

Farmers-Scientists Partnership
For
Sustainability, Bio-Diversity and Environment Purity.

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1.0 **Research in Agricultural and Allied Sciences**

The scenario in Agriculture and Allied Sciences appears fantastic, fascinating and frightening at this stage of human history.

- **Fantastic** because research has provided genetic materials and production techniques that brought about manifold increase in food production, food processing, storage and preservation. Genetic engineering to manipulate genome may produce plants/animals with higher resistance to pests and diseases and more vitamins and proteins to increase nutritional value of food.
- **Fascinating** because bio-technology is opening new vistas and creating new materials which till recently were in the realm of science fiction. Cloning of animals is full of marvels and humanity is overawed.
- **Frightening** because knowledge has overtaken wisdom and organized knowledge- science- has started controlling and directing human behavior. It is being increasingly realized that Reductionist science based development is not sustainable ecologically, socio-economically and financially

Economic growth entails much higher ecological and environmental costs; the nature has been forced to produce more but its capacity to absorb and neutralize toxins is being jeopardized.

Bio-diversity, the nature's insurance system, is being damaged irreversibly. Disastrous bio-spheric damages are discernible. The prospects of 'designer baby', genome modifications and genome mapping may throw up horrible challenges of bio-ethics. A report on "Genetic Information and the Workspace" which Mr. Al Gore, U.S Vice President released, stated that by the

year 2000 about 15% of prospective employers in U.S plan to check the genetic status of the prospective employees before making job offers. We may have new social outcasts, not wanted because of their genes. Mr. Gore highlighted the need of federal legislation to bar employers against genetic discrimination.

A stage has reached when we should pause, look back and around and analyze advantages and disadvantages of the current trend and collectively charter a new path.

2.0 **Basic Features Of Current Scientific Research: Appropriateness and side-effects**

- 2.1 **The Ideal Type:** The central point of the scientific agriculture is the "Ideal Genetic Type", identified by the process of selection, on created by breeding, hybridization or generated through induced mutation. This ideal type has genetic-potential to produce more grains, milk, meat or any targeted product. The high-yielding varieties (HYV's) attract farmers for their productivity and profit and thus get spread over larger areas replacing all the low yielding, non-descript local varieties, which the nature has created in every region over centuries through the process of evolution.

The obvious trend leads towards mono-culturing reducing bio diversities and in extreme cases even extinction of breeds and varieties. The danger is obvious: if the natural or mutated pests and pathogens cause epidemics, the narrow range of ideals types may be eliminated causing genetic vacuum with disastrous consequences. Sometimes it is argued that resistant breeds and varieties can be bred. But it is also true that pathogens also mutate rapidly, many times faster than man made gene altered plants/animals.

Moreover, not only the nature's insurance system through bio-diversity is being damaged but symbiotic relationship among different diverse entities operating in bio-diversity is also adversely affected. The scientific community is seriously concerned with damage to bio-diversity.

The bulk of earth's biological diversity is located in developing countries where indigenous people and small

farmers live and practice agriculture as way of life. Parents could create market monopolies over biological resources and exclude the original innovators from their rightful access to local, national and global markets. A farmer who grows a maize and wheat variety protected by industrial patent will be obliged to pay royalties to owner of such intellectual property rights. India is already forced to contest claims of other countries for patent rights over chickpea, Basmati rice, neem, amla, jar-amlam etc.

2.2 The change of environment for exploitation of genetic potential:

Once the ideal type is planted in soil, change the environment so that full genetic potential is expressed in high yields:

- (i) Apply chemical fertilizers to improve nutrients in the soil at right time, in right amount, in right manner. This leads to intensive use of chemical fertilizers.
- (ii) Apply irrigation to create ideal moisture regime for expression of genetic potential. Thus ideal moisture and nutrient condition are created for ideal geno-types. The implication is that on vast rainfed agriculture lands, which constitute about 70% of the crop land, and where irrigation water is not available at right time in right quantity, this Green Revolution Technology has not succeeded.
- (iii) Apply Plant Protection chemicals to save 'ideal genotype' growing under 'ideal environment'. Ideal genotype under ideal nutrient and moisture conditions create profuse growth of succulent vegetation which is ideal food for pests and pathogens and build-up their massive population.

To protect the ideal type insecticides and pesticides are applied in liberal doses and many times. As the time passes the toxins keep on accumulating in the soil damaging microbial populations. Fruits and vegetables loaded with toxins are assuming alarming propositions.

