tunnels with ventilation, insect proof net houses, shade net houses, naturally ventilated Polyhouse, climate controlled greenhouses, rain shelter, plastic wall or straw wall and bamboo structures/ staking technology.** These systems are becoming popular in different parts of the country depending upon the climatic conditions and the type of crops grown. The most important, practical and affordable production system in major parts of the country are plastic mulch, low tunnels, walk in tunnels which are affordable and remunerative. In brief they are explained below.

Plastic Mulch

In this technique crops grow through the holes in the thin plastic sheets. This is used in conjunction of drip irrigation is used mainly to conserve water and suppress weeds. Certain mulches act as barrier to keep methyl bromide, a powerful fumigant and ozone depleting agent, in the soil. Disposal of plastic mulch is a concern; however technologies exist to recycle mulch into reusable resins. Bio-degradable plastic suitable for mulching would also be available in near future.

Benefits

1. *Early planting and faster growth:* Dark and clear mulches intercept direct sunlight thereby reducing soil temperature, hence facilitating early faster growth.
2. *Soil moisture retention:* Plastic mulches reduce the water loss due to evaporation which means there is less water requirement for irrigation and even distribution of moisture reducing plant stress.
3. *Weed management:* Plastic mulch prevents weed growth by preventing the sunlight from reaching the soil and by blocking the pathway for the weeds to grow.
4. *Optimizing fertilizer usage:* Drip irrigation with plastic mulch reduce the leaching of fertilizers below root zone thereby ensuring that the nitrogen and other nutrients are applied only to the root zone as

needed. This greatly reduces the fertilizer requirement as compared to broadcast fertilization with flood and furrow irrigation.

5. *Crop quality*: Plastic mulches reduce contact of fruits and vegetables with soil thereby reducing fruit rot and keeping the produce clean.
6. *Better Soil aeration*: Plastic mulch reduces crusting effect of rain and sunlight and quantity of weed resulting in better soil aeration and aiding microbial activity.
7. *Root damage reduction*: Reduction in weed eliminates the need of cultivation ensuring lesser root damages and improving overall growth of plant.

Disadvantages:

1. *Cost*: plastic mulch comes at a much higher cost as compared to bare soil planting. The cost components include equipment, plastic film, trans-planters for plastic beds and additional labour for installation and removal of films.
2. *Environmental concern*: Conventional plastic, used as mulch film tend to accumulate in soil as the disposal of these are economically and technically difficult. Biodegradable plastics are a good substitute as they get eventually degraded by microbial community. Use of used plastic has become possible for road carpeting.

Suitable Crops: Most of the horticulture crops are amenable for plastic mulch in different ways.

Low Tunnels

Low tunnels which alternatively also called as “Plastic Tunnel” as cladding material is largely plastic/polyethylene now nonwoven fabrics, are small greenhouse-like structures, covering the plants along the row with or without provision of ventilation manually. These tunnels are erected with wire hoops and covered with clear plastic/ nonwoven fabric. The tunnels promote early growth by warming the air surrounding the plants, using heat from the sun. The tunnels also protect plants from frost that can destroy or damage them.



Low tunnels- non woven fabrics

Benefits

1. Creates suitable micro-climate for growth and development
2. Enables earlier seeding hence larger yields

3. Protecting the plants against insects and birds
4. Protects from hailstorms, frost, and heavy gusts of wind
5. More cushioning effect to the soil surface
6. Better gas exchange capacity thus less suffocation to root
7. Reduction in the need for chemical treatment of plants
8. Off-season or early production
9. Better air/water and gas permeability.
10. Can provide local greenhouse effect

Suitable Crops

Various crops such as squash, melons, tomatoes, green pepper, hot peppers, cucumber, watermelon, pumpkin lettuce, carrots, radish, cauliflower, potatoes, spinach/palak, leeks, herbs strawberries and flowers and others.

Use of low tunnels is an effective method of frost protection, both inside a high or walk-in tunnel and in field production. Usefulness of low tunnels varies with crop and production system.

Walk-in-Tunnels

Walk-in tunnels are low-cost crop season-extension crop protective technology used for producing a diversity of horticulture crops generally vegetables, fruits (strawberry), herbs and flowers. Specifically, walk-in tunnels are passively vented, solar greenhouses covered with 1-2 layers of greenhouse plastic with or without mechanically ventilation.

Walk in tunnels help farmers to extend growing off season both early and late crops, nursery multiplication for increase in productivity and profitability. They help in protection of crops from low temperature, high wind, storm and rainfall and ensure risk free production. High tunnels are made in many different shapes, sizes and structures. They can be as small as 1000sq ft and as big as an acre. Plastic cover can be removed during hot summers or when considered necessary. For temperate regions of the country these tunnels are proving to be boon for raising crops for use as fresh as well as seeds.



The experience gained so far suggest plastic mulch, fertigation and low plastic tunnels suit Indian rural horticulture farmers. A combination of these is considered best for the crop and yields better return to farmers.

As stated earlier besides above there are other protected structures such as high roof tunnels with ventilation, insect proof net houses, shade net houses, naturally ventilated poly house, climate controlled greenhouses, rain shelter, plastic wall or straw wall which have proved successful to increase farmers income. Some of these structures are expensive and should be used with adequate prior training to avoid failures. Brief description and experienced gained so far on these is a under.

High Roof Tunnels with Ventilation

These tunnels are similar to walk-in tunnel with suitable size ventilation at the top to facilitate escaping the hot air. These are suitable for cucumber, capsicum, tomato, gerbera and carnation production.

Insect Proof Net House

Insect proof net house is a closed crop production system with 6 -8 feet height that excludes insect pests via physical barrier of synthetic insect proof 40 mesh, 20 % shade net. Double layer net houses are also available which lowers the temperature in summer months. Open top insect proof net houses with more than eight feet height have been found suitable in protecting crops from insects and insect vectors. Insect proof net houses are becoming popular to protect crops biostress and abnormal climate.

Shade Net Houses

Shade net house are affordable by every farmer and considered as one of the popular technologies to provide development of healthy grafts/ seedlings, potted foliage and flower plants, medicinal and spices crops and hardening for various horticultural crops irrespective of climatic conditions. Shade nets are available with different shade percent, 20, 40, 70 and colour. Shade net houses are made keeping in view the requirements of kind of crop to be raised generally with 6 to 8 feet height.

Naturally Ventilated Poly houses

These are naturally ventilated green/poly houses with single span and total central height of 5 meters, side ventilation of 3 meters with roll-able poly-cover with or without roof ventilation and double door entry. Such poly houses are found suitable for round the year production of crops depending on the geographical area. There can/should be multi-span naturally ventilated poly house with a central height of 6.5 meters, gutter height of 4.25 meters, side ventilation of 1.5 meters. Generally multi-span poly houses are considered more suitable and economical for raising crops. Naturally ventilated poly houses have been found suitable for cultivation of large number of vegetables, flowers and strawberries besides raising their nurseries in many parts of the country.

Poly house with Pad and Fan System

These poly houses unlike naturally ventilated poly house has fan and pad system to regulate temperature and humidity. They have generally height of 4.5 meters with common side and top ventilation. These structures are clubbed with exhaust fans and cellulose cooling pads of 1.8 m in height and 150 mm

thickness. The cost of construction, running and maintenance is high. Lack of assured power supply becomes a limiting factor for such structures in our country.

Hi-tech or Climate Controlled Greenhouses

Hi-tech green houses are climate controlled structures. Green houses have a variety of applications, the majority being, off-season growing of vegetables, foliage and flower plants, planting material multiplication and acclimatization, fruit crop growing for export market, seed production, plant breeding and new varieties and hybrids development. These are available in different sizes and constructed as per requirement. The sizes vary from as small as 100 sq. m to 10,000 sq m and more. Here most of the parameters temperature, light, humidity, fertilizer, irrigation are sensed and corrected as per program through auto control systems. These can be fully or partially automated. These are considered, based on experience, very good and essential structures for nursery multiplication of horticulture crops.

Rain shelters

Rain shelter, a low cost naturally ventilated poly house is found ideal for off-season vegetable cultivation in Kerala, Andaman and Nicobar Islands, north east region and other high rainfall areas of the country. Off-season cultivation of vegetables by utilizing low cost protected structures like rain shelter can be considered as a profitable enterprise besides protecting crop nurseries from high rain during monsoon months. Such structures are boon for horticulture production in high rainfall areas of the country.

Some of the experience gained so far

The yield under poly house cultivation can be achieved to the level of 3-8 times as compared to the open crop cultivation. Various trials conducted at agro research centres in northern India indicate that capsicum (planted in mid-September), cucumber (planting –mid October) and tomato (November planting) under poly house produced 1060kg, 1460 kg and 1530 kg per 100 square meter. The duration of these crops were 4- 9 months and more than 90% of total yield were obtained during off-season (during winter before the start of summer) which fetches significantly higher market price (2-4 times than normal season). Further, the crop duration can be extended up to the July –August with the application of micro irrigation and fertigation and yield can be achieved to the level of 20-25 kg/m². Therefore, it is possible to harvest a single crop round year with minimum additional inputs and higher income can be generated. Further cut flowers like carnations, gerbera, lily, rose, orchids, anthurium etc. can be grown under poly houses/ net houses giving high returns and better quality produce. The potential of floriculture under protected cultivation is huge for Indian and global markets. The cost of construction of poly house depends on location of site, size and shape of poly house, poly house structure (wooden or GI/ Steel) and types of poly house (naturally ventilated or environmental controlled). The cost of bigger naturally ventilated poly house (1000 m²) ranges from Rs.800 to 900 per square meter whereas the environmental controlled poly houses require 2 to 3 times investments over previous one depending on the automation gadgets installed. The per unit area construction cost of smaller size poly houses are more as compared to larger poly house. Similarly the cost of cultivation in larger poly house is significantly lower than smaller poly house.

It is possible to get back the investment on poly house within a period of 3 to 5 years period. If a entrepreneurs /cultivator go for poly house for nursery production of high yielding vegetables in an area where large scale vegetable cultivation is done, in such condition he can get back his investment within 2-3 years by providing quality planting materials to vegetable or flower growers. The success of the poly house/ net house project depends upon the scale of the project.

In India, only one per cent of total floriculture is equipped with protected cultivation techniques, whereas agriculturally advanced countries such as Netherlands, Italy, Spain, France and others have 55-70 per cent flower cultivation area covered under protected cultivation.

Protected cultivation, besides increase in yield, saves water up to 50 per cent, compared to open field flood irrigation, reduction in cost of fertilisers, labour etc. Undulating terrains, saline, water logged, sandy and hilly lands can also be brought under productive cultivation using protected cultivation. A poly house in an acre would approximately cost anywhere between 1 25 and 30 lakh. This would last for at least 15 years. The yield per acre in the first year would be in the range of 1 75-80 lakhs. There is a component of more than 30 per cent subsidy available from the Government.

Experiments conducted at division of vegetable science at Indian Agriculture Research Institute, New Delhi on low cost poly houses have reported the following economics.

The low cost polyhouses which were used for raising nursery, the same type of structures was utilized for raising crops during winters. The high value crops like cherry tomato, gherkin, bitter gourd (gynoecious) and cucumber (parthenocarpic) were grown during November second fortnight. The temperature inside polyhouse was 6-10 degree celsius higher than outside. The cold waves during December-January did not enter the structure and the growth of the plants were normal. All the recommended cultivation practices of these crops were followed to raise a good crop. Harvesting of gherkin started from last week of January. Gherkin recorded Rs. 43,500/- and Rs. 59,000/- profit from 1000 m² area during first year and second year respectively. Harvesting of cherry tomato was started from mid-February and net profit of Rs. 33,750/- during first year and Rs. 50,000/- during second year was recorded. In Bitter gourd (gynoecious) a net profit of Rs. 23,750/- was recorded in first year and Rs. 40,000/- during second year onwards. Parthenocarpic cucumber recorded Rs. 37,000/- profit during first year and Rs. 52,500/- during second year onwards.

Size of structure (10m (L) x 5m (W) x 7' (H)) = 50sq.m.

No. of seedlings 8000 (polybags) + 7000 (protrays) = 15,000/-

Seedling @ Rs.2/- = Rs. 30,000/-

Investment cost (polyhouse, polybags, protrays) = 15,500 + 5,000 = Rs. 20,500/-

Net profit 1st year (30,000 – 20,500) = Rs.9500/-

Net profit 2nd year (30,000 – 5000) = Rs.25000/-

Net profit 3rd year (30,000 – 6000) = Rs.24, 000/-

During 2015 Department of Soil Science and Water Management, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan reported comparison of the productivity under open field and poly house cultivation of capsicum, tomato, cucumber, beans, peas, coriander and spinach It is given in the following table which is self-explanatory indicating to 59 to 414 percent increase in productivity.

Table 1: Effect of poly house on productivity of vegetable crops as compared to open cultivation

Crop	Open cultivation (Mt/ha)			Poly house cultivation (Mt/ha)			% increase
	Min.	Max.	Average	Min.	Max.	Average	
Capsicum	25	30	27.5	90	150	120	336
Tomato	40	45	42.5	180	250	215	406
Cucumber	15	20	17.5	80	100	90	414
Beans	10	15	12.5	24	32	28	124
Peas	10	15	12.5	20	25	22.5	80
Coriander	10	12	11.0	15	20	17.5	59
Spinach	10	15	12.5	20	25	22.5	80

(Department of Soil Science and Water Management, Dr Y S Parmar, University of Horticulture and Forestry, Nauni, Solan 173 230, India)

An extensive study has been reported in 2010 in the state of Punjab on cultivation of vegetables under net house. It has indicated that gross return was highest for tomato with Rs 1,97,828/- and least in case of pea with Rs 27,875/- The return over total production cost was maximum in case of tomato that is Rs 167419/- and least in case of pea that is Rs 8913/-. The growing of chili is expensive costing Rs 36980/- per acre and pea was least expensive costing Rs.18962/- per acre. The vegetable rotations studied were: tomato-pea; chili-pea; tomato-capsicum-potato; capsicum-chili; tomato-capsicum; capsicum-paddy; chili-paddy; tomato-capsicum-pea; tomato-chili and tomato-capsicum-chili.

Haryana Agriculture University, Hisar has reported production of 302 t/ha, of tomato, 211t/ha of capsicum and 115 t/ha of cucumber per crop cycle under naturally ventilated poly house.

A farmer in Alwar district of Rajasthan grew parthenocarpic cucumber (Kian and Hiltan) in 1000 sq. m. naturally ventilated poly house from September 2011to January 2012 and January2012 to May 2012. He harvested 50 q and 75 q fetching him Rs 1.5 lakh and 2.6 lakh, respectively, as per IARI, New Delhi report.

- 1. Israel in Rajasthan:** Sh Khema Ram a farmer from Rajasthan, trained in Israel, is having poly houses in 7.5 acres with annual turnover of Rs one crore only. He started protected cultivation in 4000 sq. m few years back. (<https://www.gaonconnection.com/badalta-india/the-farmer-of-rajasthan-khemaram-made-his-village-a-mini-israeli-turnover-of-10-million-annually>)
- 2. Classic Floritech, Sirmor (HP) 2016-17:** Mr Mohammad Mushtaq with the support of NABARD established poly house in 03 acres during 2008. He is growing roses about one lakh plants worth annual net profit of Rs 10.29 lakhs. He is a known and renowned floriculturist in India on date having

large acreage of net houses and polyhouses for flower production. He is helping farmers to adopt protected cultivation in Himachal Pradesh, Punjab and Haryana.

3. **Sardar Surjeet Singh Virk**; in a village Pakka Kheda, Karnal he had 05 acres of net houses added another 02 acres in 2017 with support of NABARD. He is growing cucumber and capsicum in these net houses with net income of Rs 4.5 lakhs (from 5 acre) per acre annually.
4. **Dr B S Rana, Narayangrah, Ambala**: He has 06 acres of net houses and growing mainly medicinal plants particularly stevia (meethitulasi) since 2013 and earning net profit of Rs 7.3 lakhs per acre annually.

Above success stories prove that protected cultivation is profitable prideful profession but construction of poly houses requires substantial investment for which following agencies provide subsidies/loan.

Cost and benefit ratio of growing tomato (4 months) and capsicum (five months) in Andaman and Nicobar Islands has been reported 1:2.5 and 1: 11.2, respectively.

In Karnataka the total returns and net returns from capsicum production under protected conditions from 0.25 acre unit were Rs 1 54734 and Rs 1 15279, respectively. The B: C ratio of capsicum production under protected conditions was 3.92

To assess the costs and benefits drawn by the farmers through crop cultivation in polyhouses, a study was conducted in Kullu and Mandi districts of Himachal Pradesh, India. A sample of about 50 poly house units of varied sizes was randomly selected in five developmental blocks of two districts. The total cost of construction was Rs. 100500, Rs. 216250 and Rs. 481600, respectively for poly houses of 100 sq.m., 250 sq. m. and 500 sq. m. and farmers had to invest only 20% of the total cost, rest came through subsidy. It was observed that about 85 per cent of the farmers grew capsicum, tomato or cucumber in their poly houses as main crops and exotic vegetables like iceberg lettuce, pokchoi and celery as covering crops. It was estimated that a farmer could have net returns up to Rs. 1.42 lacs per annum from a 500 sq. m. poly house.

