

High-tech Agriculture for Prosperous India ¹

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Good morning Ladies and Gentlemen,

I must first of all thank Dr. R. C. Maheshwari, the Vice Chancellor of this University and my very dear friend for inviting me to be the chief guest at this function. As you all know Dr. Maheshwari himself has made very important contributions both as a researcher and as an administrator and so when I received the invitation I immediately accepted it because it gave me an opportunity to meet him and also see the wonderful work of this University.

Today world over people are celebrating Environment Day which is basically to improve the environment around us. Different people have different definitions for Environment.

However I consider environment improvement as nation building. It is the enabling environment which makes you feel happy to live in, work in and just be a part of it. This environmental happiness also gives us a sense of belonging, makes us feel proud of our surroundings and gives us a sense of ownership. If we create a happy environment for our work and living then we will make India a great place to live. Each one of us should therefore work towards improving our immediate environment so that it becomes nice and cheerful. Then we will genuinely be proud to be a part of it.

However this environmental improvement can only happen when 60% of our rural population is brought into mainstream development.

¹ A talk given as chief guest to celebrate Environment Day at Sardar Krushinagar Dantiwada Agricultural University, Gujarat. June 5, 2010

It is a sad state of affairs that even 62 years after independence most of our rural population lives in primitive conditions. They have hardly any electricity; they cook on primitive chulhas which creates tremendous indoor air pollution and has not changed in thousands of years; and have no clean drinking water. Their lives are in darkness and somehow the modern technology has not touched them. There are estimates that nearly 1 million deaths take place every year in India because of indoor air pollution and unclean drinking water. Unless and until we as scientists, technologists and decision makers improve their quality of life, environmental improvement will not take place and India will not join the ranks of developed nations.

I believe that helping this 60% rural population is really nation building.

Since I am standing today in one of the premier agricultural universities of Gujarat I would like to share with you how agriculture can provide both food and energy security for India and can drastically improve the quality of life of rural population by creating wealth and employment.

However for this to happen there is a need to use high technology for rural applications. High technology allows the conversion of dilute locally available energy resources like biomass, solar, wind etc. into useful end-products and services. Our rural areas as you all know are blessed with enough resources of biomass, sun and wind.

Sophisticated technology allows the development of very efficient systems and this is what is needed in rural areas. In this process we need to follow nature and so the mantra of technology development should be biomimicry.

Natural systems have evolved into very efficient materials and energy converters. In this process, size of the system reduces and its efficiency and complexity increases. Some of our designs and technologies are following this strategy. For example, computer chips, cell phones, power plants, etc. are all becoming very efficient, small in size and complex. Technology developers should follow this strategy in developing rural technologies. In fact, much more sophisticated thought and "high" technology is required for solving rural problems since the materials and energy resources available are limited and often only available in "dilute forms". Thus the strategy of high technology allows maximum energy and materials to be extracted for useful end products.

I also think that as students of an agricultural university you should work in an agricultural area rather than management or banking. It is the technology and its appropriate applications, which provide solutions to mankind's problems. Only after the technology becomes available can you manage it. For rural areas the agriculture technology will not come from U.S. or Europe. We will have to develop it ourselves and some of our brightest minds should do it.

Farming for Energy

India produces close to 600-800 million tons/year of agricultural residues. Most of these residues are burnt in fields to solve the waste disposal problem. Not only does this create tremendous air pollution but this burning is a waste of an important energy source.

These agricultural residues can theoretically produce via lignocellulosic conversion about 150 billion liter/year of ethanol which can take care of about 50% of India's total oil demand. Similarly if we go via pyrolysis oil route then it can provide around 80% of India's diesel demand. Pyrolysis oil is produced by rapid heating of biomass to 600-700°C and quenching the smoke rapidly to produce oil. This oil with suitable modifications is very close to diesel in characteristics.

Alternatively if these residues are burnt in the biomass-based power plants then they can produce close to 80,000 MW of electricity or nearly 50% of India's total installed capacity. Biomass power plant technology is very well developed and there are close to 91 plants in India with installed capacity of about 500 MW.

Thus the use of residues for energy production can substantially ease India's present energy crisis and can be a Rs. 2 lakh crore/year industry. At the same time the use of biomass for energy production can also produce about 50 million jobs in rural areas.

Thus farming for energy can not only create huge wealth in rural areas but can also solve India's energy problem. This will lead to prosperous India.

For this to happen two things are necessary. Firstly farmers need to be paid for the agricultural residues.

It is a peculiar aspect of farming that only 25-40% of its produce fetches money and the rest 60-75% are agricultural residues and have to be discarded. No industry can run on such norms where 3/4th of its produce is not sold and in fact discarded. Yet for farming we accept these norms.

When agricultural residues are capable of producing very high quality energy like liquid fuels and electricity, they should be given very good price. Our estimates show that with proper pricing of these residues a farmer can easily earn about Rs. 5000 to Rs. 7000/acre/season by selling them for energy production.

