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INDIAN INSTITUTE OF MANAGEMENT, AHMEDABAD

CONVOCATION ADDRESS

by

M.S.Swaminathan *

I am happy to be again in this campus, particularly on this day when so many of you are being invested with the symbol of proficiency in Management. I congratulate the outgoing alumni on their academic accomplishments, and wish them opportunities for utilising the training received here in the best interests of our country.

Good Management is the key to achieving synergy (i.e., the generation of multiplier effects from a set of inputs) and symbiosis (i.e., mutually beneficial effects from interacting entities) in any developmental or living system. It has therefore been an act of vision that this outstanding institution, as well as several others of this kind were established in our country after independence. We should be grateful to visionaries like the late Dr. Vikram Sarabhai for having stimulated this movement. It is, however, a measure of the relative lack of interest in rural professions in the past that the Institutes of Management tended to concentrate on industry rather than on agriculture, which is the basic industry of the country. It goes to the credit of this Institute that it was the earliest to rectify this imbalance by setting up a Centre for Management in Agriculture. I offer

*Dr. Swaminathan is Director General, Indian Council of Agricultural Research, New Delhi.

my congratulations to the Director, Staff and Students of this Institute for the tradition they have set up for striving for relevance and excellence in its research and training programmes.

I would like to offer my sincere congratulations and gratitude to the staff and students of the Centre for Management in Agriculture for the insight they are providing on the factors which influence decisions at the farm level. We also owe a debt of gratitude to Dr. Ravi Matthai and his colleagues for their contributions to the development of educational programmes for rural development.

I am aware that only a few among those assembled here may be directly interested in agriculture. Nevertheless, I am going to spend the rest of my talk discussing problems in agricultural growth because this is the only area where I can talk with some personal knowledge and experience. Also, since food occupies the first place in the hierarchical needs of man, the future of our country will obviously be determined by our successes and failures on the agricultural front. I would like to stress that by agricultural growth I do not mean just the production of X-million tonnes of foodgrains. Equally important is the generation of adequate opportunities for gainful employment in the villages. This alone can lead to an improvement in the purchasing power of the rural poor, particularly the landless peasants, about 100 million of whom, according to Prof. P.V. Sukhatme are undernourished because they do not have the capacity to purchase the needed quantity and quality of food. Thus, agricultural growth has to satisfy the triple needs of producing more food, jobs and income.

Let me analyse the basic building blocks of scientific agriculture. Scientific agriculture means the continuous improvement of the economic yield of crop and animal products per units of time, water, soil and nutrients without detriment to the long term productivity of the soil in the case of terrestrial agriculture. In the case of inland and coastal aquaculture, this would imply producing more fish and other aquatic products per units of water surface, time and nutrients without ecological harm to the pond, or reservoir, or river, or the sea. It also means a continuous improvement in the output of food energy per every unit of input of cultural energy. The term "Cultural energy" is used to indicate all forms of energy introduced by man into agriculture to maximise the benefits of solar energy. The most efficient agricultural management system will be one which gives the maximum calories of food energy per every calorie of cultural energy used in the production process. Based on this criterion, home gardening, vegetable gardening in small plots under intensive care and raising fish in small ponds, can be very efficient.

What are the mechanisms involved in increasing the efficiency of agriculture by the criteria I have just outlined? The scientific advances involved can be grouped for convenience into four major categories.

These are: a) Genetic and agronomic revolution, b) chemical revolution, c) engineering and irrigation revolution, and d) Management revolution. I have used the word revolution to indicate radical departures from earlier concepts and technology. Let me give a glimpse of each of these major revolutions.

(a) Genetic and Agronomic Revolution

If we examine the milestones in improving the productivity of crops during this century, we find that re-patterning of the genetic architecture and developmental rythm of plants has been a major factor in increasing productivity. Let me cite a few examples.