Best Option so far-worth adopting

Best options on date for out scaling protected cultivation among small holder farmers are:

- Plastic mulch and fertigation
- Plastic tunnels both low as well as walk-in tunnels are most suitable for temperate climate with modifications according to climate of the place and raising early cucurbits in northern plains. Rain shelters have been found successful in high rainfall areas like Kerala.
- Net house + plastic mulch + fertigation for large number of crops like tomato, cucumber, capsicum; chrysanthemum, lilies, roses, gerbera, anthurium, foliage plants; stevia, basil and others.
- Climate controlled greenhouses are needed for raising plant nurseries to meet huge seedlings requirement of vegetable and flower growing clusters both under open field cultivation and cover besides ornamental/ foliage plants multiplication.

- Inputs and guidance for above from reputed private and public sectors are must.
- The crops successfully grown in these structures are cucumber, tomato, capsicum, roses, chrysanthemum, lilies, strawberry, leafy vegetables and herbs.
- Bamboo stacking in cucurbits and tomatoes + plastic mulch + fertigation

Above experience indicate that protected horticulture is potential technology for higher and quality production even under unfavourable climate.

SUMMARY

Resource crunch- land, water, and finance, in rural India is well known. This has now become very visible resulting in losing interest in agriculture especially by rural youths. Horticulture is becoming popular due to comparatively better returns and technologies. Improved technologies including low cost technologies for adopting horticulture by rural youths along with traditional agriculture practices have been emphasized in this article supported by details of technologies/innovations, success stories and empirical evidences. Prospects of horticulture in rural areas are brighter as people are becoming nutrition conscious resulting in increased consumption of horticulture produce besides better returns from horticulture crops.

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Frontier Biotechnologies for Enhancing Crop Productivity

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Advent and adoption of new technologies has had a central role in the development of Agriculture through the ages. Development of plough, sickle, primitive irrigation devices, potteries for storage and taming of animals for farming have been crucial for the crop domestication and settled farming in the famous river valleys of the world. While ancient farmers selected superior performing landraces of crop plants for cultivation, sexual hybridization and selection of new varieties from the resultant segregating progeny became possible only at the turn of the twentieth century after the discovery of laws of inheritance and sexuality in plants. Development of technologies is not possible without corresponding new discoveries in science. The biological science progressed most rapidly during the twentieth century culminating into decoding of the complete genetic blueprint (genome) of higher plants and animals and ability to conduct precise genome editing at the turn of the present century. During this journey major breakthroughs in biology were made including discovery of cell, chromosomes, nucleic acid as the genetic material as the physical basis of inheritance and finally cracking of genetic code. Our knowledge of the principles of inheritance also kept evolving in tune with the progress in understanding the physical basis of inheritance. Thus, principles of mutations, genetic recombination, quantitative inheritance, hybrid vigor, gene into gene and gene into environment interactions were propounded. These scientific advances were used for devising new plant breeding methodologies for the development of crop varieties with higher productivity and resistance to environment stresses. The modern plant biotechnology has its origin in the following breakthrough scientific advances: (i) ability to clone genes and produce recombinant DNA in a test tube with precision during 1970s (ii) ability to transform a plant cell with purified DNA and regenerate complete plants through tissue culture during 1980s. With such advances the first genetically modified tomato variety was released for commercial cultivation in 1995. The frontier biotechnologies are finding application for improving crop productivity in the following four areas.

Mass propagation of elite planting material by tissue culture

Mass multiplication of elite planting material for vegetative propagated crops has come as boon as this helps produce large number of disease free plantlets of desired varieties in a very short time. Notable success has been achieved in case of banana, sugarcane, potato, poplar and bamboo. Plant tissue culture has emerged as an important commercially viable biotechnology to multiply elite varieties of high quality, disease free and high yielding plants rapidly in the laboratory irrespective of the season of the year. In India the tissue culture Industry is growing at a rate of 15% per annum. For ensuring production and distribution of quality tissue culture planting materials the Government of India established a National Certification System for Tissue Culture Raised Plants (NCS-TCP) authorizing Department of Biotechnology, as the certification agency vide the gazette notification on 10 March 2006 under the Seeds Act, 1966. The demand for agricultural, forestry, plantation and horticulture crops for high quality, high yielding, disease

free planting material has been increased significantly over the last two decades. Conventional propagation methods suffer from the inherent limitations in the number that can be produced, non-uniformity of quality and incidence of diseases. The purpose of NCS-TCP is to ensure production and distribution of quality tissue culture planting materials. NCS-TCP is a unique quality management system, first of its kind in the world which ensures recognition of tissue culture production facilities for the production of quality planting material and certification of end products. NCS-TCP has made significant impact in the last one decade of its implementation. Currently more than 80 Companies are recognized. Two Referral Centre's and four Accredited Test Laboratories are accredited under this system. The recognized companies are eligible for getting their planting material certified from the Accredited Test Laboratories. So far, more than 275 million Tissue Culture plants have been certified through this system.

DNA fingerprinting for quality control of seed and planting material

Indian government has developed a well-established system of release and notification of varieties of field and horticultural crops. The mechanism involves minimum three years of multi-location testing for yield, quality, agronomic characters as well as reaction to pests and diseases. The varieties release is on the basis of value for cultivation and use (VCU), as evidenced by at least 5-10% yield superiority over the national, zonal and latest released varieties. Alternatively, the yield could be at par with the checks but there must be additional advantage in terms of early maturity, disease and pest resistance or better nutritional /eating / cooking quality. These criteria apply to all the varieties developed through conventional breeding while for those developed through use of biotechnology involving marker-assisted backcross breeding only two years of testing is required. To ensure the distinct identity of the varieties it is mandatory to provide DNA fingerprint of each variety proposed for the release. This will also help IPR protection for the varieties and quality control of the seed and plant materials. However, at present this is not being implemented fully as the standard operating protocols are yet to be developed both nationally and internationally. Recently ICAR has constituted a committee to develop standard operating procedures for the implementation of DNA fingerprinting in 24 major crops.

Genomics-assisted selection for accelerated breeding of new varieties

Decoding of plant genomes has been key to developing large number of genome-wide DNA markers (SSR and SNP), which can be used for mapping genes and QTLs for important agronomic traits in various crop plants. These new age DNA markers deployed using DNA chips and genotyping by sequencing (GBS) are most efficient tools for modern plant breeding involving DNA marker-assisted foreground, background and genomic selections. These are helping to enhance plant breeding efficiency globally for developing new plant varieties for the farmers with improved productivity per unit area, time and input, quality and resistance to different biotic and abiotic environmental stresses which are posing a severe challenge to maintaining agricultural production stability. Starting with the release and notification of Improved Pusa Basmati 1 with added bacterial blight resistance genes *Xa 21* and *Xa 13*, so far more than 20 varieties developed through marker-assisted breeding have been release and notified by the CVRC. Most of these are for rice due to head start with the decoding of rice genome by India in partnership with 10

other countries in 2005. Such efforts are being replicated in other crops and marker-assisted breeding has become a routine now in many crops for accelerated crop improvement in the face of challenges posed by global climate change.

Genetic modification for introducing traits from across the species barrier

The science of Genomics has transformed the way new varieties are being selected by providing vast knowledge about the actual genes responsible for a preferred agronomic trait or DNA markers tightly-linked to the trait of interest. Starting with the decoding of rice genome ICAR has played a leading role in the decoding the genomes of field and horticultural crops in India and also in using the genome information for the discovery of useful genes and DNA markers for application in breeding of crop plants thus reducing the time taken for breeding new varieties by half. The value of genes identified by functional genomics is validated at molecular level by genetic transformation. Some of these genes are negative regulators of yield, quality or resistance traits and these negative genes can be silenced by latest “Genome Editing tools” like CRISPR-Cas9 without any bio-safety risks. For varieties developed using genetic engineering or GM technology e.g. Bt-cotton, rigorous yield testing is required to prevent uncontrolled release more than 1200 Bt-cotton hybrids as truthfully labeled seeds with potential risk of sensitivity to prevalent pests and diseases.

It is crucial to continue advance research in gene discovery and genetic engineering and develop trained human resource to support the public and private seed industries. At the same time we need to continuously educate the general public and policy makers on the benefits and risks of adopting these technologies based on scientific facts to counter the propaganda both in blind support and opposition of new powerful genetic engineering technologies. There is need to lay a much greater emphasis on developing most modern infrastructure and human resource for the development and use of modern biotechnologies for the benefit of the society and welfare of Indian farmers. This will reduce the dependence of vulnerable farmers entirely on the large multi-national corporations.

Entrepreneurship development through custom hiring of farm mechanization in the hills of Himachal Pradesh

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In our agricultural production system, the efficient management of vital inputs is of utmost importance but hill state of Himachal Pradesh has very low level of mechanization in respect of use of improved tools, implements and machines. Moreover, the mechanization of farm work has three primary objectives i.e. to reduce the drudgery of farm work, to increase the timeliness & quality of farm work and to increase the productivity of farm workers. Poor mechanization has emerged as one of the major issues out of District Agriculture Plans (DAPs). At present, the farm power availability in the state is 0.9 kW/ha and utilizing age-old primitive tools with only 1500 kg/ha productivity whereas in Punjab it is more than 4.0 kW/ha with very higher productivity. On the other hand, hill agriculture is women dominated with 60-80% involvement in different operations having inefficient traditional tools. Hence, it is the need of hour to introduce/develop suitable gender friendly power source, tools/machines, for completion of different operations of farming for quicker, easier and sustained production of food and fibers. Therefore, the Department of Agricultural Engineering CSKHPKV aimed with a concrete programme:

Steps taken to carry out the programme

Four villages were selected to carry out work in four districts i.e. Kangra, Mandi, Hamirpur and Bilaspur for transfer of agricultural engineering technology especially power tiller and other improved machines through demonstration, training and exhibition for one year as per the need for tools and equipments in order to increase their adoption amongst the farmers.

Steps taken to fulfil the objectives

Farmers are facing great difficulty in performing various tasks in agriculture because of traditional tools having very low output with high drudgery and cost of operation. To make the farming condition profitable, a villages having people participatory approach were adopted for dissemination of improved farm mechanization technology in both crop seasons. Improved package of farm mechanization technology i.e. Power tiller, Multicrop planter, manual seed drill and bullock multicrop planter were kept in the village for demonstration. Two unemployed youth were selected to operate these machines and were trained in operation of power tiller and other machines. A nominal rate of Rs 150-200/- per hour was fixed for power tiller to meet out the labour, POL and minor repair & maintenance charges. In addition, number of training programmes on power tiller operation and maintenance for one week were also carried out to trained the unemployed rural youths in the university to develop the skill and promote custom hiring system.

Evidence/evaluation

How the success measured: The comparison of improved technology i.e. power tiller technology was done with the traditional bullock farming was done. The data was recorded in respect of total time consumed, capacity, cost, yield etc. and was analyzed. Interaction was also done with the farmers by organizing a

Kisan Divas on Farm Mechanization. Prospects analysis of power tiller technology on custom hiring was also studied.

Important outcomes achieved: The total utilization of power tiller in the village was approximately 400 hours for seed bed preparation and general sowing in both crop seasons. The technology demonstrated was compared with traditional method and it was found that 75% time, 70% labour and 40 % cost can be saved in ploughing and sowing as compared to traditional system. In addition, the utilization of power tiller can further be enhanced by using it in other operations i.e. water lifting, threshing and transportation.

Difference it made to farmers income or productivity: Due to the availability of improved machines and tools, there will be saving in labour, time, drudgery and cost as compared to traditional system with 10-15% increases in yield. This has a direct impact on the farmers' income.

Beneficiary interaction: The training programmes and Kisan Divas was organized in the for the farmers of the villages and interaction was held during the programmes.

Prospects analysis of power tiller technology on custom hiring

The total income earned by a farmer through hiring the power tiller is Rs 218000/- annually at the present rate of hiring Rs 400/h for total 545 working hours of operation during the two seasons. The expenditure required to operate and maintain the power tiller was Rs 177/h. Thus, a farmers having power tiller will directly earn a profit of Rs 121535/- annually without adding any additional income of yield etc.

The impact of this technology was very encouraging in the villages and more than 1000 farmers had purchased the power tiller for their own farm and using on custom hiring basis during last one decade. Not only this, many village youths had also come forward and adopted the technology as self employment. This clearly indicates that there is tremendous scope of using power tiller on custom hiring in hill agriculture as well as small farms.

Annual income from custom hiring of power tiller

Particulars	Total Utilization of power tiller			
	Rabi		Kharif	
	Time, h	Income, Rs	Time, h	Income, Rs
Ploughing/puddling	175	70000	180	72000
Sowing/planting	20	8000	20	8000
Water lifting	20	8000	20	8000
Threshing/shelling	50	20000	40	16000
Transportation	10	4000	10	4000
Total Income	275	110000	270	108000
Annual Expenditure on power tiller @ Rs 177/h	275	48675	270	47790
Net profit, Rs		61325		60210
Net profit annually		121535		

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प्रधान वैज्ञानिक, संरक्षित कृषि प्रौद्योगिकी केन्द्र, भा.कृ.अनु.प- भारतीय कृषि अनुसंधान संस्थान, नई दिल्ली-110012

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संरक्षित खेती एक नवीनतम तकनीक है। जिसके माध्यम से फसलों की मांग के अनुसार सूक्ष्म वातावरण को नियंत्रित करते हुए मूल्यवान सब्जियों की खेती को प्राकृतिक प्रकोपों एवं अन्य समस्याओं से बचाव करती है, और कम से कम क्षेत्रफल में अधिक से अधिक गुणवत्ता युक्त उत्पादन देती है। इसलिए संरक्षित खेती को अपनाने के विभिन्न लाभ हैं और इन्हीं लाभों के कारण देश के किसानों को संरक्षित खेती करने की आवश्यकता है जैसे.....

- पूरे वर्ष आवश्यकतानुसार रोग रहित गुणवत्तायुक्त एवं सुरक्षित पौधों को कम समय में कई बार उगाया जा सकता है।
- विविध प्राकृतिक आपदाओं जैसे तापक्रम के उतार-चढ़ाव, धूप-छाँव, ठण्डी हवाओं, बारिश, ओला, पाला, बर्फबारी, लू, आदि कारकों से फसलों की सम्पूर्ण रूप से सुरक्षा करती है।
- कीटों-पतंगों, जंगली जानवरों आदि से फसलों की सुरक्षा करती है।
- प्रति इकाई क्षेत्र उत्पादन एवं उत्पादकता दोनों को बढ़ावा देती है।
- मौसम, बेमौसम, अगेती एवं बाजार मांग के अनुसार सब्जियों का उत्पादन किया जा सकता है।
- कम जोत अर्थात् छोटे किसानों हेतु बहुत उपयोगी तकनीक है जिसके माध्यम से रोजगार को बढ़ावा दिया जा सकता है।
- वर्तमान परिस्थितियों में परिनगरीय एवं शहरी क्षेत्रों के लघु एवं सीमान्त किसानों हेतु रोजगारपरण तकनीक साबित हो रही है।



संरक्षित खेती [कृषि ds वरखर vkus okyh fofHkUu I jpk, a , oa mi ; षर I फ्त ; ka

संरक्षित खेती के अंतर्गत आने वाली विभिन्न संरचनाओं को अलग-अलग नामों से वैज्ञानिक खोज की गई है जिसको नीचे सारणी में दर्शाया गया है और इन्ही संरचनाओं को हम संरक्षित खेती के नाम से जानते हैं।

Ø-I a	Lkjpk ds uke	mxkbz tkus okyh I fct ; k
1.	फैन-पैड पॉलीहाउस	नर्सरी, टमाटर, खीरा, शिमला मिर्च
2.	प्राकृतिक वातायन पॉलीहाउस	नर्सरी, टमाटर, खीरा, शिमला मिर्च
3.	कीट अवरोधी नेट हाउस	नर्सरी, टमाटर, खीरा, शिमला मिर्च
4.	छायादार नेट हाउस	केवल नर्सरी एवं पत्तीदार सब्जियां

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सामान्यतः यह देखा गया है कि संरक्षित खेती की संरचनाओं को बनाने में अधिकांशतः प्लास्टिक एवं लोहे के सामग्रियों का उपयोग किया जाता है जिनको संरचना के अनुसार अलग-अलग नामों से जाना जाता है। जैसे –

- पालीहाउस संरचना को ढकने हेतु सभी प्लास्टिक सामग्रियां पराबैंगनी किरणों से प्रतिरोधी हो, छत वाली पालीथीन 200 माईक्रोन मोटी, पारदर्शी एवं लचीली हो।
- संरचनाओं में लगने वाली कीटरोधी जाली सफेद रंगों वाली पराबैंगनी किरणों से प्रतिरोधी, नाईलॉन की हो और प्रति वर्ग इंच इसमें छिद्रों की संख्या 40-50 तक होनी चाहिए।
- संरचनाओं पर लगने वाली छायादार जाली हरे या काले रंगों वाली हो, पराबैंगनी किरणों से प्रतिरोधी नाईलॉन की हो और 50 प्रतिशत तक छाया अवरोधी क्षमता रखती हो।
- सभी संरचनाओं के अन्दर टपक सिंचाई की आवश्यकता होती है।
- संरचनाओं को बनाने हेतु जी.आई. पाइपों, एंगल आयरन, बांस-बल्ली, जी.आई तार के साथ-साथ सीमेंट, बालू एवं कंकरीट की आवश्यकता पड़ती है।

