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CHINA AND THE WORLD

IN

THE NINETEES

SUSTAINABLE FOOD AND NUTRITION SECURITY

FOR THE 1990'S

BY

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Sustainable Food and Nutrition Security for the 1990's

A Panel of Environment and Food Security of the World Commission on Environment and Development chaired by me concluded "The next few decades present a greater challenge to the world's food systems than they may ever face again. The effort needed to increase production in pace with an unprecedented increase in demand, while retaining the essential ecological integrity of food systems, is colossal both in its magnitude and complexity. Given the obstacles to be overcome, most of them man-made, it can fail more easily than it can succeed." (Food 2000: Global Policies for Sustainable Agriculture. Zed Books, London, 1987)

There is now increasing acceptance at both the professional and political levels of the need to institutionalize sustainability as the norm for all agricultural programmes and policies. Agricultural assets like land and water, flora and fauna cannot be allowed to undergo any depreciation. All agree that today's progress should not be at the expense of tomorrow's prospects. Sustainability should not however be regarded as a static concept. It must have built-in dynamism so that changing human needs can be met by a continuous improvement in productivity without detriment to the long term production potential of land and water.

FAO has defined food security as "physical and economic access to food to all people at all times." I have been pleading for enlarging this concept into one of Nutrition Security. I define Nutrition Security as physical and economic access to balanced nutrition and safe drinking water to all people at all time. Nutrition security is essential for providing children with an opportunity for the full expression of their innate genetic potential for physical and mental development. Nutrition Security is equally essential for providing adults with an opportunity for efficiency in work and good health. What are the challenges in achieving sustainable food and nutrition security? There are many but the following ten challenges need particular attention.

1. **Ecological Sustainability**

Nearly 90% of our food will have to come from land-based farming. Land is a shrinking resource for agriculture due to competing demands for its use. Also, population growth is leading to increasing pressure on the carrying capacity of land. The global water resources are also not being used in a sustainable manner. With deforestation, there is erosion of biological diversity. How can we impart a dimension of ecological sustainability to technology development and transfer? What steps are needed in every agro-ecological area to promote scientific management practices in the following three categories of land.

(a) Conservation areas which ought to be preserved in their pristine purity.

(b) Restoration areas where the biological potential of land needs to be upgraded through regeneration and rehabilitation mechanisms.

(c) Sustainable intensification areas where production and productivity can be improved without harm to the long term production potential of the land.

For incorporating sustainability considerations in agricultural research and development, we need appropriate definitions and tools of measurements as indicated below.

Production: Crop output produced per year

Productivity: The ~~rates~~ ratio of the value of the output divided by the value of the inputs, plus changes in stocks of capital. The change in capital stocks should include the measurement of soil health over time.

Sustainability: A non-negative trend in the productivity of a given plot over time.

2. Economic Viability

The average size of an operational holding in China and several other countries in South and South East Asia is one hectare or even less. A small farm is ideal for intensive agriculture but a small farmer suffers from many handicaps. The potential productivity of a small farm can be increased through science and technology but the handicaps of small farmers can be removed only by appropriate public policies and farmers' own organizations. Most of the ecologically sound and cost reducing technologies such as integrated pest management, scientific water management and integrated nutrient supply are knowledge - intensive. The cost, risk and return structure of farming influences the decisions on investment in inputs by farming families. Therefore the economic viability of farm operations need careful attention among all concerned with the development of packages of technology, services and public policies.

3. Equity

Considerations of equity demand that all farmers should have access to new technologies irrespective of the size of their holdings and innate input mobilizing and risk taking capacity. Also, women who play such an important role in both the production and post-harvest phases of farming should participate actively in technology development and transfer. The additional steps needed to reduce drudgery and to increase output, efficiency and income in women specific operations need careful consideration. Independent access to income for women is important to enhance household income. This is well recognized in China where women play a "half-sky" role in agriculture.

4. <u>Youth and Agricultural Future</u>

A majority of the rural population in China and other countries in South and South-east Asia is young. About 50% of the population may be under the age of 21. The future of agriculture under such a demographic profile depends on the ability to attract and retain youth in farming and allied occupations. This may be easy if farming becomes intellectually satisfying in addition to being economically rewarding. How can this be accomplished?