2.3 **Standardization, mechanization and labor saving devices:**

The important concomitant feature of current research and development is being increasingly motivated by profit. Attempts are being made to standardize plants one height of trees, one time of maturity, similar size of fruits so that the use of machines in place of labor can be used and cost on labor is saved. In this phenomenon human and live stock labor is being replaced by tillers, tractors, harvesters and combines, threshers etc. This process has following socio-economic consequences:-

- Mechanization is not appropriate with majority of India's marginal and small farmers with fragmented holdings.
- Labor saving devices are not compatible with widespread unemployment and under-employment, particularly of landless agricultural labors which is causing tension and disturbing peace in rural areas and exodus to cities, already characterized by slums.
- Livestock is being pushed out of the agriculture which would have disastrous environmental consequences in arid and semi-arid countries like India.
- The biological nature of agriculture is made more mechanical and bio mass products are being moulded into assembly line outputs. What impact it would have on large human and livestock resources in India?

3.0 **Some macro level concerns for India:**

3.1 **Sustainability:**

The production environment, the productivity and the profit etc. are showing signs of unsustainability. The green revolution is "yellowing" and there is outcry for diversification and to limit intensification even in irrigated areas.

In commercial Agriculture of the Western developed countries the concern is even more serious. "LEISA-Low External Input Sustainable Agriculture is receiving increasing attention. Modern Economic Growth Model based on High yielding genotypes, high levels of chemical fertilizers and pesticides is being considered ecologically inappropriate, economically myopic and socially un-equitable.

3.2 **Side Effects:**

In irrigated areas rising of water-table and salinisation are causing serious concern. Not only valuable land is being affected and costly drainage schemes are proving problematic, health hazards like malaria, once unheard of in dry parts of Rajasthan, are being noticed.

Food, fruits and vegetable carrying residual pesticides are assuming serious proportion and there is premium price for organic food in western countries.

3.3 **Plight of rainfed farmers:**

The high input technology has not been successful in rainfed areas. Poor farmers who borrowed heavily for costly seeds, fertilizers, and plant protection chemicals are committing suicide when their cotton crops failed due to drought.

3.4 **Adverse effect on environment:**

Receding ground water due to over extraction and spread of aridity are hitting hard the poorer farmers where a few resourceful farmers or Corporations are raising irrigated plantation of teak, mango, grapes etc. Disappearance of sporadic trees from landscape for intensive cultivation is spreading aridity.

3.5 **Money the motive force for Research:**

In a market and profit propelled society the urge for research, is being motivated by lure of money. Private corporations and companies are hiring best brains for conducting research, patent product and process and monopolizing the natural endowment to humanity.

The original spirit of enquiry and quest for truth were motivation for enquiry and investigation for understanding the nature, its process, materials etc. Mendel the monk, the father of plant breeding was not motivated by money. He studied and crossed peas to satisfy his curiosity, the innate urge to know, to understand nature.

Our scientists in Research Institutes and Agricultural universities receive pay and perks much inferior to those of scientists working in corporate bodies. Still they are conducting high quality search.

Long term and social implications have got to be analyzed and considered. Much discussion and debate are needed. Many of our Universities and Research Institutes are operating on deficit budget.

3.6 **Distance and gap between scientists and farmers:**

With the advent of the state Agricultural universities, on the pattern of Land Grants Colleges of U.S.A Teaching, Research and Extension are being promoted as distinct and different disciplines. The extensionists have evolved as expert of communication between scientists and farmers. They work as salesman to sell the product of the Research to the users, the farmers. The direct touch between scientists and the farmers is blunted.

3.7 **Development system as an inert conduit of knowledge from Research Institutes:**

The subject matter specialist in state department mechanically receive technologies from Research and pass on to field workers to parrot the same to the farmers. Agricultural farms have been transferred to the universities and now development workers no longer need to soil their hands to make it dirty.

Thus direct contact between farmers and scientists is limited with a long chain of intermediaries.

3.8 **Innovation, trial and testing by farmers is muted:**

Farmers of today are overawed with marvel of materials produced by the researches and their fluency in language with overpowering communication skill.

For centuries innovative farmers tried and tested new techniques and selected new varieties in a natural way.

Their urge and motivation for innovation for their own research has been subdued and a dependency syndrome is overtaking them.

3.9 **The need for change:**

Fortunately many scientists are feeling the need for a change. Participatory Research or Farm Research etc. are attracting the attention of scientists and methodologies are being discussed and designed.