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कृषि मंत्रालय भारत सरकार द्वारा चलाए जा रहे विभिन्न उपक्रमों के अंतर्गत संरक्षित खेती के सभी संरचनाओं पर लगभग 50 प्रतिशत तक की सरकारी छूट हर प्रदेशों में दी जा रही है। इसके साथ-साथ किसी-किसी प्रदेश द्वारा 25 से 30 प्रतिशत की अतिरिक्त सरकारी छूट भी दी जा रही है, जिसको मिलाकर वर्तमान में 75 से 80 प्रतिशत तक की छूट किसानों को मिल रही है, जिसके कारण किसान भाईयों को अधिक आर्थिक सहूलियत एवं राहत मिल रही है। सरकारी छूट की सम्पूर्ण जानकारी हेतु प्रत्येक प्रदेश के निदेशक, उद्यान एवं जिला उद्यान अधिकारी से संपर्क करके ली जा सकती है।

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पालीहाउस एक घर नुमा संरचना होती है जिसको जी.आई. पाइपों एवं पालीथीन के सहयोग से बनाया जाता है। इसके अंदर कृषि यंत्रों का उपयोग आसानी से करके शिमला मिर्च, टमाटर, चेरी टमाटर, खीरा एवं चप्पन कद्दू की खेती की जा सकती है। हमारे देश में सामान्यतः पालीहाउसों को दो प्रकार से बनाया जाता है। जिसमें जहां बिजली की उपलब्धता आसानी से हो और सस्ती दरों पर उपलब्ध हों तो वहां बिजली चालित फैन-पैड पालीहाउसों का निर्माण करते हैं। लेकिन यदि दुर्गम क्षेत्र है और बिजली की उपलब्धता आसानी से नहीं है तो ऐसे क्षेत्रों में प्राकृतिक संवाहित (नैचुरली वेंटीलेटेड) पालीहाउस का निर्माण करते हैं। इन पालीहाउसों का क्षेत्रफल कम से कम 500 से 1000 वर्गमीटर रखना आवश्यक होता है। जिससे खेती करने के उपरांत व्यवसायिक रूप से लाभदायक सिद्ध होता है। इन पालीहाउसों में सिंचाई हेतु टपक सिंचाई तकनीक का उपयोग करना आवश्यक होता है जिसके माध्यम से



सिंचाई के साथ-साथ ऊर्वरक एवं दवाओं को भी दिया जा सकता है। वर्तमान में जो पालीहाउस 1000 वर्गमीटर क्षेत्रफल वाले किसानों के खेतों में बनाए जा रहे हैं, उनकी वास्तविक लागत औसतन 10-12 लाख के लगभग पड़ रही है। पालीहाउस के अंदर लगने वाली मूल्यवान सब्जियों के नाम, उनकी प्रजातियां, रोपण अवधि, उनकी उत्पादन क्षमता एवं लागत-लाभ प्रति 1000 वर्गमीटर में प्रति वर्ष की दर से नीचे सारणी में दर्शाया गया है:

फल/सब्जी	प्रजाति	उत्पादन अवधि	उत्पादन (kg/ha)	उत्पादन (kg/ha)	उत्पादन (kg/ha)
बीजरहित खीरा	सैटिस, कियान, हिलटन	जुलाई-अक्टूबर अक्टूबर-फरवरी फरवरी-मई (तीन फसल)	120-130	2.5-3.0	3-4 (तीनों फसल से)
शिमला मिर्च	स्वर्णा, ओरोवेली, इन्द्रा, नताशा, वाम्बी	अगस्त-मई (एक फसल)	60-70	2.0-2.5	1.50-2.0
लता टमाटर	जी.एस. 600, रक्षिता, स्नेह लता, नवीन एवं रीतूजा	अगस्त-मई (एक फसल)	140-150	2.0-2.5	1.75-2.0
नर्सरी पौध	सभी प्रकार की सब्जियों की पौध	6 बार प्रति वर्ष	20-25 लाख पौध	3-4	4-6

2- नेट हाउस का निर्माण [क्र]

यह संरचना भी पालीहाउस संरचना की भांति होती है। इसमें फर्क सिर्फ इतना होता है कि पालीहाउस को पालीथिन से ढका जाता है और इसको सिर्फ कीट अवरोधी सफेद जाली के द्वारा ढका जाता है। इसमें छतों को इच्छानुसार वर्गाकार, त्रिभुजाकार, आयताकार बनाया जा सकता है। यह संरचना उन क्षेत्रों के लिए उपयोगी साबित होती है जिन क्षेत्रों में कम से कम बारिश, पाला एवं ठंडक, सामान्य से कम पड़ती है और तापमान सदाबहार अर्थात् एक सा बना रहता हो। इस खेती का मुख्य उद्देश्य छोटे-छोटे शत्रु कीटों से रक्षा करके फसलों को विषाणु रोग से बचाया जाता है। इस कीट अवरोधी नेट हाउस के अन्दर वर्ष में दो बार खीरे की फसल, एक बार टमाटर और शिमला मिर्च की फसल ली जा सकती है। इसी के साथ-साथ इसे अन्दर 4 बार सब्जियों की पौध को भी उगा सकते हैं। इसमें सब्जियों का उत्पादन पालीहाउस खेती से 25-30 प्रतिशत तक कम आता है। यदि नेट हाउस संरचना 1000 वर्गमीटर की है तो इसको बनाने की लागत औसतन रु. 5-6 लाख तक आंकी जाती है।



3- पत्तीदार सब्जियों का निर्माण [क्र]

यह संरचना भी कीटरोधी नेट हाउस की तरह बनाई जाती है और इसके अन्दर हम गर्मियों के मौसम में पत्तीदार सब्जियों को उगाकर अधिक लाभ कमा सकते हैं। क्योंकि पत्तीदार सब्जियां जैसे- पालक, मेथी, मूली, चौलाई, धनियां आदि गर्मियों

में खुले खेतों में नहीं होती है इसके साथ-साथ गर्मियों में इस नेट हाउस का उपयोग अगेती गोभी वर्गीय सब्जियों की खरीफ प्याज की व अन्य सब्जियों की नर्सरी उगाने हेतु लाभकारी साबित होती है। इस प्रकार यह नेट हाउस गर्मियों के मौसम में सब्जी उत्पादन में अहम भूमिका निभाता है। इसकी भी लागत 5-6 लाख रूपया प्रति 1000 वर्ग मीटर क्षेत्रफल पर पड़ जाती है।



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- सर्दियों के समय नेचुरली वेल्टीलेटेड पालीहाउस के अन्दर लगे शेडनेट पर्दों को खोल दें। वेल्टीलेटरों पर लगे पालीथीन पर्दों को प्रतिदिन शाम को गिरा दें। दिन में इन पर्दों को 2 घण्टे हेतु खोल दे या उठा दें।
- फैन-पैड पालीहाउस में सर्दियों के समय, में कूलिंग पैड को न चलाएं। सिर्फ आधे घण्टे हेतु लगे सभी पंखों को दिन में 1-2 बार चला दें। जिससे पालीहाउस के अन्दर वातायन हो जाए।
- पालीहाउस के छतों को सर्दियों के महीनों में धुलाई करके साफ कर दें, जिससे अधिक से अधिक सूर्य की रोषनी फसलों को मिलती रहे अन्यथा उत्पादन में गिरावट आ जाती है।
- टपक सिंचाई के सहयोग से भूमि में नमी की पूर्ती बनी रहनी चाहिए और उर्वरकों को घोल के रूप में देना चाहिए।
- सभी संरक्षित संरचनाओं को जमीन से 1-2 फीट की ऊंचाई पर बनाना चाहिए। जिससे बारिस के समय संरचनाओं के अन्दर पानी न लगे।
- संरचनाओं की लम्बाई अधिक एवं चौड़ाई कम रखें।
- संरचनाओं की लम्बाई वाली दिशा तेज आधी बहने वाली दिशा की तरफ ही रखें।
- गर्मियों के समय 50 प्रतिशत छायादार जाली का उपयोग पालीहाउस या नेट हाउस के अन्दर या छतों पर करें। जिससे फसलों को गर्मी से सुरक्षा मिलती है।
- गर्मियों में पालीहाउसों के वेंटीलेटरों के ऊपर लगे सभी पालीथीन के पर्दों को खोल या उठा दे। पूरे समय वातायन (वेण्टीलेसन) होने दे अन्यथा फसलें खराब हो जाएगीं और उपज में गिरावट प्राप्त होगी।
- जहां कहीं भी पालीहाउस या नेटहाउस कटे-फटे हो उसे तुरन्त रिपेरिंग कर देते हैं। जिससे बाहर से हानिकारक कीटों का प्रवेश न हो सके।
- संरक्षित खेती के अन्तर्गत लगने वाली सभी सामग्रियों की गुणवत्ता अच्छी होनी चाहिए।
- खराब होने के उपरान्त समय-समय पर पालीहाउसों के छतों की पालीथीन को बदलते रहें।
- संरक्षित खेती हेतु सर्वप्रथम अच्छा सिंचाई का पानी, भूमि, बीज पौध एवं कुशल प्रबंधन हेतु अच्छे कृषि यंत्रों का होना आवश्यक है अन्यथा लाभ नहीं लिया जा सकता है।

- क्षेत्रीय बाजारों को ध्यान में रखते हुए उन्हीं सब्जियों को उगाए जिसको आसानी से उचित भाव में बेचा जा सके।
- पालीहाउसों के गटर की ऊँचाई या साईड हाईट लगभग 3–4 मीटर ऊंची अवश्य होनी चाहिए।
- पालीहाउस संरचना के चारों तरफ लगभग 15–20 मीटर की दूरी पर घने हवा अवरोधी वृक्षों को (विंड बेक्स) लगाना आवश्यक होता है।
- संरक्षित खेती के सभी संरचनाओं में प्रतिदिन आने जाने हेतु डबल दरवाजे एवं कृषि यंत्रों को ले जाने हेतु अलग दरवाजे का प्रावधान अवश्य होना चाहिए।

Utilization of solar energy in agricultural production system

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Renewable energy-such as solar, wind, and biofuels can play a key role in creating a clean, reliable energy future. The benefits are many and varied, including a cleaner environment. Electricity is often produced by burning fossil fuels such as oil, coal, and natural gas. The combustion of these fuels releases a variety of pollutants into the atmosphere, such as carbon dioxide (CO₂), sulfur dioxide (SO₂), and nitrogen oxide (NO₂), which can create acid rain and smog. Carbon dioxide from burning fossil fuels is a significant component of greenhouse gas emissions. Renewable energy, on the other hand can be a clean energy resource. Using renewable to replace conventional fossil fuels can prevent the release of pollutants into the atmosphere and help combat global warming. For example, using solar energy to supply a million homes with energy would reduce CO₂ emissions by 4.3 million tons per year, the equivalent of removing 850,000 cars from the road (Svejkovsky, 2006). Renewable energy is energy which comes from natural resources such as sunlight, wind, rain, tides, and geothermal heat, which are renewable (natural replenished).

Energy is the prime mover of economic growth, and is vital to the sustenance of a modern economy of India. Future economic growth crucially depends on the long-term availability of energy from sources that are affordable, accessible and environmentally friendly. India is endowed with rich solar energy resource. The average intensity of solar radiation received is 200 MW/km². The daily average solar energy incident over India varies from 4 to 7 kWh/m² with about 1500–2000 sunshine hours per year (depending upon location). With about 300 clear, sunny days in a year, the theoretical solar power reception, on only its land area, is about 5000 Petawatt-hours per year (PWh/y). Technological breakthroughs for cost-effective photovoltaic technology in recent years made the solar energy of high utility in Indian context. It has also embedded with tool to avert eco disasters which is associated with commercial energy sources. The massive energy crunch is one of the main hurdles in the development of rural eco system of India. Unreliable grid power is one of the primary impediments to farming community; particularly for primary processing, irrigation, drinking water, small machinery operations. In this situation, farmers are constrained to have stand-by power supply unit run on diesel which supply electricity at 2-3 times the cost of that obtained from grid power. The price of diesel is increasing as about 14% per annum, if we visualize the last decade prices of diesel. It all compels farmers to go for manual operations, which is drudgery to them. Socio-economic factors of drudgery to farmers, declining interest of educated rural youth towards farming, and low order of dignity to farm work complicating the agricultural growth. In addition, fast depleting coal and petroleum reserve shortages are further intensifying the threat of energy crisis.

Now with advancement of electronic interventions the price of core material and accessories of SPV has also declined significantly. At present total grid-connected solar PV installations in India has crossed 2.7

GW. The average peak power deficit over the last seven years ending in 2013 was more than 10%. Solar energy is harnessed through the available technologies like Solar Photovoltaic (SPV), Solar Thermal (ST), and Concentrating Solar Power (CSP). Photovoltaics are best known as a method for generating electric power by using solar cells to convert energy from the sun into electricity. The photovoltaic effect refers to photons of light knocking electrons into a higher state of energy to create electricity. Photovoltaic production has been increasing by an average of more than 20 percent each year since 2002, making it the world's fastest-growing energy technology. Photovoltaic power capacity is measured as maximum power output under standardized test conditions (STC) in "Wp" (Watts peak). Solar photovoltaic array capacity factors are typically under 25%, which is lower than many other industrial sources of electricity.

Mankind from time immemorial is using solar energy for various purposes. Photovoltaic is the creation of electricity from sunlight. Since certain kinds of material have a property called the –PHOTOVOLTAIC EFFECT ||, this effect enables them to absorb photons of light and convert it into electrons. These free electrons when captured at the single source point or cell produce electricity. A basic photovoltaic cell is also known as – solar cell and is made of materials like silicon. A thin semiconductor wafer is specially treated to form an electric field positive on one side and negative on the other.

Solar Photovoltaic Panel selection should be done with respect to peak load (wattage), Current, voltage, geographic location, site specific location and project cost. Commercially available modules are commonly three types: Mono Crystalline, Poly Crystalline and Thin Film. These types of modules have differences in conversion efficiencies as well as cost. It is imperative to note that the module efficiency is linked with temperature. It has been observed that efficiency loss may be up to 9% due to temperature. Hence, at the time of module selection the module should be selected according to temperature of application and module characteristics. Another important factors are estimation of current load and voltage of application. Accordingly, series and parallel circuit of module has to be structured.

Solar cell output is a strong function of irradiation and temperature. It is desirable to extract the highest possible power at any moment. Power output is not usually a monotonic function of control variables, however, so controls derived from linear system methods cannot track the peak power level. Many Maximum Power Point Tracking (MPPT) techniques for photovoltaic (PV) systems are well established. Hence, an efficient MPPT technique has to be identified for specific use. Ripple Correlation Control (RCC) yields fast and parameter-insensitive MPPT of PV systems. RCC has simple circuit implementations that are helpful to some users and is a general power electronics technique with several applications.

Conductor selection is also important as with faulty conductor the generated power cannot be utilized efficiently. During the transmission significant amount of power will be lost. In general, the conductor should be selected as voltage drop from generation to consumption should be less than 2V.

Application of Solar Energy

Solar Energy has lot of application in domestic as well as industrial use like:

Solar heating systems

- **Solar cookers:** Two different types of solar cookers i.e. indirect and direct focusing type have been developed in the country. The indirect type solar cookers consisting of an insulated box with transparent window through which sunlight enters into the box have been satisfactorily developed and commercially exploited for domestic cooking. Such solar cookers are being marketed on commercial scale in most of the states through State Energy Development Corporations or other nodal agencies of the Ministry of Non-conventional Energy Sources (MNES), Government of India.
- **Solar dryers:** Open sun drying of various agricultural produce is the most common application of solar energy. With the objective of increasing the drying rate and improving quality of the produce, natural convection and forced convection type solar dryers have been developed for various commodities. The movement of air in the forced convection solar dryer is through a power blower whereas in natural convection solar dryer air moves through the produce due to natural thermal gradient.
- **Solar water heater:** Water heating is one of the most common applications of solar energy for domestic and industrial applications. Similar to solar dryers, water heating systems are also available in natural convection and forced convection designs. Natural convection water heating system also known as thermo siphon water heating system consist of a flat plate solar collector, insulated water storage tank and necessary insulated pipe fittings.

Lighting and power supplies

The solar energy can be used for operating DC/AC lighting appliances for illuminating work space of house or processing area through SPV system and energy storage unit. It can be panacea for remote areas where grid power assurance is problematic specifically future generation.

Water pumping

A solar powered pump can be cost-effective, environment-friendly and low-maintenance solution for meeting water requirements for irrigation, livestock, community water supply and other purposes using surface water structure as well as ground water. This is powered by solar energy which consists of Solar Photo Voltaic panel or set of panels, a pump (centrifugal or rotary), electronic controls or a controller device to operate the pump, the required hardware and in some cases other items like inverters, batteries, etc. The solar powered water pumping system is like traditional electric pump with the only exception that it uses solar energy instead of fossil fuel or electricity. There are two types of solar powered pumps on the basis of water lifting; can be used e.g. Surface and Submersible. On the basis of type of electrical energy, the solar powered pumps can be classified as DC pumps and AC pumps. The solar powered water pumping system can also be classified as tracking and fixed types. Each type of the system has its advantages as well as disadvantages. Hence, selection of system specific to site condition and utilization is of utmost importance. The criteria for choosing between a surface and a submersible pump are the groundwater level and the type of water source. If the well is a bore well and total head(suction + delivery) is greater

than 10-15 meter, a submersible pump should be used. However, if the water source is an open well, pond, canal, etc. then a surface pump is more feasible.

Selection of Submersible and Surface pump

Submersible Pump	Surface Pump
Advantage	
To start the pump, there is no need of priming	Easy to set-up, installation
	Low upfront cost
Disadvantage	
High upfront cost	Priming is required
Bore well drilling, development increases the cost of installation and involvement of machine and skill.	Dry operation of pump severely damage the system
	Higher repair and maintenance costs
	Not able to lift water from more than 10 meter

DC and AC motor pump set are available both submersible and surface pump for operating by SPV system.