Fortunately, there are now attractive opportunities for achieving an optimum blend of traditional and frontier technologies. Among the frontier technologies, biotechnology including tissue culture, genetic engineering and bio-processing, computer technology, micro-electronics and satellite imagery, can help to improve the efficiency of small farm agriculture and help to achieve a reduction in the cost of production without reducing yield. The challenge lies in combining the ecological and social strengths of traditional technologies with the opportunities provided by forward-edge techniques to improve efficiency and productivity. Up-stream research capability must be sought to solve down-stream problems. For example, in rice, pests and diseases depress yield and increase instability in production. Fortunately, the wild relatives of rice possess genes conferring resistance to the serious pests (**Table 1**). Thanks to recent progress in moving genes across ~~several~~ sexual barriers, we can try to incorporate these genes in cultivated varieties. Similarly, there are opportunities for producing value-added products from every part of plant and animal biomass. If these new opportunities are harnessed through the establishment of Agricultural Refineries, farming could become both intellectually exciting and economically rewarding. This is the best way of keeping up the enthusiasm of the youth for taking to farming as a profession.

5. <u>Monsoon Management</u>

Much of Asian agriculture is rain-fed. During the major monsoon season (May to October) drought and floods occur frequently. <u>Monsoon Management</u> with a view to maximising the benefits of a normal monsoon and minimising the adverse impact of unfavourable weather, therefore assumes urgency. Drought and floods also affect severely farm animals. Therefore, full advantage should be taken of our ability to impart resilience in crop varieties with reference to sowing and harvest dates and to introduce alternative cropping strategies based on weather probabilities. Computer simulation models of different patterns of monsoon behaviour would help to get a series of contingency plans, alternative farming systems and compensatory production programmes prepared. Just as food grain reserves are important for food security, reserves of seeds of alternative cropping patterns are important ~~from~~ for crop security under unfavourable monsoon conditions. The research and development aspects of successful monsoon management deserve attention on a systems basis.

6. Preparing for Climate Change

Mathematical models of the potential impact of climate change, induced by increasing CO_2 concentration in the atmosphere and extensive deforestation, have been developed by several research groups. While there is little agreement among the various models about the precise nature of the changes expected during the next 50 years at the regional level, there is considerable agreement on the nature of the changes at the global level. Based on the available information, Sinha, Rao and Swaminathan (unpublished) have calculated the probable impact of climate change on the production of wheat, rice and maize. The data are given in **Tables 2, 3 and 4**. The climate scenario used in developing this data is based on predicted temperature changes (Rosenberg, 1987, Drought and Climate change: for better or worse, In Planning for Drought - Toward a Reduction of Social Vinnerability, eds. D.A. Wilhite and W.E. Easterling, ~~West/rew/~~ Westview Press, Boulder, Colorado, Pg. 297-316). It will be prudent to start some anticipatory research to deal with the various probabilities as they arise.

[Westview]

7. Fighting the famines of job and of purchasing power

Already, economic access to food has become in many developing countries the most serious food security challenge. Land and water based occupations such as crop husbandry including horticulture, animal husbandry, fisheries and forestry will have to provide the bulk of the additional jobs needed for the growing populations. For this, it will be essential that farming systems research is re-oriented in such a manner that for every job in the primary sector, four to five jobs are created in the secondary and tertiary sectors. Rural occupations based on agricultural produce and biomass should be so designed that decentralised production by individual farming households is supported by well organised services. New approaches will be necessary in training farm families in new skills. The prevailing gap between know-how and do-how should be bridged.

8. <u>Home and International Trade</u>

Normally, land use decisions by a family with a small holding will be based on the home needs of the family. When a family has surplus production for the market, assured and remunerative marketing opportunities will hold the key to stimulating greater efforts to produce products for the market. Without adequate reward to farmers for their toil, it will be difficult to move agriculture forward. Unfortunately, many developing countries are not able to ensure that their farmers get a remunerative price for their surplus products. This is particularly true for perishable commodities like fruits, vegetables, flowers, and animal and fish products. There is need for a farmer-oriented marketing policy at the national level.