4.0 **The need is being felt. How to go about it?**

The purpose of this paper is to stimulate the debate for change and not to prescribe procedure. However following suggestions may constitute the basis of future discussion:-

4.1 **The Research Methodology:**

The reductionist science The first step in agricultural Research is thesis in partial fulfillment of Master's degree. A typical thesis consists of the following:

- (i) Introduction: Identification of the problem.
 - (ii) Literature: A review of research already done and of published papers.
 - (iii) Formulating possible solutions.
 - (iv) Develop a design to test the possible solutions which lends itself for statistical analysis.
 - (v) Conduct the research process.
 - (vi) Analyze the data.
 - (vii) Build-up hypothesis.
- In this process the problem analysis should not be done in the library. It should be done in the field with the farmers.
 - The chapter on Review of literature may not be compulsory in all the cases. Problems should be identified through studies and consultations with farmers.
 - The need for Replications may also be modified.

Thus the first step should be to enable direct contact with future scientists and the farmers.

4.2 **P.G Apprenticeship:**

After Master's Degree and before start of Research for Doctorate at least one year should be spent with the farmers in the village on the pattern of house job for medical students or of Industrial Apprenticeship. Good financial support should be provided to enable future scientists to stay in the village.

5.0 **Participatory Research:**

All the Research scientists in Institutes and Universities should engage themselves with the following: -

5.1 While campus based laboratory research is essential for advancing basic research at least half to one third time should be spent in participatory research on the field of the farmers.

5.2 Farming systems Research:-Instead of disciplinewise research, teams of agronomists, horticulturists, animal scientists, economists and sociologists should conduct farming system research for identified households.

5.3 **New systems of design and analysis:**

This is a challenge that scientific community would have to meet for developing new research design and analysis procedure for complex systems. This is a difficult job and would require a change of mindset as methodologies which have so far been evolved for specialization and simplification would have to change.

Farmer is the most integrated partner in participatory research and the methodology should meet his whole system rather than break it into different parts: The whole is more than sum total of its parts.

We have to remember Aristotle:

Other details should evolve through debates, discussions, workshops, field visits jointly by all the partners and stakeholders.

6.0 Understanding Agriculture:

To many of us agriculture mean food production because it is the responsibility of the government to provide food grains through Public Distribution System. To some specialists the major concern is their own areas. In this era of specialization and reductionist science the professional excellence is linked with specialization. The trend is to go deeper and deeper from micro to mini-micro level. Specialization is also essential as backbone of the science. But a stage has reached when we have to broaden and widen our perception about agriculture. We should view agriculture in its true form and appreciate its vital role in bio-spheres as the largest user of water and land.

6.1 Agriculture and air-environmental purity:

In India agriculture and live-stock related land use cover about 50-60% of the land mass:

- Agricultural crops photosynthesis: consume huge volume of carbon dioxide and generate tremendous volume of oxygen near the villages, hamlets.
- During the process of composting waste materials like household sweepings, waste from fruits and vegetables, dropping of livestock's, poultry etc. are buried and utilized avoiding foul smell and pollution.
- Scavenger animals like pigs and local poultry birds keep the environment clean and convert wastes into wealth.
- In a arid and semi-arid country like ours rain is limited only to 3-4 months and 9-8 months are dry. During dry months there is no microbial activity in soil and decomposition does not take place. In this period non-discript animals decompose dry bio-mass and convert it into useful products.
- Modern Agriculture is also polluting through excessive use of chemical fertilizers and plant protection chemicals.

The both positive and negative roles of agriculture in purity/impurity of environment should provide framework for our thought and action.

6.2 Agriculture and water:

As the largest users of land mass, agriculture has profound impact on water resources. Most of water falls on agricultural lands and flows on agricultural lands. Agriculture influences groundwater and its recharge, surface storage in village ponds, pokhars, wells, bawadees etc.

Agriculture also has the potential of polluting water. Many of us think that for agriculture only irrigation water is important. The fact is that land husbandry, crop husbandry, agro-husbandry, horticulture, sericulture, animal husbandry decide the quantity and quality of water for:

- Human drinking
- Livestock
- Domestic and household uses
- Irrigation
- Industry
- And miscellaneous use like road and building construction.

7.0 Friends, a stage has reached when we have to debate and discuss the current trends in agriculture and biology in the Indian context where agriculture and cottage industries have sustained rural life. Of course, scientific advances should be utilized to build upon the indigenous systems and not to destroy it by money propelled economic pursuits.

The profit is fast converting into greed. Gandhiji said 'there is enough to meet needs of all and not the greeds of a few. (लाभ तेजी से लोभ में बदल रहा है)

Ladies and Gentleman, if you get some inspiration to think, I would feel highly rewarded. Let me repeat: my attempt is to accelerate thought process and not to offer solution.