Direct Current (DC) Pump	Alternating Current (AC) Pump
Advantage	
The discharge of DC Solar water pumping system is approximately 10% higher an AC pump system.	Low upfront cost compared to a DC pump system.
There is no any requirement of inverter between the SPV panels and the pump system.	Easy installation, maintenance and repair at rural or remote areas.
Disadvantage	
High upfront cost	Low system efficiency and water output compared with a DC pump System.
Lack of repair and maintenance services in rural and remote areas.	Additional inverter is required
Higher repair and maintenance costs	Less operational hours.

Tracking system is imbedded for harnessing maximum solar irradiation by the SPV panel. The orientation of solar panel should be as such, at any given point of time, the incident solar rays fall on the SPV Panels perpendicularly. A dual axis tracker helps to orient SPV panels in the direction of maximum irradiation. In general there are two type of tracker available *i.e.* Manual and Automatic. Although the tracker enhances the system efficiency, however additional initial investment as well as maintenance cost is involved.

Power of Motor-Pump set: Actual water requirement for agricultural land depends on type of soil, crop and environmental factors. In agricultural production system timelines is important factor and specifically in irrigation. On the basis of water requirement, the motor-pump set power can be deduced. In general, the optimum power requirement for motor-pump set for solar powered system can be computed as:

Motor-Pump set Power (hp)	1	2	3	5
Approximate time for irrigation/acre (h)	14	7	5	3

In this way, 2-3hp capacity solar powered water pumping system is sufficient for irrigating 2-3 acre land holding. Water output from AC and DC solar water pumping system are given below:

Total Dynamic Head (m)	Water output/watt peak PV array with D.C. Motor Pump Set with Brushes or Brush Less (l/W-day)	Water output/watt peak PV array with A.C. Induction Motor Pump Set with a suitable Inverter (l/W-day)
10	100	90
20	55	50
30	35	32
50	21	19
70	14	13

SPV panel and space requirement

In general, approximately 10m² of land are required for every 1,000 Wp of solar panels installation. SPV peak power requirement can be estimated by using rule of thumb as 900Wp for per HP power of motor – Pump set. Furthermore the space requirement for SPV system is also significantly affected by type, orientation, module size and efficiency of SPV panel.

Techno-economic analysis

There is a general perception that diesel water pumping systems are generally affordable and that Photovoltaic powered water pumping systems. On critical analysis, it clear that photovoltaic pumping systems are far more cost effective than diesel generator water pumping systems for periods exceeding 2-3years. It is evident from analysis that life cycle costs for PV increases at a much lower rate of just 40% compared to an increase of 300% for diesel generator pumping systems. When considering a choice for a water pumping system, vital cost components such fuel costs, energy costs, source of funds and transportation to the site should be carefully analyzed before making a final choice. The life cycle cost analysis of pumping water shows that the SPV water pumping system is more economical and feasible compared to Diesel system. Hence, it can be inferred that the direct coupled PV pumping system is cost-effective in terms of life cycle cost and technologically feasible for rural water supply by virtue of its very low running cost and high reliability of the component and the system as a whole. Moreover, the replacement of diesel pump set; by SPV system will protect the environment from green-house gas emission 924 kg/year-hp of CO₂, 2.28 kg/year-hp of CO, 0.253 kg/year-hp of NO_x, 0.172 kg/year-hp of HC, 1.86 kg/year-hp of SO₂, and 20.4 kg/year-hp of suspended particles. However, lack of funds to offset the initial capital cost and absence of skilled maintenance personnel may be constitute serious limiting factors in the use of photovoltaic pumping systems.

Government financial assistance

Visualizing the higher upfront cost and multidimensional benefits of use of solar energy in agriculture; capital subsidy schemes for it has been launched by Ministry of New and Renewable Energy (MNRE). Ministry of Agriculture and Farmers Welfare has also undertaken it in scheme entitled “Sub-Mission on Agricultural Mechanization”. The important points of the scheme are as follow:

- Solar Pumps higher than 5 HP and upto 10 HP will also be eligible under the scheme.
- Any farmer who has more than one pump in his/her field/s but the total capacity of all the pumps does not exceed 10 HP he/she will be eligible for subsidy equivalent to 5 HP.
- Farmer Producer companies are eligible to receive subsidy under the scheme. If required more than one pump set would be made eligible for such companies.
- Solar Pump sets used for all purposes relating to agricultural allied activities like diary, poultry etc. as also for manufacturing of salt are covered under the programme.
- Any bank can grant loan for balance amount after deducting subsidy from the total cost of the system. The MNRE has advised to all banks that not to insist for additional security with respect to collateral security in terms of mortgage of land for loans under the scheme.
- Apart from the scheme, banks are also financing for installing the SPV water pumping system.

Farm machinery

Many human powered small machineries can utilize stored solar energy in form of chemical storage system i.e. battery and reduce drudgery of farmer/s and enhance work efficiency with advantages of timely completion of operations. Such operations may be post-harvest, secondary tillage, weed control and intercultural.

Conclusion

Lot of research and development has taken place in this area but a lot needs to be done. Most of the organizations all over the world are engaged in making this technology more affordable for the common masses and also in ensuring that it replaces the renewable source of energy in times to come.

Role of Micro-irrigation in Enhancing Agriculture Productivity and Profitability of Farmers in India

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Agricultural sector is the largest consumer of water. The demand for water has also been consistently increasing in non agriculture sectors including, municipal use and industry etc., and such uses can often be at the cost of agriculture. Out of about 141 million ha of net area sown in the country, about 65 million hectare (or 45%) is presently covered under irrigation. Substantial dependency on rainfall makes cultivation in unirrigated areas a high risk, less productive profession. Irrigation is essentially the artificial application of water to overcome deficiencies in rainfall for growing crops. Irrigation is a basic determinant of agriculture because its inadequacies are the most powerful constraints on the increase of agricultural production. The dominant method of irrigation practiced in large parts of the country is surface irrigation under which crop utilize only less than one half of the water released and remaining half gets lost in conveyance, application, runoff and evaporation. In order to reach anywhere close to so-called water smart agriculture all these water losses in irrigation need to be minimized. Empirical evidences suggest that assured or protective irrigation encourages farmers to invest more in farming technology and inputs leading to productivity enhancement and increased farm income.

Micro irrigation is proved to be a one such efficient method which offers a scientific alternative for reducing irrigation water losses practically to a zero level. Micro-irrigation conventionally has been considered useful only for a limited number of widely spaced crops. During the last decade micro-irrigation systems have been evolved to efficiently irrigate orchards, vegetables, cereals, pulses and other crops too. A large number of research studies have shown that micro-irrigation can be adopted successfully in most crops including so-called water guzzling crops like sugarcane and rice. Many farmers have validated research findings and have demonstrated that almost all crops can be grown with drip irrigation not only successfully but profitably too. We need to look beyond the mindset of micro-irrigation for widely spaced crops and innovative steps need to be initiated for large scale adoption of micro-irrigation methods for saving water for extending irrigation facility to hitherto un-irrigated fields.

Micro-Irrigation System

Micro irrigation systems are essentially of two types: Drip irrigation and Sprinkler irrigation. The focus of the drip irrigation system is irrigating the root zone of the crop, rather than the surface itself. The system allows for application of frequent but small quantities of water and therefore, a continuous supply of water throughout the day. One key reason for the superior performance of such a system is the fact that such a system can neutralise the nutrients and level of water available to the crops, in contrast to the traditional surface irrigation systems, under which, plants face stress as a result of feast and famine cycles. Sprinkler

irrigation, on the other hand, is a method of applying water akin to natural rainfall. Water, distributed through a system of pipes, is sprayed on the crops and falls as smaller water drops. This system does not apply water directly to the soil or root zone

Rationale for Drip Irrigation

As water is supplied directly to the root zone of cultivated plants and regulated in small portions using a dispenser-dropper in drip irrigation system it allows significant savings of water, as well as fertilizer. It diminishes the labor costs, shortens energy usage and length of pipelines. Drip irrigation also provides other benefits, such as an earlier harvest, prevention of soil erosion, reducing the likelihood of disease spread and weeds. Initially it became widespread in greenhouse production, later it became widely used in the open ground for the cultivation of vegetables, fruits, and grapes. The greatest effect the use of drip irrigation provides in the areas of insufficient moisture.

Process and equipment

A drip irrigation system normally consists of a water extraction unit, a filtration unit, a *fertigation* unit (fertigation is the application of fertilizers along with irrigation water), a general pipeline (the source of water for the drip irrigation), return piping, and drip lines. With help of micro-droppers, water is supplied in the form of small discrete droplets or micro jets. This method is suitable for greenhouses, smaller plants, and bushes. There are also micro sprays which supply a larger amount of water to accordingly poured large areas, compared with micro rays, which are used for irrigation of medium and large shrubs, hedges, small trees.

Components of a Drip Irrigation system include: (but not limited to)

- Controller/Timer: Controls watering cycle, directing when, how long and how often the system operates.
- Backflow Preventer: prevents water from being siphoned back.
- Valves: Used to turn water on/off.
- Filter: Keeps dirt and debris from clogging the system
- Pressure Regulator: reduce incoming water pressure to the ideal pressure for the system.
- Pipe: Carries water through the system.
- Micro-Tubing: delivers water from the emitters to the plants.
- Emitters: deliver water at a slow, consistent rate.
- Flush Valve/Cap: attached to the end of each irrigation line so that dirt and debris can be
- Flushed out.

Components of a Sprinkler Irrigation system include: (but not limited to)

- Prime Mover/Pump Suction Pipe: required for lifting water from the source and pushing it through the distribution system under sufficient pressure.
- Main Line: carries water from the source (pumping unit) to the various parts in the field.
- Sub-Main: carries water from the main to the lateral lines.
- Lateral Lines: carries water from the main line or sub lines to the sprinkler head through the rise pipe. These are portable and equipped with quick coupling devices.
- Sprinkler Head: used for spraying water on to the field. These may be rotating head, fixed head or perforated type.
- Sprinkler Lead: classified based on pressure: low operating pressure sprinkler intermediate pressure sprinkler or high pressure sprinkler

Significance of Micro-irrigation in Modern Farming around the Globe

The widespread use of drip irrigation kicked off in Israel, which was wanting in irrigation water in the 1950s. Once introduced it became a boom in irrigation technologies, not least it has been ecologically friendly method saving the soil and complex microorganism system from erosion processes. In India farmers having drip irrigation units or sprinklers of same type reaping rich harvests which far exceeding productivity of past century technologies predominant in the country. The vast majority of India's farmers are still using archaic methods: they water their crops by flooding fields with water from wells, or, if they are really short of funds, they just wait for the monsoon rains. Market steadily adopts to the needs of small plot owners, offering affordable models of drip irrigation units of large variety available for online purchase and easy manual set up. Italian farmers use drip irrigation to increase field productivity by 35-40%. On the broad lands wind used to blew away spray water of the standard agricultural sprinklers, and thus prevented even watering, resulting in lower yields. Installation of new drip irrigation systems has also helped the Italian farmers halve water consumption, especially valuable in drought years

Impact of Micro-irrigation in India

The Ministry of Agriculture, GoI is dedicated to the efficient use of water and treated waste water and promoting water recycling which is equally backed with strong political will. The ministry allocates grant to farmers who practice sustainable agriculture practices such as drip irrigation. As a result of the improved water use efficiency through judicious use in micro irrigation systems, the overall irrigation cost has been brought down. An average reduction of 31.9 percent is observed. Gujarat, Haryana and Rajasthan are the leading states with farmers in Gujarat seeing their irrigation cost almost cut in half. Consequently, farmers also showed interest in the new crops on the farms as a direct result of adoption of micro irrigation. About 30.4 percent farmers introduced new crops. Recognizing the importance of micro irrigation, the current government manifesto has talked about **Har Khet Ko Pani**.

ISAP Initiatives on Water Conservation and Promotion of Micro-Irrigation

ISAP consider water as the most critical resource for sustainable agricultural development. This precious and limited resource should be conserved and handled carefully in the most efficient manner, to minimize the dependence of agriculture on monsoon. With this in view, ISAP makes efforts in each of its agriculture development project to sensitize people for making judicious use of water by adopting micro-irrigation system. Based on socio-economic condition of farmers and field requirement ISAP provides different options on types of micro-irrigation systems suitable for their crop and accordingly small and marginal farmers are motivated for installation of low cost micro-irrigation system in their field. The results have been quite encouraging in all the projects across the countries including in Gangetic Plain of Uttar Pradesh where majority of farmers do not feel scarcity water and prefer to adopt flood irrigation. With the facilitation ISAP farmers from Sidhauri block of district Sitapur have started using micro-irrigation system in Banana cultivation. They have formed Farmers Producer Organisation (FPO) for market integration and value addition of their agriculture produces. The FPO promoted by ISAP in district Sitapur is also managing cold storage-cum-ripening chamber established under the project.

Pradhan Mantri Krishi Sinchai Yojana

Hon'ble Prime Minister of India has launched an ambitious irrigation plan (namely, Prime Minister Krishi Sinchai Yojna, PMKSY) to take irrigation water to each cultivated field. The overreaching vision of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) is to ensure access to some means of protective irrigation to all agricultural farms in the country, to produce 'per drop more crop', thus bringing much desired rural prosperity. Pradhan Mantri Krishi Sinchayee Yojna (PMKSY) was launched in 2015, integrating micro irrigation in the flagship scheme as an integral component. The scheme focuses on providing an end-to-end solution to the irrigation supply chain. One key differentiator for micro irrigation is that when compared to other components of this scheme, which include creating infrastructure to bring water to farms and watershed development, micro irrigation presents a quick-win opportunity for all the stakeholders where the implementation can be seen on ground within months.

Developing infrastructure takes years while bringing area under micro irrigation is a task that only requires a few months.

The broad **objectives** of PMKSY include

- Achieve convergence of investments in irrigation at the field level (preparation of district level and, if required, sub district level water use plans).
- Enhance the physical access of water on the farm and expand cultivable area under assured irrigation (Har Khet ko pani).
- Integration of water source, distribution and its efficient use, to make best use of water through appropriate technologies and practices.

- Improve on - farm water use efficiency to reduce wastage and increase availability both in duration and extent.
- Enhance the adoption of precision - irrigation and other water saving technologies (More crop per drop).
- Enhance recharge of aquifers and introduce sustainable water conservation practices.
- Ensure the integrated development of rainfed areas using the watershed approach towards soil and water conservation, regeneration of ground water, arresting runoff, providing livelihood options and other NRM activities.
- Promote extension activities relating to water harvesting, water management and crop alignment for farmers and grass root level field functionaries.
- Explore the feasibility of reusing treated municipal waste water for peri - urban agriculture.
- Attract greater private investments in irrigation.

Hon'ble Prime Minister of India has launched an ambitious irrigation plan (namely, Prime Minister Krishi Sinchai Yojna, PMKSY) to take irrigation water to each cultivated field. The Indian States like Gujarat, Andhra Pradesh, Tamil Nadu, Maharashtra and Karnataka have evolved several successful models for large scale adoption of micro-irrigation in the past. In recent times, the efforts of State of Karnataka in launching large micro-irrigation projects with thousands of hectare command namely Sehere and Ramthal may provide lead for others to follow. Integration of micro-irrigation with major irrigation projects, particularly in their tail end reaches, are likely to become a reality soon to bring at least 10 percent canal command areas under micro-irrigation as envisaged under PMKSY. Integration of micro-irrigation with watershed projects particularly for utilization of harvested water as aimed under PMKSY too are likely to result in efficient utilization of available water resources in agriculture with significant savings of water for extending the irrigation facilities to hitherto un-irrigated areas. India has already achieved a distinction of having the largest area under micro-irrigation. India already stands first in area coverage under micro-irrigation (exceeding 8 Mha) and is likely to surge ahead in its adoption in future in view of the increasing food demand and shrinking land and water resources availability for agriculture.

Technological Intervention for Enhancing Income of Farmers- Cucumber Intercropping with Sugarcane

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The Sugarcane crop is generally grown alone which gives the return after one year. The household requirement for money is on day today basis. This need led to improvement in system and cucumber was taken as intercrop for regular additional income. The sugarcane crop and cucumber were sown 15-16 February 2016 and also during 2017 on 20-22 February. Earlier cucumber was taken as intercrop as creeper without stacking in unscientific manner resulting in low yield and poor quality produce. The use of stacking for cucumber crop led to better quality produce with handsome additional return.

Need of New System

The need of intercropping of cucumber with sugarcane was due to less return from sugarcane alone and that too after one year. The cucumber intercropping with sugarcane on stacks is giving very good results in terms of productivity and quality of produce. The growth of sugarcane crop during initial 2-3 months is slow which gave opportunity of intercropping without affecting the growth of sugarcane crop. The cucumber crop started the return just after 45-50 days of planting. This system generated additional employment for three persons.

Details of Technology

Cultivated Crops	Productivity, (kg/acre)		Cost of Cultivation, (Rs./acre)	
	Past	Present	Past	Present
Intercropping of Sugarcane + Cucumber	Sugarcane-51000	Sugarcane- 55800	Rs. 55000.00	Rs. 48000.00
	Cucumber- 4000	Cucumber-5757.3	Rs. 42000.00 Grown without stacking	Rs. 38274.00 Stacking cost additional @ Rs. 28000.00/Acre

Economics of Intercropping Module

Crop	Gross Return, Rs./acre	Net Return, Rs./acre
Sugarcane	174522.00	126522.00
Cucumber	126660.00	60386.00

Yield Difference due to Intercropping System

The yield of sugarcane and cucumber both improved due to adoption of scientific management. Cucumber cultivation through stacking resulted in better growth which ultimately resulted in additional yield of 1757.00

kg per acre while in sugarcane additional yield of 6800.00 kg per acre. This additional yield is due to scientific management of the system.