Technological milestone	Approx. year of introduction
Hybrid maize	1933
Chlorinated hydrocarbons for insect control	1945
Minimum tillage	1945
Foliar feeding	1945
Direct application of anhydrous ammonia	1947
Dwarf Rice	1955
Hybrid sorghum	1957
Hybrid Pearl millet	1959
Chemical weed control	1958
Systemic biocides	1959
Dwarf Wheat	1961
Opaque-2 maize	1972
Hybrid cotton	1973
Triticale	1973

The drive for tailoring plants to suit the precise needs of each agro-ecological and management condition is on at various Agricultural

Universities and Research Institutes in our country. Scientists of the Gujarat Agricultural University have made particularly valuable contributions by developing high-yielding strains of hybrid cotton and hybrid pearl millet. We can be proud of the fact that ours is the first country to exploit hybrid vigour in cotton commercially. Plant scientists today talk about "ideotypes" or conceptual plant types which are likely to perform best under a given set of growing conditions. Some of the characteristics sought after by a plant architect are:

Some characteristics of crop ideotypes

1. Hybrid vigour or additive gene action
2. Population performance
3. High productivity per day and per unit of water
4. High phtosynthotic ability
5. Low photorespiration
6. Photo- and thermo-insensitivity
7. High response to nutrients and other inputs of cultural energy
8. Multiple resistance to insects and diseases
9. Better nutritive quality
10. Crop canopies that can retain and fix maximum CO_2.

To realise the yield potential of a given plant type, it is necessary that appropriate changes are introduced in agronomic practices. If this is not done, the potential will remain hidden. The following are some of the important changes now taking place in agronomic concepts.

Some recent trends in agronomic research

1. High plant density leading to dense crop canopies
2. Weed-free environment
3. Minimum or appropriate tillage
4. Controlled release of fertilizer and use of nitrification inhibitors
5. Use of bacterial, algal and other microbial fertilizers
6. Integrated nutrient supply involving an appropriate blend of organic, inorganic and biological sources of fertilizer
7. Foliar feeding and use of low cost anyhydrous ammonia
8. Better on-farm Management of water, including drip irrigation in arid land
9. CO_2 fertilisation for maximising production in glass houses
10. Integrated pest and disease Management involving agronomic, genetic, biological and chemical methods of control
11. Use of hormone and growth regulators in fruit trees and ripeners in sugar cane
12. Organic recycling leading to crop-livestock and crop-livestock and fish integration

An important characteristic of the new plant types of dwarf varieties of wheat and rice is their ability to apportion as much as 50 per cent of the total dry matter produced during the life of the crop for making grains. It is this high partition coefficient in favour of the grain, as compared with straw and leaf, that confers on the new strains the ability to give higher yields at low, medium and high levels of fertilizer application. Hence, contrary to the view sometimes expressed, the relevance of appropriate high-yielding varieties increases with a higher price and inadequate availability of fertilizers. Plant Breeders ~~today are engaged in specifying~~ varieties for optimum response to High, Low, and Zero input conditions (popularly referred to as HIP, LIP, and ZIP systems of cultivation).

(b) Chemical Revolution

Starting with the discovery of chemical fertilizers in the last century, there has been a series of remarkable advances in chemistry leading to the introduction of fertilizers, micro-nutrients, fungicides, insecticides, herbicides, hormones and other growth regulators in crop husbandry. Hormone sprays have introduced new possibilities in horticulture, such as getting two crops of mangoes in a year as is being done in the Philippines. In a plantation crop like rubber, the latex flow can be regulated by spraying a stimulant like Ethrel, with the result that the production of this elastomer can be regulated in accordance with market needs and conditions.

It has however become obvious that while using chemical aids in agriculture, an impact analysis should be made in order to understand the likely positive and negative consequences of their introduction. The energy input-output relationships should also be studied so that the progress in productivity does not get linked up too closely with an increasing use of non-renewable forms of energy. When properly used along with organic manures in integrated management systems - fertilizers and pesticides can help to maintain soild health in a good condition, thereby making the law of diminishing return of the soil irrelevant.

(c) Engineering and Irrigation Revolution

Considerable advances have taken place in recent years on the application of better implements, tools and machinery at both the production and post-harvest phases of agriculture. Improved tillage implements are available using both animal and tractor as energy sources. The entire field of water technology has witnessed rapid growth - whether it be water harvesting and drip irrigation in arid or semi-arid areas or better drainage, water conveyance and on-farm management of water in humid and irrigated areas. In many temperate areas of the world, the period of maximum sunlight coincides with the period of good and even precipitation. In our country, the period of maximum sunlight, i.e., summer, coincides with the period of little or no precipitation. Water hence becomes the major limiting factor in crop production. Small and fragmented land holdings make the job of water technologists challenging from the point of view of introducing efficient watershed management procedures. Efficient water harvesting in dry farming areas will be possible only if all farmers in a water shed area cooperate.