International trade in agricultural produce is now facing many problems, the more serious of which are caused by the heavy farm subsidies and protectionist policies followed by developed countries. Unless there is greater international understanding and cooperation among developed and developing nations in agricultural trade, developing nations, many of which are already suffering from severe debt burdens, will suffer more.

Another unfortunate result of severe debt burden is the unsustainable exploitation of forest and other natural resources by poor nations for earning foreign exchange. There should be a ban on trading practices which result in ecological disasters in the country which supplying the natural products. In additional to economic viability, ecological sustainability should become a criterion in trade promotion.

9. Symphonic Agriculture Matrix

Agricultural development is a multi-dimensional process. Unless there is a systems approach with concurrent attention to all the links in the production-marketing-consumption chain, both producers and consumers will not reap full benefit from higher production. Hence, we need a symphonic approach with mutually reinforcing packages of technology, services and government policies. These packages will have to satisfy the tests of ecological systainability, economic viability and equity. A matrix of the type shown in **Table 5** can be constructed to examine this requirement in relation to:

(a) Land and Water Management

(b) Energy Management

(c) Crop/Farm Animal/Fisheries Management

(d) Post-harvest Management

Without internal consistency and harmony, it may be difficult to ensure that progress is sustainable over time.

10. Technical Cooperation among Developing Countries

Developing countries represent the centres of origin and diversity of most crop plants and farm animals. The potentials and problems of tropical and subtropical agriculture are also very different from those of developed countries. Most of the additional population of the world during the next 50 years will be in developing countries. Therefore, most developing countries will have to produce more and more food from less and less land in the years to come. There are opportunities for mutually beneficial TC DC programmes in the field of agriculture.

There is also vast scope for collaboration between developed and developing countries in the area of integration of frontier and traditional technologies.

Conclusion

We are entering a difficult but exciting phase in agriculture. Sustainable nutrition security will be possible if the use of ~~national~~ natural resources is done in a manner that the short and long term goals of development are in mutual harmony. Generating a systems approach both at the planning and at the implementation levels is not an easy task. Without it however, we will not be able to meet successfully the challenges ahead.

TABLE 1

Agronomically Important Characteristics Identified Among the Wild *Oryza* Species

SPECIES	2n	GENOME	CHARACTERISTICS
O. nivara	24	AA	Grassy stunt virus resistance
O. rufipogon	24	AA	Source of cytoplasmic male sterility, Tolerance to stagnant flooding
O. glaberrima	24	AA	GLH resistance, early vegetative vigour
O. barthii	24	AA	Bacterial blight resistance
O. longistaminata	24	AA	Floral characteristics for out-crossing
O. punctata	24,48	BB,BBCC	BPH, WBPH, GLH, resistance
O. officinalis	24	CC	BPH, WBPH, GLH, resistance
O. eichingeri	24	CC	BPH, WBPH, GLH, resistance
O. minuta	48	BBCC	BPH, WBPH, GLH, blast and bacterial blight resistance
O. austrliensis	24	EE	BPH resistance, drought tolerance
O. brachyantha	24	FF	Rice whorl maggot and stem borer resistance
O. ridleyi	48	--	Rice whorl maggot resistance

Source: International Rice Research Institute, Los Banos, The Philippines.

Table 2. Effect of doubling of atmospheric carbon dioxide on area and productivity of wheat (Total production in 1985 = 510 million tonnes).

Country/ Region	% share of Production	Yield (tonnes/ha)	2 X CO_2 climate scenario T C	Soil moisture Conditions	Effects on crop production Area	Yield
China	17	3.0	4	Some regions Wetter	+	-
India	9	1.9	3	Wetter	-	-
USSR	16	1.6	6	Drier	++	-
Canada	5	1.7	8	Drier	++	-
U.S.A.	13	2.5	5	Drier	+	-
W. Europe	16	4.6	6	Wetter	+	-
Australia	3	1.4	2	Wetter	-	-
Developed countries	60	2.3	5-8	Drier	++	-
Developing Countries	40	2.1	2-4	Wetter	+	-

Table 3. Effect of doubling of atmospheric carbon dioxide on area and productivity of rice (Total production in 1985 = 465 million tonnes).