Effect on Cost of Cultivation

The cost of cultivation of cucumber (on stacks) increased by Rs. 28000.00 per acre in comparison to grown without stacks but this additional cost led to higher additional return from cucumber and also from sugarcane. The stacking system facilitated all the operations in easy manner which gave better crop canopy leading to higher productivity and return.

Other Benefits

This scientific cultivation of sugarcane +cucumber intercropping gave recognition in the district and nearby areas which led to various certificates/ awards and ultimately social pride for me and my family. More than 250 farmers growing sugarcane have visited my field and more than 80% of them are adopting this technique. Now our areas is known for cucumber and nearby farmers collect their produce at one place and collectively transport it to Azadpur Mandi, New Delhi. All the farmers are not required to be involved in marketing process but they simply pool their produce at a point where grading and packing is done and then two farmers go with the trucks to Delhi. The cost and profit is shared by all as per their quantity.

Crop Production before the New System

The sugarcane crop was grown alone with some area with cucumber as creeper without stacking. The old system was not able to support the family demand.



Other Particulars

This intercropping module has been demonstrated by Krishi Vigyan Kendra, in adopted village where farmers visited and interacted with KVK, Scientists. About 200 farmers are using this module since February, 2016 and are satisfied with its results.

Average Yield of Village

Crops	Yield (kg/acre)
Sugarcane	36000.00
Cucumber	4200.00

Agroecological Approaches: A Path to Sustainable Intensification

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Livelihoods, crop production and livestock economy demand attention to highly interrelated challenges of rural ecology related to the state of health of the eco-system functions connected with the management of soils, water, pests and disease and biodiversity. It is not possible to understand individually these challenges. Positive and negative consequences for the state of health of eco-system functions are directly an outcome of the pathway of agricultural development. Degradation of eco-system functions has come from two major sources: first from the extent of deforestation and degradation of land taking place on account of vegetative cover, resulting in low water table and loss of top soil which have a direct bearing on the productivity of soil, its vulnerability to rainfall variations, scarcities of drinking water, fodder and fuel wood causing hardships to the rural poor and second from the misapplication of yield increasing inputs like water, chemical fertilizers and pesticides, causing water logging and salinity and pollution of drinking water, loss of fish, etc.

Current path and its associated problems

Punjab, Haryana and Western Uttar Pradesh have seen a shift from 'subsistence agriculture' to 'commercial agriculture' involving multiple changes in the state of agro-ecology due to the practice of high external input system of agriculture. Intensification of agriculture has involved changes in cropping pattern coupled with high input high crop yields particularly in rice and wheat. Multiple shifts in cropping patterns occurred in Karnal during 1880-1980. In 1880, jowar (27% of total cropped area-TCA) was the most important cereal, followed by rice (16%), wheat (14%), bajra (8%) and barley (6%). In 1960, wheat accounted for 25% of TCA, and rice claimed second place (13%), followed by jowar, bajra and ragi (5% each). Over the next two decades, the areas of wheat and rice expanded (to 42% and 31% of TCA, respectively) at the expense of all other cereals.

As far as the story of changes in carbon content of live vegetation is concerned, total carbon stock in Karnal declined from 17% (from 2.1×10^6 T in 1880 to 1.7×10^6 T in 1980). The primary cause of this decline was conversion of land bearing forest cover to agriculture after 1950. By 1980, 83% of the district was cultivated and accounted for 90% of the total carbon stock of the district. Coming to the organic carbon pool in agricultural soils, its improvement depends on addition from crop residues and on losses from erosion and decomposition. In Karnal, there exist today sustainability concerns because of loss of biodiversity, soil degradation and declining water table which need to be arrested and remedied suitably.

Cultivation of a single variety over large areas has resulted in reducing bio-diversity and increasing risks of building new insect pests complexes. Phlaris minor which was only a minor weed in 70s has assumed a menacing population since the early 90s. There is a sharp decline or loss in the micro-flora, e.g. earthworms

in the soil, with a continued cultivation of rice-wheat system. Due to excessive mining of nutrients, lack of integrated use of organic and chemical fertilizers, tractorization of agriculture and burning of residues in the machine harvested area. Water logging and salinity have been faced in a larger way than ever before experienced in this area. Lowering of water table is forcing many farmers to lower their pumping sets with consequent increase in the cost of lifting water.

Property relations and ecological degradation

The breakdown of the traditional institutions of management of common property resources and the failure of new types of institutions to fill in the vacuum have also contributed to ecological degradation. Encroachment of the common property (land and water) resources by the powerful within the village is itself an important cause of ecological degradation. The demand induced prospects for quick and substantial commercial profits from farming following high input high crop yields approach without accounting for the consequences for agro-ecosystem soil and water, biodiversity at the level of village, district and region have also contributed to this degradation over the period.

Problems of ecological sustainability are becoming the biggest barrier to the enhancement of agricultural productivity. Land degradation is today an important cause of reduced land potential and reduces crop yields. Cultivators are compelled to increase the use of farm inputs, which in turn raise costs and contribute to further degradation of land. 147 ma of land is known to suffer from various kinds of degradation. 57% of India's total area is subject to degradation (32%) or deforestation (25%), the degradation of dry land areas, soil erosion by water accounts for 70% of total land degradation. Chemical degradation accounts for 17%.

Failures of soil and water management have contributed a lot to the aggravation of ecological degradation. Policies linked to the current path of agricultural intensification have ignored soil and water conservation and discouraged the use of organic manure. Neglect of the practices of intercropping and of the practices of integration of husbandry of plants and animals and the adoption of the practice of monocultures in the cropping pattern are also now the causes of the excessive use of external inputs and the loss of valuable biodiversity.

In Punjab, Haryana and Western Uttar Pradesh rural agro-ecology has ceased to be self-sustaining in the sense that it can no longer find the natural conditions of its own regeneration on account of the path of agricultural intensification in practice. Correcting inappropriate input use requires the shift to intercropping and appropriate crop rotation and integration of husbandry of crops and animal. Land use and farming system need to be planned consciously by paying attention to the challenges of ecological intensification.

Past efforts for the augmentation of yield potential were insufficient in the case of coarser grains and pulses. Even with the current state of our knowledge of agriculture it is possible to obtain an additional 180 million tonnes of coarser grains from the semi-arid and arid areas and bring a major change in the state of food grains-based nutrition. India can achieve this additional production even without pursuing the conventional path of agricultural intensification promoting high external input system of agriculture. In

order to encourage the cultivation of coarser grains the PSMs are also now focusing on obtaining value added products by developing the technology of millets processing.

Policymaking and the challenge of viable farming

Sources of growth in agriculture have changed from the expansion of area under irrigation to the expansion of area under high external input responsive varieties of selected crops like wheat and rice over the period. Yield which played a significant role in the growth of agriculture during 80's due to spread effects of green revolution has come down during 90's. By persisting with the same approach to technology of crop production the government is imposing a great amount of economic burden on the peasantry and rural labour.

With the advent of neo liberal policies leading to reduction in public investment on irrigation and seeds, technology and extension which has greatly affected yield, the economics of agriculture has become unfavourable for the poor and middle peasants. Lack of appropriate correctives has led to the persistence of ecologically degrading path of technical change.

Area cultivated both in term of net sown and gross sown area has shown a decline in the post reform period. Particularly the risks for the poor and middle peasants are becoming greater, and many of them are exiting from crop production. Cultivators have been compelled to move away from food grains to commercial crops. But even these factors have now turned negative for commercial crops.

Towards an alternate path of agricultural intensification

Various kinds of sustainable alternatives to high input high yield based thinking on agriculture are under perusal in the form of real world experiments in different parts of the country. Broadly these alternatives can be categorized as follows: (1) Switch over to organic inputs instead of chemical inputs in agriculture and (2) Integrated ecological agriculture based on the path of ecological intensification. The PSMs have been involved with the implementation of the path of integrated ecological agriculture.

We have the experience of Centre for Ecology and Rural Development (CERD), Puducherry in respect of the reconstruction of social organization of tank management. By providing the peasantry, fishermen and rural labour their basic rights or entitlements in respect of water and biomass and getting the powerful vested interests to abandon their greed the CERD Puducherry was able to address the challenge of ecological intensification of agriculture in Puducherry. Experience of Puducherry shows that the new institutions of management of common property resources are going to be crafted in the midst of unequal power relations.

The PSMs believe that the peasants and rural labour need to be developed as users and providers of various services such as water, energy and infrastructure related to the maintenance of ecosystem functions to make farming economically viable and ecologically sustainable. We need to make demands on the government to help rebuild the institutions of soil and water, livestock and biodiversity management.

While building these institutions we need to keep in mind the interests of landless and rural labour.

There exists the need to build associations of producers of new services and products to promote the alternate path of ecological intensification and to try out experiments specific to the resource constraints and the opportunities available to the farmers.

Below we give in brief an idea about some of the experiments being undertaken by the PSMs in different parts of the country.

Biofarm approach in Eastern India

In the Biofarm approach under implementation in Tripura, West Bengal and Orissa, the models that have been developed at single farm scale are based upon the first principle of ecology that all the components of nature, biotic and abiotic are interrelated. It is an established principle in ecology now that stability of a system is enhanced by higher connectivity among different components among different biotic of a system. A stable system has to have capacity for maximum resilience, optimum productivity with maximum input use efficiency and regeneration capacity for higher sustainability. This has been illustrated amply by a number of experimental validations undertaken during the last two and a half decades.

Agricultural systems are essentially managed ecosystems. Even though they are much simpler in structure and complexity than a natural ecosystem are guided by the above guiding principles too. The concept of agricultural systems as agro-ecosystems provides a fundamental insight that any farming system should ideally emulate a productive natural ecosystem. In operational terms, this means the following in this model:

1. The diversity of the farm should be increased as much as possible by introducing at least 5/6 types of cereals and pulses/oilseeds, 10-12 varieties of vegetables, 5-6 varieties of fruit trees and fuel wood and fodder trees, 5-6 types of spices or medicinal plants, 5-6 types of livestock, 3-4 types of birds or insects and fish. That could ensure food and livelihood security throughout the year.
2. External inputs will have to be reduced. At least 1-2 members of each family should take the responsibility to produce inputs like seeds, fertilizer, shrubs for live fencing etc from within the villages.
3. Measures should be taken for soil conservation and rainwater harvesting and also for prevention of water run-off and soil erosion. The organic wastes generated from farms, cowshed, household should be reused, best would be to recycle them. For example excreta of livestock can be used to produce biogas, a part of the liquid slurry obtained as a by-product of the process, can be used as fish feed and rest can be applied to paddy or vegetable field.
4. Even the inherent behavior of the livestock can be utilized also. If the integration is done at right time and quantum, they might serve many of our purpose free of cost. As Hens can provide fertilizers in fruit orchard along with clearing up weeds and pests; local variety of ducks and predator fishes kept in paddy field can save works like weeding, fertilizing, aerating and so on.

5. Water hyacinth and other organic weeds like Cassia tora, Ivy Gourd, Prickly Amaranth, lamb's quarters (*Chenopodium album*) etc, which are grown on its own, should be processed and utilized to meet consumption requirements of human and livestock.
6. Fast growing trees like *Gliricidia*, Ipil Ipil, Common Sesban, Variegated Bauhinia (*Bauhinia variegata*), Pigeon Pea, and Bamboo should be planted as they add high nutrient content soil. They can be used for enriching soil as well as fodder of livestock. At the Same time these may also be used as firewood.
7. Farmers should take initiative to sell their products, not directly from field, but should process them, which help them to earn more profit. And this is also a good process to keep the organic wastes within the village. Selling of mango leather instead of mango, extraction of oil from Neem/Indian Beech (*Pongam Oil Tree*)/Castor within the village, selling of fruit juices are few examples of such post harvesting technologies.
8. Uses of chemical pesticides are to be stopped while practicing integrated farming. In fact, use of chemical fertilizer like urea, super phosphate, Ammonium Nitrate, Potash should also be stopped gradually. Though little amount of chemicals like DAP or NPK can be used mixed with organic fertilizers, yet it is advised to reduce the application. Instead of rock phosphate; limestone, wood ash etc can be used if required. Emphasis should be given on preparing and using of organic fertilizer, green manure, Vermicompost, extract of various plants and weeds or ash as organic weedicide etc.
9. Besides making the farm diversified, there are scopes to create different system level diversity also. If we have different ecosystem like unproductive high land, low lands, productive lands, garden or some wetland together – we can try out different types of farming system and techniques.

Non-Pesticide Management (NPM) in Andhra Pradesh

The 'Non Pesticidal Management' which emanates from collaborative work of public institutions, civil society organizations and Farmers in Andhra Pradesh shows how diverse players can come together to work in generating new knowledge and practice.

Pest is not a problem but a symptom. Disturbance in the ecological balance among different components of crop ecosystem makes certain insects reach pest status. From this perspective evolved the Non pesticidal management which is an 'ecological approach to pest management using knowledge and skill based practices to prevent insects from reaching damaging stages and damaging proportions by making best use of local resources, natural processes and community action'.

Non pesticidal Management is mainly based on

- Understanding crop ecosystem and suitably modifying by adopting suitable cropping systems and crop production practices. The type of pests and their behaviour differs with crop ecosystem. Similarly the natural enemies' composition also varies with the cropping systems.
- Understanding insect biology and behaviour and adopting suitable preventive measures to reduce the pest numbers.

- Building Farmers knowledge and skills in making best use of local resources and natural processes and community action. Natural ecological balance which ensures that pests do not reach a critical number in the field that endangers the yield. Nature can restore such a balance if it is not meddled with too much. Hence no chemical pesticides/pesticide incorporated crops at all. For an effective communication to farmers about the concept effectively and to differentiate from Integrated Pest Management which believes that chemical pesticides can be safely used and are essential as last resort it is termed as 'Non Pesticidal Management'.

Enhanced biomass production for rural livelihoods in Maharashtra

Crop production is part of a wider process of biomass production. The concept of biomass gives a way of conceptualizing many distinctions that are important in planning for a sustainable and equitable water use. It gives a measure of ecosystem productivity and also helps us set criteria for sustainable resource use. It helps assess water requirements for livelihood assurance and consequently also helps us assess the requirement of exogenous water for an area. Biomass means here the total dry mass of vegetative matter produced within an ecosystem. Biomass has many roles to play. Biomass is used to meet needs directly in various forms like food, fodder, fuel, timber, oils and resins, fibre, etc.

There is the need to make a clear distinction between primary and secondary productivity of an ecosystem. Primary productivity of an ecosystem may be defined as the productivity that an ecosystem will have if external inputs were to be withdrawn from it. Secondary productivity is the increment in productivity that results from the use of external inputs. Aggregate productivity is then the sum of primary and secondary productivity. This distinction between primary and secondary productivity is close to the distinction between 'natural stock of capital' and 'human made capital.' Sustainability then means maintaining or enhancing primary ecosystem productivity or the natural stock of capital. Sustainability planning needs to include recycling of part of the biomass produced, as a thumb rule one-third of total throughput- a farming practice promoted by SOPPECOM, a PSM organisation working in the state of Maharashtra.

Politics for an alternate path of ecological intensification

Access to water, forests grasslands and wetlands is essential to the survival of the agrarian system. The goal of socialization of agrarian production and resources must be realized through the active perusal of experimentation wherever possible. In the areas of their influence the Kisan organizations and Agricultural Workers Unions should help create favourable political and social conditions for collective farming by pooling resources, by forming Cooperatives and Self Help Groups in the field of production, processing, value addition and marketing. The Left Front government in Tripura came to be known as a leader with regard to the initiatives taken for the implementation of forest dweller rights, land reforms and environmentally sensitive technological innovations like the system of rice intensification (SRI). In Kerala, the Left and Democratic government used the means of decentralized planning to revive paddy cultivation, vegetable production and compost making out of urban solid waste.

Systemic change is the need of the hour

The PSMs are in favour of emphasizing sustainable farming systems involving intercropping and integration of crop and animal husbandry. Although the currently prevailing dominant view is still that the rising demand for the grains of wheat and rice from the growing population demands the continuation of the conventional path, but the PSMs believe that this understanding leaves little scope for us to do fresh thinking on the problems of eco-degradation. The democratic movement as a whole must prioritize the new challenges of agricultural intensification by putting the agenda of implementation of the pathways of ecological intensification in front of the peasantry, rural labour and women farmers.

Empowerment of the Farmers through Agribusiness: A Pilot Project for Punjab, A 500 Days Pilot Project

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If we see the history of agriculture after independence, Punjab has created history and had glorious past but for last two decades the reverse trend in agriculture is evident, it is almost saturated and stagnant due to continuation of same practices which were appropriate when we were not self-reliant for food but now, we are food surplus state, so why we are not changing ourselves with the time?

With the continuous progress and the innovations in agriculture has given birth to AGRIBUSINESS (I recall my memories that we I coined the words like AGRIBUSINESS, HORTIBUSINESS, AGRIPRENURESHIP etc. in my writings, people were sarcastic in their statements that WHYI AM CREATING MY OWN DICTIONARY but now everyone is using these words which I had coined in 1990.