Post-harvest technology is yet to receive the attention it deserves. As production advances, inappropriate or inadequate post-harvest technology serves as a barrier to further improvement in production, and to getting the producer the fruits of increased production and the consumer food of good quality. Grain drying has become a major problem in areas where the production of rice, maize and other cereals is registering a substantial rise during the south-west Monsoon period. The experience of the Kaira District cooperative is an excellent reminder of the value of linking production with processing and marketing in an integrated manner. This holds true not only for milk and animal products but also for grains, vegetables and fruits. The concept of Agro-industrial complex involves linking not only the production and post-harvest phases of agriculture but also agriculture with agro-industries. For example, in a rice-based farming system this will imply the use of urea or ammonia fortified rice straw as animal feed, extraction of rice bran oil, and the use of de-oiled bran as poultry or other animal feed. In this way, agriculture and animal husbandry can get linked in a symbiotic manner. The increase in importance of the plant-animal-man food chain in affluent countries is one of the causes of the world food problem. In our country, in contrast, man and cattle lead a complementary rather than a competitive existence. Crop-livestock integration is a must for increasing the purchasing power of landless labour and for reducing unemployment and hence we need to develop our own strategy in this area.

(d) <u>Management Revolution</u>

Given all the ingredients essential for progress, the pace and quality of progress will depend on the scientific management of resources and the blending of resources and technology in a manner that will generate symbiosis and synergy. While the role of scientists and technologists is in the area of development and demonstration of economically viable technology which is neutral with reference to feasibility of adoption by farmers with different sizes of farm holdings, management experts will have to assist in specifying and introducing the package of services and public policies essential for enabling small and marginal farmers to take to new technology. The management concepts in agriculture developed in Europe or North America or Oceania are by and large irrelevant under our conditions. The average Indian farmer has a small and often fragmented holding, has little or no risk taking capacity, has poor resources and is often illiterate. In spite of these handicaps, he is receptive to new ideas and has great wisdom arising from proximity to plants and animals, hardiness arising from toil in the sun, wind and rain and the power of discrimination to decide what is useful and what is not. Poverty makes it essential for him to base his decisions not on yield per hectare but on stable income per hectare. Hence, profit-maximising technology characterised by stability of income and low risk appeals to him more than just production - maximising technology.

Interest of management specialists in agriculture is a recent phenomenon in our country. I have already mentioned about the useful start made at this Institute in developing a management approach which is relevant to our socio-cultural and socio-political conditions. The most urgent task before management experts is in my view the analysis of the constraints which come in the way of realising the untapped yield reservoir existing in our major crop plants and farm animals.

How can we measure the untapped yield reservoir in different cropping and farming systems? In 1965, the Government of India introduced a National Demonstration Programme to provide opportunities to scientists to demonstrate in farmers' fields the economic viability of new technology. These demonstrations are generally laid out in the fields of the poor farmers in an area, since the yields obtained in demonstrations in rich farmers' fields tend to get attributed to the effect of affluence rather than of technology. The impact of good demonstrations will be evident from the fact that from an area of about 4-hectares under high yielding varieties of wheat in 1965, our farmers raised the area to about 4 million hectares in 1971-72.

If we compare the average yield obtained in farmers' fields in national demonstrations with the average yield obtained in the area concerned, we get a measure of the untapped yield reservoir. Studies can then be conducted to identify the factors responsible for the gap between the yield of demonstrations and of the area as a whole. The constraints responsible for this gap which can be termed as a "Resources cum Extension cum Management Gap" can be classified from the point of view of the remedial measures needed. Obviously, the remedy suggested must be capable of being adopted under a given set of socio-economic and socio-political factors."

Let me give you some indication of the size of the untapped yield reservoir in a few crops.

Improving the productivity of major crops and farming systems

(a) Wheat: On the basis of 1974-75 data, the ratio between National Demonstration yields and State average was of the following order in different States.