Country/ Region	% share of Production	Yield (tonnes/ha)	2 X CO_2 climate scenario		Effects on crop production*	
			T C	Soil moisture Conditions	Area	Yield
China	37	5.3	3	Wetter	+	+
India	20	2.2	3	Wetter	+	+
Indonesia	8	2.1	2	Drier	-	+
Bangladesh	5	4.1	3	Wetter	+	+
Developing Countries	94	3.1	2-4	Wetter	+	+

***For rice, sterility effects of increasing temperature, may neutralize increase in production.**

Annex-I

THE NAMES AND AREAS OF THE TIGER RESERVES OF INDIA

TABLE - I

Sl.No.	Name of the Tiger Reserve	State	Area (sq.km.) Core	Buffer	Total
	Tiger Reserves Established in 1973				
1.	Bandipur T.R.	Karnataka	523	343	866
2.	Corbett T.R.	U.P.	320	200	520
3.	Kanha T.R.	M.P.	940	1,005	1,945
4.	Manas T.R.	Assam	391	2,449	2,840
5.	Melghat T.R.	Maharashtra	308	1,289	1,597
6.	Palamau T.R.	Bihar	213	717	930
7.	Ranthambhore T.R.	Rajasthan	392	433	825
8.	Similipal T.R.	Orrissa	845	1,405	2,250
9.	Sunderbans T.R.	West Bengal	1,330	1,255	2,585
	Tiger Reserves Established in 1979				
10.	Periyar T.R.	Kerala	350	427	777
11.	Sariska T.R.	Rajasthan	498	302	800
	Tiger Reserves Established in 1983				
12.	Buxa T.R.	West Bengal	313	432	745
13.	Indravati T.R.	Madhya Pradesh	1,258	1,541	2,799
14.	Nagarjunasagar T.R.	Andhra Pradesh	1,200	2,368	3,568
15.	Namdapha T.R.	Arunachal Pradesh	1,808	177	1,985
	Tiger Reserves Established in 1987 & 1988				
16.	Dudhwa T.R. (1987)	Uttar Pradesh	648	163	811
17.	Kalakad-Mundanthurai T.R. (1988)	Tamil Nadu	571	229	800
		TOTAL	11,308	15,335	26,643

Table 4. Effect of doubling of atmospheric carbon dioxide on area and productivity of maize (Total production in 1986 = 490 million tonnes).

Country/ Region	% share of Production	Yield (tonnes/ha)	2 X CO_2 climate scenario		Effects on crop production	
			T C	Soil moisture Conditions	Area	Yield
U.S.A.	46	7.4	4	Drier	+	-
W. Europe	8	5.5	4	Drier	+	-
China	13	3.5	3	Wetter	+	+
Brazil	4	1.9	3	Wetter/Drier	+	+
Developed Countries	65	6.0	4	Drier	+	-
Developing Countries	35	2.2	3	Wetter	+	+

Table 5. Symphonic agriculture matrix.

	Action Points		
Needs	Technology	Services	Government Policies
Ecology	Conservation and enrichment of environmental assets Farmer participation in location specific technology development	Associations for sustainable development	Agro-ecological rehabilitation Monsoon management Long term commitment
Economics	Cost reduction without yield reduction	Timely and adequate supplies of inputs Management tools	Input and output pricing policies Home and international trade
~~Equity~~ Employment	~~Small farmer~~s ~~Women~~ Farming Systems research to generate favourable growth linkages	Knowledge, skill input transfer Services for ~~Diversification of~~ on-farm and off-farm employment	Political will and action for ensuring ~~livelihood~~ rural ~~security~~ development and gainful self-employment

九十年代的中国与世界

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日程

AGENDA

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MAY 30—JUNE 2, 1988