I got the first opportunity to travel across Punjab (with mature and awakened mind) by road during 1990 while going to Himachal for a Scientific event in Solan, which gave me a food for thought to think about Punjab because I fell in love with Punjab soil and Punjabi hospitality and warmth of their culture and preview of their big heart.

My thinking took a shape, when I decided to come to Punjab in 1999 to sensitise people for trying a new option that is Agribusiness. Though, it was little difficult but Punjab farmers accepted it as they have a great instinct to adopt the new or innovative options and this instinct has taken them on the top of the community evolution or you may call it development.

Vision in 1999

I had read that many Punjabis are living overseas but due to their love to their soil, they have always been developing agriculture lands and they have become absentee land lords, so to sensitise them and motivate them to make use of optimum use of their land with new crops, I came to Punjab with a plan to have a participatory approach with a win-win situation and to earn money as a bi-product (this has been my philosophy after November 3,1985 when I made a road map for my active commercial life till 2021 and decided to leave my job after five years and I left on 31.12.1990 as a Scientist).

Vision in 2018

Based on my experience of knowing Punjab during 1999, understanding it and working with people, I feel that the PUNJAB NEEDS TO SWITCH OVER FROM AGRICULTURE TO AGRIBUSINESS, which is already happening not because of my efforts but because of the time which is always most powerful and all wise people always match the pace with it.

Now, my vision is to empower **SMALL, MARGINAL & LANDLESS** farmers of the Punjab.

Present Punjab

Punjab has 22 Districts, 82 Tehsil and 146 Blocks and 13 Parliamentary seats, 4 Rajya Sabha seats and 117 Assembly seats with approximately 2.77 Crore population, living in 143 towns and 12575 villages having a fair ration of 96:4 percent, respectively for rural and urban population including 36.74% economically weaker castes and about 43.34% landless people. Though per capita income of Punjab is 49529 against National average of 39904 but we still need to improve it.

Punjab of my day dreams

Empowered Farmers and agriprenures with happiness, healthy and prosperous life style. Now, to achieve it and to make it happen, I am going to adopt a participatory mode having 100% transparency in operation with in-built risk sharing mechanism.

The Model

My proposed model is called "**FARM TO ENERGY**". In 2003, I had developed a model "FARM TO FORK" for Ministry of Agriculture with an example of Uttar Pradesh and demonstrated it for the first time in Punjab jointly with Punjab Markfed and now I have modified my model from "farm to fork" to "farm to energy" (all human being and the animal take food to take energy as ATP and release the waste as excretion which is a waste which can be further converted into energy which will be used to empower them further by fuelling their agribusiness operations, so the current model will be called "farm to energy").

Basic Assumptions of the Model

Business model is very simple but looks little complicate due to its interconnectivity and interdependence on linkages which will be linked with two main pillars i.e. PRODUCER (farm produce producer or produce processor) and CONSUMER (which can be an individual or an organization).

These two pillars will be linked with the chain having all the stake holders which will be independent for their sustainability and will grow together rather growing on each other and creating a internal competition and here we will call them value chain partners.

Two very influential factors will be in-built in the model i.e. TRANSPARENCY IN ENTIRE VALUE CHAIN (through Transparent Agribusiness Guarantee System) AND RISK SHARING MECHANISM (by adopting participatory mode with win-win situation) which will ensure the adoptability and sustainability of the model.

The Result

Following the Nature's principal (creating the energy, giving the path and taking the result), we also proposed to create an energy (the thought converted into model), give a path (to implement the model) and take the result i.e. FARMERS AND AGRIPRENURES EMPOWERMENT.

Target

With a humble beginning, we are targeting the EMPOWERMENT OF 1,46,000 farmers and 20,000 Agriprenures in 500 Days with effect from 15th August, 2018 till 31st December 2019.

Components of the Model

We will have two major components i.e. PUNJAB AGRI MART to address the issues related to backward linkages to connect the farmers or producer and connect with PUNJAB FOOD MART to address the issues related to forward linkages and connect with consumer. The Agri Mart will be a tool to empower the farmers through guidance, facilitation and interventions and Food Mart will agriprenures through livelihood options with complete hand holding from concept to execution and continuous support till financial sustainability.

Business Model

The business model is divided into two parts i.e. FARM TO FORK & FARM TO ENERGY and following is the FARM TO FORK model where all the farm produce is going to be supplied to end users including individual house hold, institutions and the importers.

In another model which we call FARM TO ENERGY model where we convert all the biological waste whether it is agriculture waste or human waste or animal waste into Biogas (for cooking), electricity (for consumption) and the CNG (for commercial use) and hence we recycle the whole energy which is present in the farm produce and cycles through living system and go back to pen system from where it comes back through biological systems.

Existing Value Chain

The existing value chain is very long and competing with each other and growing at each other's cost creating a unhealthy business competition and hence we have made it very very short and perhaps this is the shortest possible value chain which is explained below:

Gap Analysis

To understand the commercial existing value chain versus proposed value chain, a gap analysis was done and a proposed value chain cost was estimated to have a win-win situation among all the proposed value chain partner with minimum interdependability and competition within the value chain which is summarized below:

Our Experience to Implement the Proposed Model

Retail of food stuff and especially fresh produce is one of the most difficult retail business and many big corporate have burnt their fingers and finally closed their operations. Due to the involvement of middle men in the fresh produce retail, both the value chain partners i.e. farmers and consumers are suffering



GAP ANALYSIS



Farm	→	Consumer	→	100-400%
Local Mandis	→	Consumers	→	100-200%
APMC(s)	→	Consumers	→	100-200%
Factories	→	Consumers	→	35-70%
Ginkgo Mart (Proposed)	→	Consumers	→	35%

and advantage goes to middle men only. Keeping in mind the price increase and the problems being faced by the consumers and farmers, this concept has been developed and tested by our principal M/S Indian Potatoes Ltd at Chandigarh, Rohini and Noida and it is found that this is the one of the best solution to implement FARM TO FORK concept and remove middle men and ensure the suitable prices for the farmers and ensuring supply of hygienic food stuff to the consumer's door step at the competitive prices, which is notified in advance.

The above experience was a outcome of an initiative taken jointly by Punjab Markfed & HPMI and during 2003 which was a pilot project to demonstrate FARM TO FORK MODEL, developed for Ministry of Agriculture and Cooperation, Govt. of India in 2003 to avoid the middle men and benefit farmers and consumers. So, we have requisite understanding about the project and experience of handling it.

Business Model

Business model will include all the stake holders as independent value addition center who will strengthen and supplement without competing with each other with a transparency in the operation to avoid any kind of operational confusion and clash and the all the stake holders will be knit closely through FRANCHISEE model with a 100% sense of ownership and belongingness to ensure its success and smooth operation.

Each District will have a common infrastructural facility as a Master Franchisee to cater the operational demand of Agri Mart and Food Mart as a Franchisee. All these franchisees will be given required training, orientation and support from developing concept till execution including project funding, market linkages and continuous support during their operations to ensure the feasibility and sustainability of the enterprise.

The model will be implemented in a three tier system i.e. Food Marts, Mobile Food Marts and Village Food Marts having 65 different livelihood/business model under food mart concept. These food marts will be the forward linkage arm of Agri Mart which will be their backward linkages arm. Each Agri Mart at block level

will only cater to identified and registered shareholders of respective FARMERS PRODUCER COMPANY which will have two members from Corporate and Technical Resource Agency (as per the Govt. of India norms for providing technical and commercial support and hand holding).

These Agri Mart and Food Marts will be called PUNJAB GINKGO AGRI MART and PUNJAB GINKGO MARTS in all further expressions.

Concept

This model ensures the home delivery of all kind of Fresh Fruits & Vegetables, Cereals, Pulses, Spices, Dairy Products, Processed Foods, Certified Organic Produce and products and other processed foods & FMCG products at a pre-defined price.

We, at GINKGO MART- Franchisee, will get the supply of required food stuff through our principal who will source the produce and products from adopted farmers of Indian Potatoes Limited as well as from produce markets, if required. Similarly, we will market all non-perishable, staples, processed food and FMCG products from GINKGO Mart at a very competitive price directly to the consumers at their doorsteps and that too at highly competitive and pre-defined prices with 100% quality guarantee.

Operational Model

We will take up the franchisee from the GINKGO MART and will get all required infrastructure required and will book the orders from the pre-identified customers for purchase of fresh fruits & vegetables and value added products as per the marketing protocols. The order will be taken in advance and the same would be delivered next day. The GINKGO MART will ensure the dully graded, packed food stuff as per the individual customers and will pack them in a basket or crate and deliver it to the Franchisee at the respective out let or Franchisee will collect the packed deliveries from the Pack House to be delivered to the respective customers against cash payment. The entire sale proceed will be deposited in the collection account of IPL and in turn IPL will release the agreed sales commission and other payables on every 3rd of the respective month.

In addition to the home delivery, there will be counter sales of cold & hot beverages and snack foods.

Products to be Sold at Counter

1. Cane Sugar juice
2. Orange/Citrus/Pomegranate juice
3. Vegetable juices
4. Tea/Coffee/Soups
5. Snack foods
6. Cooked Food
7. Ready to Eat Food

Products to be Sold (Under Home Delivery)

1. Graded, washed fresh fruits and vegetables
2. Pre-cut fruits and vegetables with a shelf – life of 7 to 10 days by using patented German technology called “FOOD FRESHLY” from Food Freshly GmbH, Germany
3. Value added products and food FMCG products
4. Certified organic produce and products

Advantages

1. Convenience, hygienic, value for money
2. Highly competitive and pre-notified prices valid for six days
3. 100% unconditional quality guarantee

How We Are Competitive

We have eliminated the middle man from farmer/Producer to consumer i.e. Farmer – Local Traders Consolidator – Wholesale - Commission Agent – Wholesaler – Retailers - Consumer.

In Ginkgo Mart, we are the only agency to facilitate and we work on minimum overheads, the margin of the operator as well as all franchisee’s margin while other existing models are operating at very high prices.

Mechanism and Economics

The outlets will be given to the franchisees on the following pattern:

Mechanics and Economics for a Franchisee

As per the market survey and feasibility studies a GINKGO MART operator can earn about Rs. 15,000 to 60000/- per month or even more, depending upon the model selected out of three options i.e. GINKGOMART, GINKGO MOBILE MART & GINKGO VILLAGE MART.

Outcome after 500 days

- 01- Happy Farmers due to increase in their per capita income.
- 02- Happy Agriprenures due to their sustainable self-employment.
- 03- Happy Consumers as they get best food at their door steps at pre-notified price
- 04- Increase area under Horticulture Crops
- 05- Reduction in migration from rural area to urban area

Future Road Map for India Based on The Success Story of This Pilot Project

Strengths: India is one of the first four diversity rich countries (China, India, Mexico, Brazil) has tremendous

potential, backed by hard working farming community which represent 705 of the country's population with unlimited local market and access to global market.

Opportunities: If we see the data, generated by CMIE (Centre For Monitoring Indian Economy), India has 31 million unemployed youths (Times Of India dated March 6th 2016) and rate is increasing with a rate of 6.06% (monthly rate of increase, based on February, 2016 data). India is divided into States (36 including UT's), Districts (593), Blocks (5410) and villages (6,49,491). Based on this structure, if we integrate agribusiness options and adopt participatory mode and converge all the available fiscal incentives and other interventions under the various schemes and access to the finance under recently launched schemes like Mudra, CGTMSE, PMRY etc. on merit and develop the linkages with central Govt. sponsored schemes like MDMS, ICDS, Urban and Rural livelihood schemes, CSR funding, the entire unemployed youths can be self-employed and we can achieve a faster growth in National economy through agrarian economy.

Weaknesses: In spite of all the strengths, we have few serious weaknesses which are due to the deterioration in our value system e.g. dishonesty in our approach, lack of trust on each other, lack of team spirit and lack of trust on Govt. functionaries due to corruption and tug of war for political powers with absolutely selfish moto and people do not mind making efforts at the cost of others.

Threats: Though, we have wonderful schemes, designed by our visionary people having world class expertise and experience but execution is very very poor because we lack strong political will at every level though we have intent and content. Here, I would like to underlying the inhibitory role of Bankers and it is a undisputed principal that without easy financial, no agriprenureship or agro-industrial growth would be possible because this is the most sensitive sector as industry which require many things to be integrated with a committed approach as well as hand holding.

दृश्य [कृषि]

जित दल उ उ

गाँव व डाकघर— अजायब, तहसील महम, जिला— रोहतक—124522, हरियाना

कुदरत ने महामुल्यवान संपदा के रूप में जो चीजें हमें उपहार में दी हैं, उनमें धरती यानी माटी की महिमा सबसे ज्यादा है। धरणी धन से परिपूर्ण है, इसलिए बड़ों ने इसे वसुंधरा कहा है। मेरी माँ सवेरे खाट छोड़ते ही सबसे पहले तीन बार धरती को मैया कहकर पुचकारा करतीं और इससे सुखी जीवन के लिए इन शब्दों में प्रार्थना किया करतीं— 'धरती माता तू सूद घी, तेरे से बड़ा न कोय। तेरे ऊपर पग धरे तो सुख में वासा होय।।'

किसान होने के नाते मेरे पिता का भी खेत की माटी से उतना ही मोह था जितना चातक का मेघ से होता है। वे नित्य खेत की माटी को मस्तक पर लगाया करते और खेती को सारे जहान की माता कहा करते। खेती का सारा काम वे अपने हाथों से किया करते और बांगरू की एक कहावत अकसर दाकहराये करते— 'खेती, पाती, बिनती अर घोड़े का तंग। अपने हाथ सम्हारिये, लाख लोग हों संग।।'

कीट-पतंगों और पशु-पक्षियों के साथ भी उनका अपार नेह था। उनका विचार था कि वह किसान भाग्यवान होता है, जिसके घर और खेत में पशु-पक्षियों का गुजर-बसर होता है। से संबंध में वह एक देसी कहावत कहा करते, जो इस प्रकार है— 'पशु, पखेरू जीव बिन बंजर होज्या खेत। जी कै नैडै राखियो, तकियो इनका हेत।।'

वे बैलों की हिफाजत बड़े जतन से करते थे। उन्हें खूब खिलाते-पिलसते थे। वे खुद भूखे रह जायें तो रह जायें, मगर बैलों को हरगिज भूखा न रहने देते थे। वे बैलों को किसान के अगले पांव बताया करते। वे गर्व से कहा करते कि एक गठरी भूसे के एवज में बैल सारा दिन छाती फाड़कर हल खींचते हैं। उनका अटल विश्वास था कि गउ के जायों के खुरों के स्पर्श से हर्षित होकर धरा सोना उगलती है। मेरे पिता पारंपरिक खेती के प्रबल पक्षधर थे। उन्होंने जीते जी अपने खेत में रासायनिक खादों और कीटनाशकों का प्रवेश नहीं होने दिया। हम जहर बो रहे हैं और जहर खा रहे हैं। हमारे बड़ों ने जिस माटी को माँ का दर्जा दिया उसकी बेहुरमती करने में हमने कोई कसर बाकी नहीं रखी है। हम माटी का मान रखने की बजाय उसे नीची निगाह से देखते हैं तथा अन्न व जल रूपी अमृत उगलने वाली जमीन में सैकड़ों प्रकार के घातक रासायनिक खाद व कीटनाशक टूस-टूस कर बंजर बनाने पर उतारू हैं। केवल दो कौड़ी की खातिर हमने जमीन की समस्त गरिमा नेस्तनाबूद कर दी है। अन्न प्रदूषण से हमारा शरीर कंडम हो गया है। जल प्रदूषण से हमारे प्राणों पर सेकट आन पड़ा है। भू-प्रदूषण से हमारा धर्म भ्रष्ट हो गया है। वायु प्रदूषण से हमारा धैर्य लुप्त हो गया है और पर्यावरण प्रदूषण से हमारी धारणा-शक्ति नष्ट हो गई है। हमें और सरकारों को यह नहीं भूलना चाहिए कि हमारा जीवन जमीन के सहारे चल रहा है और इसमें किसी भी तरह की लापरवाही की छूट नहीं दी जा सकती।

मैं प्रकृति का अदना सा अरदली हूँ। ओर खेती-बाड़ी का काम करता हूँ। मैं चिछले 10 साल से पांच एकड़ जमीन में कीटनाशकों के बिना कुदरती खेती कर रहा हूँ हमने तय किया है कि किसी भी सूरत में हम अपचे खेत में कृत्रिम खाद और कीटनाशक दवा नहीं डालेंगे। कृषि में कीटनाशकों के इस्तेमाल को रोकने की यह पहल हमारे घर व खेत में आशा की संजीवनी लेकर आयी है। हमारे क्षेत्र में केंचुओं की तादाद बढ़ गई है। खेत में खड़े वृक्षों पर सभी प्रकार के पक्षियों का बसेरा होने लगा है। फलों अ सब्जियों का रंग अच्छा हो गया है। पड़ोसियों के मुकाबले गेहूँ और धान के दानों का

आकार और वजन बढ़ने लगा है। यही नहीं, खेत में बने कुएं का पानी और अधिक मीठा हो गया है। खेत में उगने वाले खर-पतवार को हम हमेशा खुरपी और दंराती से निकालते हैं। मेरे ताऊ देसू कहा करते कि—

*बांध कुदारी, खुरपी हाथ। लाठी हंसुआ, राखे साथ।।
काटै घास अर खेत निरावै। सो पूरा किसान कहावै।।'*