State	National Demonstration Yield (Q/Ha.)	State Average (Q/Ha.)	Ratio: Demonstration / Average
West Bengal	27.00	19.84	1.36
Punjab	52.50	23.60	2.22
Haryana	63.00	17.48	3.60
Bihar	56.05	13.53	4.14
Rajasthan	67.50	12.80	5.27
Maharashtra	53.00	8.41	6.30
Madhya Pradesh	61.00	8.44	7.22
Uttar Pradesh	85.00	11.74	7.24

Thus, while Punjab leads in productivity, West Bengal has the lowest untapped yield reservoir. The large ratios observed in Madhya Pradesh and Uttar Pradesh are partly due to the extensive unirrigated areas under wheat in these two States. The National Demonstration yield pertains to irrigated wheat. Nevertheless, the data provide an insight into future production potential even at current levels of technology.

Only a detailed constraints analysis, block by block, will help to understand why the growth curve in wheat yield has tended to get flattened in recent years. Prof. V.S. Vyas has analysed some of the factors involved in getting the best out of the high-yielding varieties of wheat (V.S.Vyas, 1975, India's High-yielding Varieties Programme in Wheat - 1966-67 to 1971-72, published by CIMMYT, Mexico).

The average yield of 31.2 quintals per hectare obtained in the pilot project blocks in wheat in Maharashtra State during 1975-76 indicates that a well-designed developmental effort can help farmers to raise the average yield considerably.

Stability of yield is as important as increase in yield. In addition to public policies relating to price of inputs, purchase price of grain and other related issues, plant health and soil health determine to a large extent yield stability. This year there was a severe outbreak of leaf rust in the Yaqui Valley of Medico, which is the main wheat producing area of that country. An analysis by Dr. N.E. Borlaug of the factors which were responsible for the outbreak indicated the following factors:

(a) Carry-over of considerable viable rust inoculum on volunteer wheat plants that germinated during the summer when the land was not sown to a second crop like soybeans or maize. The failure to sow a second crop was due to uncertainties in land tenure.

(b) Early planting in October by a few farmers to take advantage of the soil moisture left by the Hurricane Liza. These fields became infested early and provided large amounts of inoculum for other fields, and

(c) Approximately 70% of the area was planted to one variety, Jupateco. Such extensive planting with a single strain enhances the genetic vulnerability to attack by pathogens.

Thus, running a well-organised production programme involves attention to every aspect of the production chain.

"The size of the untapped yield reservoir is even greater in rice, which occupies about 38 million hectares. Our present national average yield is only about 20% of the average yield obtained in Spain, Australia and Japan. Partly, this is due to our having an extensive area under rainfed rice. The highest average yield has been reported from Punjab (2072 kg/ha), followed by Tamil Nadu (1855 kg/ha), Karnataka (1687 kg/ha) and Andhra Pradesh (1604 kg/ha). Bihar and West Bengal which are major rice growing States have average yields of the order of 872 and 1207 kg. per hectare respectively. Orissa, which is regarded by Botanists as anoriginal native home of the rice plant has an average yield of only 714 kg/ha.

"In contrast, Krishi Pandits have achieved yield levels of over 10 tonnes per hectare every year. In the National Demonstrations conducted in farmers' fields during <u>kharif</u>, 1976, the average yield in 43 demonstrations conducted in Orissa was 54.22 quintals per hectare. How can we tap this vast potential? Again, a malady-remedy analysis will be needed in each Block to identify the precise action needed. In most areas, a single institutional device like raising a Community Nursery would help to remove several of the handicaps of marginal and small farmers. Healthy seedlings of the right high-yielding variety can be given for timely transplanting to each farmer in accordance with the topo-sequence of his farm, he said.