Any marginal farmer can produce agricultural residues even if the main crop fails. The income from these residues can give him benefits even in the case of distress sale of his crop and this is the best hedge against farmers' suicides. I also feel that unless and until the farmer gets remuneration from his entire produce, farming will never become economically viable. This is an aspect of farming which should be understood by policy planners.

The second aspect of farming is the need for very high science and technology inputs in it.

Thus it is imperative that modernization of agriculture takes place. Presently most of the agriculture in India and other developing countries still exists in stone ages. There is very little mechanization and ancient agronomic practices are used. The problem has also been compounded by the fact that because of land reforms in India the land holdings have reduced thereby restricting the use of existing big and heavy farm machines. In fact this farm size reduction could be a boon in disguise since it can allow precision agriculture which can reduce inputs and increase productivity and is becoming popular in western countries.

Thus very extensive R&D is required for developing efficient farm machinery for small farms. This requires inputs from very bright young scientists and engineers. Presently all the bright students opt for engineering, medicine, MBA, etc. and so agricultural sciences and engineering do not attract them. Even if you have done engineering in presently fashionable fields like IT, Mechanical etc. you can help by joining companies which can produce good farm machineries and not join banks or financial institutes. This will considerably help in R&D in this sector and will be your contribution to society.

One of the major problems of farming today is that it is becoming very non-remunerative and hence farmers' children do not want to get into it. There is a general refrain that farming is not a dignified profession any more and that the sons of farmers are not considered to be a "marriageable commodity"! Besides being uneconomic, farming is also hard work. By developing high technology farming equipment like small combines, harvesters, baling machines etc., it is quite possible that farming can be made less labour-intensive and more attractive to younger generation. As we have seen before, with production of energy from agriculture, farming can also become very remunerative. At the same time if some of you bright agriculture scientists and engineers from premier institutes go into farming then the rural youth may emulate you. Also very concentrated effort needs to be made by the advertisement agencies to make it glamorous. Once farming becomes remunerative it will also become glamorous!

Water Issues

However, for farming to increase so that it can bear the load of food and energy production, adequate water supply has to be ensured. To my mind supply of adequate water to rural areas and poor regions of the world is a much bigger challenge than even energy availability, and where you engineers and technologists like you can play an important role. I feel that rainwater harvesting technology, and management should be a compulsory minor in all agricultural universities and colleges. With your education you can help not only in agriculture but also in watershed development.

With the coming of green revolution in India, there has been an extensive use of water, resulting in shortage in some parts of the country. Not only is there a water shortage, but lack of clean potable water results in millions of deaths every year due to diarrhea. This is despite the fact that there is enough rainfall. Every year India receives ~ 4000 billion cubic meters of rainfall, whereas the present yearly water consumption is only 650 billion cubic meters or 16% of the total rainfall. Thus theoretically we have enough clean water, but the rainfall is not evenly distributed over India and it comes in short spells, thereby pointing to the need for rainwater harvesting and storage programs.

However, the issues of rainwater harvesting and its supply to the community in rural areas raise a question of who will own the water bodies. This is a touchy issue and quite a

few developing countries are grappling with it. I feel there is a need for the local governments to develop policies so that rural water utilities can be set up which can harvest the rainwater, store and clean it and then supply this water to a village throughout the year. These water utilities may also be able to buy water from the government through the existing canal system. Presently, all the water utilities in India are owned by the government and this leads to corruption in supply of water and its very inefficient usage. In 2003, the Government of India passed a revolutionary electricity act allowing for the first time the private players to produce, sell and distribute electricity anywhere in the country. This act has allowed power producers to break free from the clutches of inefficient and corrupt government power utilities. I feel a similar water act will help in the efficient supply of water to rural areas.

Sustainability Issues

One of the best ways to improve environment is to live sustainably. Environment and sustainable development go hand in hand.

One starts living sustainably when we reduce our greed for resources and materials. This can be facilitated by spirituality, which helps us become internally secure and less greedy. The way the whole world wants to emulate the unsustainable life style of Americans will spell doom to the world. For example an average U.S. citizen consumes about 350 GJ/person/year whereas an Indian consumes only 18 GJ/person/year. If every citizen of India lives an American lifestyle then the whole world's energy resources will only be used by India.

I believe that it is possible to live a decent and emotionally satisfying lifestyle by using 50-70 GJ/person/year. This will put much less pressure on earth's resources besides reducing substantially the environmental pollution.

Thus high technology for farmers together with living sustainably has to be the mantra of development for rural areas.

I do hope in this short talk I have been able to give you a flair for what high tech agriculture can do for India. I believe that in introducing good science and technology for agriculture we can help the farmers.

I strongly feel that when the farmers are neglected the long term sustainability of the country is threatened. When farms produce both food and fuel then their utility becomes manifold. In India 65% of its population depends on farming and with energy from agriculture as a major focus, India has the potential of becoming a high-tech farming community. This will help improve the rural environment and create better India.

Thank you.

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Dr. Rajvanshi giving his talk



Dr. Rajvanshi receiving the memento from Vice Chancellor Dr. R.C. Maheshwari

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