देशी तरीके से किसान के मित्र कीटों की प्राण हानि नहीं होती। गाय के गोबर, मूत्र और घास-पात को सड़ाकर गोबर की खाद हम खुद बनाते हैं। गोबर की खाद खेत के लिए उतनी ही जरूरी है जितना आदमी के लिए भोजन पानी। बागरू की कहावत है— 'खाद पड़े तो खेत, नहीं तो कूड़ा-रेत।'

गोबर की खाद से जमीन में सूक्ष्म जीवाणु, केंचुए और कीड़े-मकोड़े पैदा हो जाते हैं जो माटी को नरम, छिद्रित और पानीदार बनाते हैं। देशी खादों से माटी की गुणवत्ता बढ़ती है तथा इनसे पर्यावरण प्रदूषित नहीं होता। हरी खाद के लिए हम उर्द, मूंग, मोठ, मटर, अरहर, जंतर, जौ, ज्वार व जई आदि बोते हैं तथा बिजाई के 45 दिन बाद जमीन जोतकर उसे भी खेत में बिछा देते हैं। वृक्षों की सूखी पत्तियां भी खाद का काम देती हैं। देशी खादों के इस्तेमाल से हमारे खेत में मृदा उर्वरता के लिए जरूरी सभी पोषक तत्वों की मात्रा बढ़ रही है। हम अपने खेत में घर का शुद्ध बीज का इस्तेमाल करते हैं। फसल की पैदावार शुद्ध बीज पर निर्भर है। खाद से भरे खेत में बढ़िया फसल तभी उग सकती है जब शक्ति से परिपूर्ण बीज बोया जाए कृत्रिम बाज धरती में गल जाता है किंतु निर्दोष बाज सौगुना फलता है। कहावत है— 'स्वस्थ बीज हीरा-सा चमकै, पड़ा खेत में हरदम दमकै।'

माटी की ताकत बनाये रखने के लिए हम साल-दो-साल के अंतर पर फसलसे की अदला-बदली जरूर करते हैं। एक ही तरह की फसल कई साल लगातार कभी नहीं बोते। एकाध बार हम साल में एक ही साख लेते हैं। दूसरी साख के समय जमीन की जुताई करके उसे खाली छोड़ देते हैं। ऐसा करने से जमीन की उर्वराशक्ति बढ़ती है। गेहूं की पैदावार हमारे खेत में प्रति एकड़ तीस मन के हिसाब से होती है और धान एक एकड़ में पैंतीस मन निकालता है। हम शुद्ध अन्न खाने के आदि हो गए हैं। इसलिए जितना अनाज हो जाए उसी में सबर कर लेते हैं। कुदरती खेती अपनाकर हमने कुछ खेया नहीं है पर पउया बहुत ज्यादा है। कुदरती खेती से जो अनुभव मुझे मिले हैं उनके आधार पर मैं बरत दावे के साथ कह रहा हूँ कि हमारी भूमि अन्नपूर्णा है। यह सिर्फ हवा, पानी और सूरज की रोशनी के सहारे ही उत्तम अनाज पैदा करने में सक्षम है। वतावरण में प्राणवायु की कमी और आबहवा बिगड़ने के कारण मानव समेत तमाम प्राणियों का जीवन सेकट में पड़ गया है। हमें याद रखना चाहिए कि जमीन केवल मनुष्यों को ही भोजन और आश्रय नहीं देती बल्कि दूसरे जीवों तथा वनस्पतियों को भी आहार और ठिकाना देती है। धरती पर आदमी के अलावा लाखों किस्म के जीव-जंतु और वनस्पतियों हैं। इनमें से प्रत्येक की सैकड़ों-हजारों नस्लें और किस्में हैं। यह जैव-संपदा हम और हमारी आगामी पीढ़ियों के लिए बेहद उपयोगी है। सजीव खेती एक मात्र ऐसी पद्धति है जिससे जल, मिट्टी, पर्यावरण और जीव-जगत का संरक्षण होता है। मेरे बिचार से हम प्राकृतिक साधनों के इस्तेमाल से धीरे-धीरे खेतों को ठीक कर सकते हैं। कुदरती खेती एक अच्छा विकल्प है।

Agricultural Sustainability: The key for Food Security and Rural Development

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The Indian agriculture is facing multiple challenges. For example, the challenges of achieving high productivity in less acreage, to feed the burgeoning population with low purchasing power, to increase the crop diversity targeted to reduce protein, mineral and vitamin malnutrition to face the unpredicted or less simulated shocks of climate change; global warming, drought and disasters and to enhance the income of the farmers as called by Hon'ble Prime Minister of India. The agro-ecosystems are severely degrading with lower soil carbon pool, lower soil microbial diversity and severe contaminations of toxic agro-chemicals, contaminating the entire food chain and have poisoned our food basket.

The success of green revolution has been limited to high yield of wheat, rice, maize, jawar etc. and availability of hybrid seeds for certain other crops including vegetables with high external input which have enhanced the input cost of cultivation. The seeds, fertilizers, pesticides, herbicides are quite expensive and become unbearable to the farmers, if the crop yield get lost due to some epidemic or disaster. In spite of subsidies on the irrigation and fertilizers, the farming is expensive within our agriculture economics in terms of net income of the growers. The market and prices are very uncertain and not in control of the producers.

The land availability for agriculture and horticulture is reducing generation by generation due to division of families or other reasons, hence the number of small scale and marginal landholders are increasing in the country day by day. The farm equipment and farm machinery are largely based on combustion of the fossil fuel and adding to the climate change related problems. The expenditure on hiring of these tools is increasing for the farmers, yet their owners are not happy with the income and expenditure involved at their end for its purchase, operation and maintenance. The wages of agricultural labourers are considered high by the famers and low by the labourers and this conflict between the two important operative partners of Indian agriculture is increasing day by day. The small farmers and labourers both are migrating to cities and metros for want of new jobs and new generation of the rural India is no more interested in Agriculture or Horticulture. Increasing man-animal conflict like 'Neelgaay' and 'Annagaay' problems in Uttar Pradesh due to diminution of forest areas, common grass lands and water bodies, which were the traditional home for the wild animals, have created a serious problem of protection of crops from the wild animals. Due to ever reducing common lands, grasslands, natural ponds and small forests the animal husbandry is also becoming difficult for the small farmers and agriculture labourers.

Agriculture consumes about 40-60% water for irrigation, which is getting more and more precious day by day. Water losses are increasing due to continuation of flood irrigation and increase in surface temperature.

The new technologies e.g. protected agriculture, bio-agriculture, new food systems, drip irrigation, small and medium size semi-mechanized renewable (largely solar) energy based agricultural machines and tools, multi-cropping of crops, contract and co-operative farming systems etc. have a good potential to sustain the Indian agriculture socially, economically and environmentally but the plans, perspectives and projects available in the government systems are not reaching to the farmers adequately. As a consequence the farmers are either getting distressed and leading towards mental illness, making suicide or leaving the land and moving to the cities. The irony of Indian Agriculture can also be seen in rapid increase in land prices and decrease in the net income of farmers day by day. The increasing aspirations of farmers' family for good food, good house, good education, good healthcare and good life style support is not getting fulfilled. The information technology has opened up the entire world on a handset and aspirations of each one rural or urban are increasing to grab more and more for the own comfort.

The growth of human civilization has faced its own unique challenges and questions and the intellectual and executive leaders of the time have solved it by their innovative plans and technologies. We have a shared responsibility to identify the challenges and questions of our own time and to address it by our innovative prospective and technologies.

Though we, in India, are facing these unique problems in the agriculture sector at present, the country has witnessed a tremendous progress in the growth of agricultural technologies after independence. The green revolution, white revolution, blue revolution, yellow revolution etc. are various names given by the planners and scientists time to time for the efforts made to enhance yield of cereals, milk, fish and oilseeds etc. in a more organized way. The impact of these efforts could add a lot to our empty food basket, but possibly it is not enough. The hybrid and gene technologies have also added a lot in bio-augmentation of crops, animals and microbes but some of these technologies have not been evaluated yet adequately for many serious social, economic, cultural, health related and environmental concerns and hence not accepted by the intellectuals in many sectors and society at large.

The Science and Technology has enormous potential for solving the problems of human world, but yet a more holistic approach is required to apply them in the current socio-economic and cultural context addressing the bigger challenges and questions of our time. Not only the technologies but concepts and methodologies of science are also to be exploited adequately.

The agro ecology needs to be restored and maintained with rich fixed carbon pool, rich biodiversity and rich culture of living together and helping each other for the agricultural sustainability and food security. The organic principles are solving these problems. The organic agriculture can reduce food toxicity, the toxicity of agro-ecosystems, and can generate more jobs in agriculture sector by providing local small scale production and marketing units for fertilizers, pesticides, farm tools, land irrigation systems, as backward linkages and sorting, packaging and marketing of products as the forward linkages. The innovations and applications of crop protection technologies can save the crops from disasters, odd environments, diseases and pests and wild animals. The multi-cropping of various crops suitable to such management and designing new agro-ecosystems for the crop combinations and soil systems suitable

to emerging markets is required. The fortified crops, non-saccharide sweeteners, medicinal and aromatic crops, new horticultural crops etc. can enhance the income of farmers provided there is proper technical and economic support from outside agencies and a stable and reliable marketing, agro-processing and product making system can be established. The conflict of agricultural labourers and farmers has to be resolved amicably on acceptable logics for both concerned. New innovative semi mechanized or solar based small and medium sized agricultural tools and machines are required to be developed and marketed. The small, medium and big cooperatives or contract farming companies are to be established and operated to increase the control of producers on market by maintaining the need and supply ratio. Food processing units may be established in rural areas to provide jobs to the rural youth and to restrict their migration to the overcrowded cities and metros.

The development of infrastructure, healthcare system, education and skill development, parks, green belts, good sanitation, art and creativity centres, culture and harmony centres, games and yoga centres, and healthy competition among the youth for games, cultural programs and debates etc. can make the rural destinations a better place to live.

Several government and non-government projects are operative in the rural area since independence. However, there are no transparent, independent and authentic impact assessment mechanisms. A good amount of money is allocated to each village in each plan. No one knows what sanctioned amount is, what mechanism of execution is and what net outcome is. There is no debate on its outcome or succession. The continuous evaluation and socio-economic and environmental auditing of each penny of the expenditure made can reduce the anarchy, mismanagement, corruption and ambiguity in outcome of the public expenditure made for the rural development. We need to look into it more seriously to have a better future for the rural India.

Facilities for testing of Post-Harvest Machine and Foods at ICAR-CIPHET

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ICAR- Central Institute of Post-Harvest Engineering and Technology (CIPHET) was established on 29 December 1989 at the PAU Campus, Ludhiana, Punjab, India as a nodal institute to undertake lead researches in the area of the Post-Harvest Engineering and Technology appropriate to agricultural production catchment and agro-industries. The institute's second campus was established on 19 March 1993 at Abohar, Punjab, India, which is primarily responsible for conducting research and development activities on fruits and vegetables, and commercial horticultural crops. CIPHET is also headquarters for two All India Coordinated Research Projects (AICRPs) viz. AICRP on Post-Harvest Engineering and Technology (PHET) at 31 Centres and AICRP on Plasticulture Engineering & Technology (PET) at 14 Centre's. Mandate of the institute are conducting research for solving problems and identifying technologies related to post-harvest loss assessment and prevention, processing, value addition and storage of agricultural, horticultural, livestock, and aquaculture produce targeted to achieve food safety and quality assurance. Besides this infrastructure ICAR-CIPHET has two major facilities for testing of post-harvest machinery and testing of foods:

Post-Harvest Machinery and Equipment Testing Centre (PHMETC)

The PHME testing centre was approved by Dept. of Agriculture & Co-operation, Ministry of Agriculture and Farmers Welfare on 15th July, 2015 at ICAR-CIPHET, Ludhiana with fund assistance of Rs. 1.42 crores. The main objective of the Testing centre is to test the new Machines and Equipments developed by industries engaged in the field of Post-Harvest processing of agricultural produce. Besides, to identify and educate the potential PHT machine and equipment among manufacturing industries and to develop entrepreneurial skills to manufacture quality, high efficiency, low energy and compact machines to meet the national and international standards. Testing of about 40 machineries have been received from 10 different companies and commercial test reports of the machines have already been released. The testing team comprises of agriculture process engineers supported by technical persons. The request received so far for testing of different post-harvest machinery mainly includes dryers of different capacity, cleaner cum grader, Flour mills, dehullers, dehuskers etc. Total revenue of Rs. 30 lakhs have been generated from the testing of machineries and equipment's till date.

Food Testing Laboratory

Ministry of Food Processing Industries approved the setting of FTL lab with financial assistance of Rs.2.20 crore on 23rd August 2011. The laboratory houses around 30 no of instruments which include basic and some of the semi-advanced equipment for food analysis and evaluating the safety aspects of food products. This laboratory catering to the food testing and quality analysis requirements of different stake holders,

**Commercial Machine and Equipment Testing Charges/Fees at PHTME Testing Centre,
ICAR-CIPHET, Ludhiana**

S.No.	Name of the Machines/Equipments	Amount (Rs.)		
		Operated with Electricity	Operated with Tractor	Operated with Fuel
1.	Grain Dryer (Stationary/Mobile) (Capacity: 1-5 t/ha)	202063	234501	208071
2.	Seed/Grain Cleaner/Grader/ Cleaner cum grader/ Destoner, Mobile Grain Cleaner/ Grader (Capacity: upto 2 t/ha)	97707		
3.	Mini Dhal Mill (Capacity: upto 150 kg/ha)	97707		
4.	Grain Cleaner cum Dryer with or without Treater (Capacity: 1-5 t/ha)	202063	234501	208074
5.	Opo Corn Machine (Capacity: upto 100 packets/ha)	37018		
6.	Potato/Banana Chips Making Machine (Capacity: upto 100 kg/ha)	37018		
7.	Mini Rice Mill/ Double Rubber Sheller/ Air Cooled Polisher cum Broken Separator (Capacity: upto 1 t/ha)	103719		109730
8.	Mini Oil Expeller/ Extraction plant (i.e. oil seeds such as soybean, mustard, groundnut, sunflower etc.), Capacity: upto 500 kg/ha)	130938		
9.	Areca nut Dehusker (Capacity: upto 500 kg/ha)	91696		
10.	Chilli/Masala Pounding Machine (Capacity: upto 20 kg/ha)	43029		
11.	Hammer/Beater Type Pulverizer Machine (Capacity: upto 100 kg/ha)	63996		
12.	Flour Mill Machine (Attrition/ Burr Mill) (Capacity: upto 50 kg/ha)	49714		
13.	Grinding Mills (Capacity: upto 300 kg/ha)	97707		
14.	Rawa/Suji Grinder Machine Plate Type (Capacity: upto 20 kg/ha)	39735		
15.	Sugarcane Crusher having Double Roller (Capacity: upto 200 litre/ha)	37932		
16.	Sugarcane Crusher having Triple Roller (Capacity: upto 1000 litre/ha)	97707		
17.	Papad/ Roti/ Chapati Rolling/ Making Machine or with Electricity (Capacity: upto 300 No./ha)	39735 (Operated manually also)		
18.	Semi-Automatic Papad/ Roti/ Chapati Plant (Capacity: upto 100 kg/ha)	102661		115885 (Operated with Gas+Electricity)
19.	Vermicilli Machine (Capacity: upto 50 kg/ha)	48103		

Note: 1) Testing with additional crops/materials using tested machine/equipments will be charged @ 40% of original fees charged for testing the machine/equipment.

2) Raw materials required (about 5 times of machine capacity) for testing machines/equipments has to be provided/ supplied by concerned firms on their own cost.

entrepreneurs in getting their samples tested at the new establishment. Some of the major equipment available in the laboratory is Atomic absorption spectrophotometer, Amino Acid analyser, Gas chromatograph, Thermocycler, Gel Documentation system, Microwave digestion system and instruments for proximate analyses and milk quality (Fat, and SNF). These instruments are essentially required for carrying out proximate of raw and processed foods and nutritional composition microbiological contamination of foods water quality testing. Testing protocols for certain parameters like, fat, protein, moisture ash and fibre analysis, mineral contents etc. have been validated. This facility will enable the institute to answer the need based test requirement for processors, entrepreneurs, small and medium enterprises and industry of Ludhiana district and from other parts of Punjab at reasonable testing charges. The institute is under the process for getting NABL accreditation, and soon this laboratory will be playing a vital role in the northern part of the country in food testing and analysis.

Information for Customer/ Clientele for testing work

Interested stakeholder, customer can contact us through e-mail and submit request for the test parameter that is to be tested by the laboratory along-with the details of the sample, viz. sample no. test standard to be followed and other requirements. The suitable testing charges needs to be deposited for the testing work which will be informed to the customer, prior to accepting the samples for the testing work.



Grass Roots Research & Creation India (P) Ltd
An ISO 9001:2008, 14001:2004 & OHSAS 18001:2007 Certified Co.
Accredited by QCI/NABET: Approved by MoEF&CC, Govt



ATAL INCUBATION CENTRE (AIC) - GRC INDIA
Innovation Hub (under the aegis of NITI AYOJ, Government of India)
Creating Sustainable Ventures From India



GRC Green E-Com India Pvt Ltd
B2B E Commerce Marketplace -Building a world of difference by promoting green technologies



EIA Environmental Consultancy including EIA/EMP
State-of-the-art Environmental Consultancy Services in India



Environment Lab Monitoring and Testing Services
GRC India Training & Analytical Laboratory) duly accredited by NABL and recognized by MOEF&CC
Environmental Testing & Compliance Monitoring covering Ambient Air Analysis, Water Analysis, Soil Analysis and Noise level analysis



Janma Bhoomi-Karma Bhoomi
Connects donors, companies & NGO's in all the 712 districts of India to join hands & extend support for a social cause of their choice & contribute to the place of their origin / workplace.