Even in a rainfed crop like Sorghum (Jowar), the average in National Demonstration plots has been consistently of the order of 25 to 30 quintals per hectare in contrast to the national average yield of 5 quintals per hectare. Similar is the situation in groundnut. In 134 national demonstrations conducted during 1973-74 all over the country, the highest yield was 58.20 quintals per hectare, while the average of the demonstrations was 22.58 q/ha. In contrast, the national average has been of the order of 7 q/ha, which includes both irrigated and rainfed crops. Some of the more widely prevalent causes for low yield such as poor seed quality leading to poor plant population, damage by the unholy triple alliance of weeds, pests and pathogons, and inadequate nutrition are well known. However, the remedy in many instances lies in group rather than individual action. Where groups of farmers and in some cases all farmers in a watershed can be activated to adopt certain common practices, the results can be spectacular" as will be seen from the following data from an operational research project area near Indore:

Crop	Yield (Q/Ha) State Average	Operational research area
Jowar	6.1	31.5
Maize	10.7	27.5
Soybean	6.5	12.2

Such operational research projects provide an insight into the major constraints operating in an area which limit yield.

For the efficient management of small and marginal holdings, individual action by the farmer and his family, group action by a set of neighbouring farmers and finally collective action by a watershed community may have to be blended in an appropriate mixture. This is where students of Management can play a pivotal role by bringing about a marriage between the social engineering and technological aspects of rural transformation. Only in this way can risks be minimised and the potential of small holdings for getting a high conversion efficiency of cultural energy into food energy maximised.

I have so far spoken only about crop based farming systems. "As the pressure of population on land increases, water will become an increasingly important source of food. The soild and the sea and the farmer and fisherman will hence have to be bestowed with equal care and attention. Management Specialists will hence have to work on the conservation and efficient use of the basic assets of both agriculture and aquaculture." With a 200-mile economic zone along the sea coast, special centres for the Management of the ocean will have to be set up in some of our Management Institutes. I hope this Institute will again become a pioneer in starting a Centre for Management of our inland and coastal aquaculture resources.

While we start paying attention to the inland ponds, reservoirs and rivers as well as the ocean from the Management angle, an immediate need is to pay attention to the Management of our soil resources since we have practically no additional soil available for being brought under crop husbandry. Take for example the use of good soil for brick making. What are its implications to the future of our agriculture? The normal practice by brick makers is to dig up to a depth of about 120 cm. The soil taken out up to this depth in a hectare may weigh about 8000 tonnes. On an average, the formation of 1 cm. of soil <u>in situ</u> may take even 500 to 1000 years depending upon the nature of the parent material and the intensity of weathering. A home providing about 500 sq. feet space may consume 40,000 bricks and thereby about 120 tonnes of soil. According to the National Bureau of Soil Survey and Land Use Planning the soil used up for construction work in Delhi area would have taken about a lakh of years for being formed in nature. Hence for harmonising the future of agriculture with the needs of house and other construction, specific areas may have to be earmarked after proper surveys for the brick industry. Thus, every resource will have to be husbanded carefully if we are to ensure the necessary growth rates in production and productivity.

Our farmers increased the capacity for annual food production during the 25 years period, 1951-76, by a quantity which is more than the total annual production in any year in the country since the dawn of agriculture about 10,000 years ago. They have to repeat this performance again in the next 23 years. The size of the untapped yield reservoir reveals that this can be done, provided small and marginal farmers are helped to adopt and benefit from new technology, and landless labour and rural women are enabled to improve their purchasing power through subsidiary employment in animal husbandry, fisheries and agro-industries. Fortunately, we have today a good grain reserve. If the wherewithal to purchase food is generated, no one need to go to bed hungry. The Government of India has introduced a "Food for Work" programme, which if used properly, could help to reduce undernutrition among the economically handicapped sections of the community and at the same time strengthen the infrastructure for agricultural advance.

The right to work and the right to daily bread are correlated rights. The biologically or economically handicapped sections of the community need specific attention with regard to both these rights. Every country finds its own response to this basic human obligation. Recently, the "Food Stamp" programme of the United States is being recast so as to ensure that the poor get their minimum needs of calories. We have in some States like Gujarat and Maharashtra "Right to Work" and "Employment Guarantee" programmes. Employment generation policies based on strategies for the scientific utilisation of the resources of each area can provide self-replicating and self-propelling models of "Food-cum-Cash for Work" programmes. There is considerable challenge in this area of programme formulation and implementation for Management specialists. I, therefore, hope that several of you whose work has been recognised at this convocation will get opportunities for participating in the Management Revolution so urgently needed in our agricultural and rural sectors.

I once again congratulate all of you and wish you much happiness in your personal and professional levels.