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Grass Roots Research and Creation India (P) Ltd. (GRC India) continues to be the leading environmental consultancy organization in India with ISO 9001:2008, 14001:2004 & OHSAS 18001:2007 certification. The set up was established by a team of dedicated professionals with the core objective of providing a wide range of research and consultancy services in diverse areas of environmental science & technology.

The expert team of GRC India consists of 'in-house' and 'on panel' experts and professionals, which include environmentalists, engineers, scientists, sociologists, economists, statisticians, town planners and distinguished personalities from other functional areas. While the company is registered at New Delhi, its corporate office is located at NOIDA (U.P). The regional offices of GRC India are located at various places across the country.



GRC India is a multidisciplinary consultancy organization for environmental studies. It has been accredited by Quality Council of India/NABET (QCI) under the aegis of Ministry of Environment, Forest & Climate Change (MoEF&CC), GOI. Supporting the EIA firm is our in-house Environmental Laboratory (GRC India Training &

Analytical Laboratory) duly accredited by NABL and recognized by MOEF&CC. We are currently accredited in 17 sectors for conducting EIA related studies and other Compliances that come under the purview of EIA notification. GRC India has undertaken more than 5400 projects in the field of EIA/EMP, Compliances and other regulatory studies. Email id: bd@grc-india.com



GRC India is among the very few private organization that has been selected by Atal Innovation Mission (AIM) to set-up AIC under the thrust areas "**Renewable Resources & Environmental Sustainability**". AIC at GRC India will nurture innovative start-ups

to become scalable and sustainable enterprises. The AIC will provide world class facilities, coupled with the availability of mentors, business planning support, access to seed capital, industry partners, trainings and other relevant components required for encouraging innovative start-ups. To associate with AIC at GRC India as Mentor, Investor, Strategic Partner, do mail us at vijay.vir@grc-india.com



EcoTechMart is India's first B2B marketplace for **Sourcing & Procuring** sustainable Building Materials, Products, Technologies & Services with the commitment to provide the best price, on time

delivery, top quality & quantity of materials. We have built our platform to help our customers with requisition management, procurement, fulfillment & analytics. In addition, we help with securing credit via banks and financial institutions. We are presently live with the beta version of supplier module and had started on boarding the sustainable building products/materials/technologies brands & suppliers to our platform. Please register your entity with us through this link, <http://seller.ecotechmart.com/> or mail us at vijay.singh@ecotechmart.com.



HelpBharat is an online philanthropy platform built on the principle of "**Janma Bhoomi - Karma Bhoomi**" that connects donors, companies & NGO's in all the 712 districts of India to join hands &

extend support for a social cause of their choice & contribute to the place of their origin / workplace. This concept essentially implies that we shall strive to repay our onus towards "**Janma Bhoomi**", to which we owe our existence through the resources we attain through our "**Karma Bhoomi**". This online platform will be in line with the "**Digital India**" initiative of Hon'ble Prime Minister of India. For more information on associating with helpbharat.org, please do write to us at info@search-foundation.com.

**Agricultural & Social Services for Upliftment of Rural Economy
(ASSURE FOUNDATION)**

Regd. under section- 7(2) of companies Act-2013. Section 8 license no. 107204
CIN No. U01110DL2016NPL301935

Master Development Plan



Accelerating Rural Economy..

Think of doing something in Village which are needed in other villages and cities

*An Initiative by Technocrats, Social Scientists, Health sector Professionals
and Management Wizards*

**“Initiate, Intervene and partner in developmental and economic initiatives to realize
Happy, Healthy and Satisfied life in Rural India”**

**Methodological interventions with Human Centric Approach and
initiatives for planning and development in rural areas, by the people
themselves, under the guidance of right knowledge, skill and support
is simply irresistible**

Identifying and Problem Solving

- Identify village
- Initiate Quality Circle Group
- Enroll the group as member
- Initiate Discussions
- Identify Problem and solutions
- Finalizing/ Prioritizing actionable
- Forming hand-holding group
- Meeting of QC group, Experts, Non - resident, Hand-holders and Govt officials.
- Finalizing Action Points
- Selecting Action Groups
- Resource Management
- Initiate actions
- Review & change, where needed
- Attaining success

KEY OFFERING

1. QC group formation
2. Backward and Forward linkages
3. Development of Entrepreneurship
4. Education, Health, Cleanliness
5. Organize non-resident's help
6. Investors
7. Help of Govt. Schemes
8. Reliable development partnership

Key achievements of Team

The team is well experienced in farm development, Irrigation, Post-harvest, Value addition, entrepreneurship development and supply chain management.

If you are group of 6-12 ambitious person interested in development of village and your development

Contact Us

**Agricultural & Social Services for Upliftment of Rural Economy, Foundation,
(ASSURE FOUNDATION)**

Phone: 011-28041073, +919910491556

E-mail: assure@assurefoundation.org

website: <http://www.assurefoundation.org>

RURAL DEVELOPMENT MOVEMENT

Foundation realizes that each village is unique, important and critical for overall development of India. Therefore, plan of development of village should be designed supporting culture and traditions. It should be participative and inclusive. Experts, Government and Society shall partner through knowledge and skill with physical, financial and moral support. The Foundation plans "QUALITY CIRCLE CONCEPT" for participative and inclusive developmental

क्या क्या जा सकता है.....?

- उत्पादन समूह या व्यक्तिगत उद्यम।
- कृषि कार्यों में यांत्रिकरण
- आदानों (देशी खाद, बीज वगैरह) को बनाना।
- दुग्ध उत्पादन और प्रसंस्करण
- गोबर गैस, खाद और ऊर्जा
- कटाई और कटाई बाद की क्रिया
- प्रसंस्करण और मूल्यवृद्धि
- गाँव के नाम उत्पाद की ब्रांडिंग।
- स्वास्थ्य, शिक्षा और रोजगार उद्यमिता विकास से
- अनिवासी ग्रामीण विकास में उत्प्रेरक बनें।
- गाँव में ग्राम उत्सव और अनिवासियों की सहभागिता।
- जैविक खाद और कीट नियंत्रक
- टिश्यू-कल्चर केला
- फूल की खेती
- शब्जी की खेती
- बीज उत्पादन
- बी कीपिंग
- आटा, चावल और दल बनाना
- गुड बनाना
- एकत्रीकरण और बेचना
- और बहुत सारे उद्यम

Bee Safe Farming Solutions

V.K. Singh

Managing Partner at Bee Safe Farming Solutions, Ghaziabad

Email: bks.Bee Safebiologicals@gmail.com

Bee Safe Farming solution strives to improve the supply chain linkages between farmers, input suppliers and the food consumers and agri-business companies, allowing for greater transparency, traceability, safety and profitability for the farmers and all stakeholders in the food chain. All Bee Safe cultivation solutions promote residue free farming practices with improved socio-economic and environmental benefits.

The primary objective of the company is to share technical knowledge and good agricultural practices with farmers, enabling the use agri-products which meet the environmental and food safety standards of the markets. The focus area is the cultivation of residue free high value crops in an environmentally safe and sustainable approach to farming and improved farm profitability.

Bee Safe package of practices for cultivation are anchored by the use of Bee Safe labeled bio-inputs. Bee Safe bio-inputs have been developed in partnership with a leading biological research organization.

Bee Safe cultivation package of practices emphasize that dependence on chemical derived inputs is expensive, not sustainable and Bee Safe's focus is to replace current farming methods with environmentally friendly and sustainable production practices.

Our on-going efforts on out scaling innovations, introducing climate smart technologies, farmer training, reorientation of extension systems and making sure all our farming practices are safe for the honey bee are just a few of the examples which we believe are necessary for Indian farming to remain globally competitive in an environmentally sustainable manner.



SUPER CROP SAFE LIMITED – An Overview

Super Crop Safe Ltd enjoys the unique distinction of having strong brand equity in agrochemicals and Bio fertilizers. Built on a foundation of trust and respect for quality product are increasingly recognizing the mutual benefit of distributors and farmers working with Company.

Domestic agri-inputs focus on developing strong brands backed by quality supply for the Indian market. These are high performance, high potential, early stage products, which Super Crop Safe Ltd enjoys early entry benefits.

The domestic agri-inputs operation has shown consistent growth over the past few years and all this was possible with continuous farmer connect initiatives, strong and extensive distribution capabilities and professional marketing team with experience and straightforward and transparent dealings with all stakeholders.

In line with Government Organic Farming initiative the Company has started its Bio-Technology Division for research and development work in the field of Organic Farming and development of organic fertilizers. At Bio-division of the Company VAM, Mycorrhizal Bio-fertilizer with brand name **SUPER GOLD** is developed and commercially marketed. SUPER GOLD is licensed product for which production from root level to formulation is developed in Bio Division, which is done by only few Companies in India. It increases roots in crops and increases reach of roots to absorb more fertilizers and water which remains untouched otherwise. Use of this product will reduce the use of chemical fertilizers and water that will result in low cost farming to Indian farmers.

Super Crop Safe Limited enjoys the unique distinction of having strong brand equity in agrochemicals and Bio fertilizers. Built on a foundation of trust and respect for quality product are increasingly recognizing the mutual benefit of distributors and farmers working with your Company.

Domestic agri-inputs focus on developing strong brands backed by quality supply for the Indian market. These are high performance, high potential, early stage products, which Super Crop Safe Limited enjoys early entry benefits.

ORGANIC FARMING

Organic farming preserves soil quality and diversity in crop production and avoids hazards to the environment on a long-term basis. Organic farming to sustainable agriculture has benefited farmers. The certified cultivated area under organic farming has grown but, still, the total area under organic farming is insignificant compared to the net sown area. Against this backdrop, to provide a major fillip to organic farming in India, the existing components of organic farming under the NMSA have been put together under a new programme called “**Paramparagat Krishi Vikas Yojana**”. The programme envisages development of 10,000 organic clusters and provides chemical-free inputs to farmers and increase the certified area by 5 lakh hectares within a period of 3 years.

The domestic agri-inputs operation has shown consistent growth over the past few years and all this was possible with continuous farmer connect initiatives, strong and extensive distribution capabilities and professional marketing team with experience and straightforward and transparent dealings with all stakeholders.

GLIMPSES OF RESEARCH AND DEVELOPMENT WORK UNDERTAKEN AT BIO-DIVISION

The Company has diversified into Microbial biotechnology (Mycorrhiza, Spirulina) and further our need-based R & D is going on to develop sustainable Botanicals and active pharmaceutical ingredients (API) for Ayurvedic, Herbal and Microbial Therapeutics (Nutraceutical & Nutri-therapeutics). Products developed because of this R&D activity will be marketed with the existing strong marketing network of the Company.

Products Developed

- 1. Mycorrhiza VAM (Vesicular Arbuscular Mycorrhiza)** - a complete Biofertilizer, under the brand name Super Gold The main benefit of this, to the farmer is, it reduces the dose of phosphatic fertilizer by fifty percent, and hence there is no any additional expense. It increases the yield up to 20 percent besides many other benefits to improve the soil structure, pH & maintaining the rhizosphere microbial community, organic carbon (OC) responsible for the optimum C:N ratio an index of soil fertility.

Mycorrhiza (VAM); an important component of soil life and soil chemistry, responsible for nutrient mineralization, solubilisation particularly (P, Zn, Fe, Mg, Mn, Mo, Cu Etc...) transports developed as Granule, Powder and Liquid Bio - Fertilizer for sustainable agriculture, horticulture and plantation.

Mycorrhiza (VAM) increases 10 - 100-fold roots potential to absorb the nutrient from rhizosphere and imparts natural defence against various pathogens. It reduces the use of chemical fertilizer up to 50% and enhances the yield up to 40% of plants. A consortium of natural companion species of Glomus developed and being produced by nurse culture approach. Further our R & D have strengthened it as Super Gold with MHB (Mycorrhiza Helper Bacteria) - a consortium of 14 in-house sturdy isolates for N, P, K and Zn which make our formulation a UNIQUE of its kind.

- 2. Spirulina:** Dietary supplement under the brand name Superlina

A highly nutritional and therapeutic micro-algae; Protein 60 % (approx.) hence a good admixture of food supplements for malnutrition. High Concentration of Iron, Calcium, Phosphorus, Potassium, Zinc, Selenium and Iodine works well for iron deficient children, pregnant women. Good for cardio vascular disease due to potassium (k) and rheumatism due to selenium (Se). Rich in Antioxidants by virtue of higher concentration of Vitamin B12, Beta-Carotene, Phycocyanin and Polynuclear Aromatic Hydrocarbon (PAH) help to work as blood purifier hence antiaging.

Besides this: Abundance of Energy, Strengthen Immune system, inhibit allergic reaction, Fight obesity, improve muscle strength and Endurance, Control Blood Sugar level, Keeps skin healthy etc.

- 3. Super Wonder:** A super protector against pest and disease SUPER WONDER is a biological insecticide based on botanical extract produced by Nano technology & formulated as balanced poly-botanicals WS (Water Soluble Concentrate) with nano concentration of Co-factors for plant defines enzymes.

Actions: Protect from sucking pests Like, Aphids, Jassids, White Fly, Thrips, Mites etc and fungal pathogens (Mildews, Wilt, Damping off, Leaf spot etc). It has ovicidal effects. Minor insect is easily killed by different natural plant extracts. Besides Poly-botanicals, the extract contains various natural elements responsible for the growth of the plants. Boost crops immunity and over all biomass hence yield.

Products Under Development

4. Soil Reclaim: Reclaim Alkaline & Sodic Soil

Plant absorbs nutrition at pH ranging between 5.5 to 7.5. Above pH 7.5 are alkaline whereas below pH 5.5 are acidic. Both the conditions are unfavourable for crops growth and development. Degraded alkaline soil is called sodic soil since there is no exchangeable calcium (Ca), pH is more than 8.5. Seven million hectare of Indian soil is either alkaline or sodic hence non-productive for crop. It is a great challenge for scientist to reclaim these soils. We are at the verge of development of a combination of natural alkaline / sodic microbes with green chemicals having great potential to reclaim it slowly.

Bio-resources conservation and sustainable utilization as per National Biodiversity Authority (NBA) is an important regulation guideline to be followed while working in this arena, however since we have already ventured into Microbial Biotechnology (Bio-fertilizer, Bio-fungicide & Bio-pesticide), we have decided to develop a state of the art R & D institution to develop cell as bioreactor, a recent trend in biotechnology to develop chemicals, pharmaceuticals & therapeutic molecules in-house in completely closed/controlled environment without any hazardous waste hence with green chemistry approach.

The endeavour includes the

- Development of In-house medicinal plants garden Development of High-tech nursery for mass propagation
- Development of Plant Tissue Culture for mother stock
- Development of Cell line approach to produce API's
- Development of nutritional & therapeutically important yet un-explored bio resources

Outlook

The agrochemical industry has seen structural changes on the back of relative increase in purchasing power of the farmer largely and to a certain extent on account of enhanced farm dynamics. The cost benefit of usage of pesticides has improved with continual increase in MSPs and the changing food habits

of the rising middle class. Higher labour cost has also given boost to agrochemical consumption in the country. As a result, agrochemical industry has witnessed sustained growth in the last decade, driven by volume growth as well as change in product mix followed by pricing growth. The Government of India, together with several private players continues to take incremental efforts to push higher penetration of agri-inputs in India. Within agrochemicals, fungicides and herbicides are expected to show healthy growth on the back of increased acreage under horticulture, rising horticulture produce prices and emergence of organised retail (largely used in fruits and vegetables).

About RASSA

Science-led interventions hold the potential for development of people can show it's impact only when it reaches the right hands timely. Efforts from all responsible organizations and citizens including Government is needed to ensure that the potential of scientific innovations is realized for the benefit of the masses, to improve their income and living conditions. **Royal Association for Science-led Socio-cultural Advancement (RASSA)** is a group formed as All India basis by like-minded Scientists, Technocrats, Business persons and other luminaries to facilitate the noble goal for overall advancement of the people in a sustainable manner protecting natural resources and ecosystems.

Foundation stone of RASSA was laid in the very first meeting on such luminaries held on April 09, 2016 at New Delhi to act as bridge between the scientific research and general people in society to ensure development at faster pace. After a long deliberation on characteristics of conceptualised society held at Varanasi and Lucknow, RASSA has finally been registered on October 24, 2016 at New Delhi as a National Society for serving the science and people. The prime focus of RASSA is to help the students and the elderly in every manner to help the society more peaceful and trustworthy.

Vision

To create a strong and coherent society sensitive to the social, cultural & educational needs to serve the society adopting science-led approaches.

Mission

To engage like-minded intellectuals in serving the society though science-led interventions

Objectives

- To create a platform for likeminded people for the sustainable advancement of the society.
- To promote the educational and economic well-being of people by formulating plans and creating interest for entrepreneurial activities.
- To mentor and provide support to bright young individuals from less unprivileged section of the Society.
- To help to business professionals to setup and run their businesses in emerging fields.
- To organise conferences, meet, fare, Kisan Gosthi, etc., to update the community on science-led techniques
- To publish a multi-disciplinary journal and Sandesh for farmers and stakeholders.
- To explore and nourish social and cultural heritage for idealistic development.

Website: www.rassa.org.in **Email:** royal.association2016@gmail.com