The Science Summit brought into sharp focus the urgent need to address the issue of food security with all the knowledge and skills at our command. The meeting threw up several cases from actual successful experiences worldwide and emphasized the need to blend the traditional agricultural practices with what modern biotechnology has to offer. What we need, probably, is a people-oriented Super Green Revolution that can ensure all the benefits of the Green Revolution on a global scale minus its environmentally harmful effects, and at the same time make economic sense. We need a research agenda that integrates sustainable development, food security and the environmental concerns.

The mood is one of cautious optimism. While the tasks facing us look daunting, it is felt that one can win the battle with an appropriate blend of scientific and technological inputs and conducive public policies.

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Madras Declaration of the Science Academies Summit

The text of the declaration adopted at the Science Academies Summit convened at the M.S. Swaminathan Research Foundation, Madras, during 8–11 July 1996, is reproduced below.

We, the participants of the Science Academies Summit, call upon the world leaders assembling at the World Food Summit convened by FAO in Rome in November 1996 to adopt this agenda as a means of harnessing science and technology for the transformation of agriculture into a primary instrument of a global *Evergreen Revolution*. Based on the principles of ecology, social equity, energy efficiency, employment generation and economic viability, this revolution will provide the technical foundation for the universal eradication of hunger and achievement of a food and nutrition secure world for all. At the same time, we wish to emphasize the urgent need for adaption, particularly by developing countries, of population policies which can ensure that children are born for happiness and not for mere existence.

A new revolution in agriculture

In the over 50 years since FAO took up the challenge of 'food for all', never before has science offered greater opportunity to achieve this goal for even the poorest of the poor. Scale-neutral innovations including those emerging from the fields of biotechnology and information technology, as well as the holistic management systems of soil health care, conjunctive water use, integrated pest management and integrated intensive farming systems represent only a few of the new opportunities to reach the nearly 800 million people lacking adequate nutrition.

Tapping this unprecedented potential will depend upon strengthening the capacity of national agricultural research and development systems to respond to these new challenges with creativity. Therefore, we urge world leaders to reverse the global trend of disinvestment in agricultural research and development, convinced that such short-sighted policy can but only have tragic results. At the same time, limited resources make prioritization of research initiatives essential, and it is intended that this agenda assist political leaders in that task.

Meeting the challenge of increasing food availability now and in the future demands equal focus on production systems and on the larger issues of access to food. Therefore, science must work in partnership with farmers to create a new agriculture. An Evergreen Revolution must bridge the gap between the past's gains in production and the persistent need for reliable access to food by all. This will require a number of innovative approaches, including:

• Transformation of the most marginalized farmers of the world into agents of poverty alleviation and environmental management through the blending of traditional and frontier technologies in socially equitable, economically viable and environmentally sustainable *ecotechnologies*.

• Production of more food from a diminishing resource base, requiring new agricultural technologies and management systems providing *increased productivity* per unit of land, water, energy, labour and investment. Part of this will involve focussing research on neglected crops such as minor millets, grain legumes and tubers which can perform in times of environmental stress and in neglected areas such as arid and semi-arid coastal and mountain areas.

• A *systems approach* marshalling the combined and coordinated efforts of physical scientists and agricultural researchers, as well as systems analysts, mathematicians and social scientists. While agricultural production will remain the foundation of food and nutrition security, the larger scientific framework must integrate post-harvest technology, distribution systems and rural development, as well as economic and social empowerment of the poor, especially women. This holistic approach must also be taken in restructuring administrative systems, leading to a high degree of professionalism of such services.

Eliminating hunger among the poor of all nations will depend upon tapping the new opportunities offered in these *unconventional approaches*. Such *uncommon opportunities* are rooted in a new and broader conception of food and nutrition security which integrates multiple physical, social, economic and environmental dimensions.

National policies for sustainable food and nutrition security should ensure

• that every individual has the *physical, economic, social and environmental access* to balanced diet that includes the necessary macro- and micro-nutrients, safe drinking water, sanitation, environmental hygiene, primary health care and education so as to lead a healthy and productive life.

• that food originates from efficient and *environmentally benign production technologies* that conserve and enhance the natural resource base of crops, animal

husbandry, forestry, inland and marine fisheries.

The principle operational implications of the above mission statement are the following:

1. The *physical dimensions* of food and nutrition security will involve a transition from chemical- and machinery-intensive to knowledge- and labour-intensive farming technologies.
2. The *economic dimensions* of food and nutrition security require the promotion of sustainable livelihoods through multiple income-earning opportunities, such as crop–livestock–fish integration and agro-processing and agri-business.
3. The *social dimensions* of food and nutrition require addressing gender, class and ethnic discrimination against marginalized sectors of society, who consequently tend to be the most food and nutritionally insecure.
4. The *environmental dimensions* of food and nutrition security involve attention to soil health care, water harvesting management and the conservation of biodiversity, as well as to sanitation, environmental hygiene, primary health care and education.

Ultimately, self-reliance and skill- and labour-intensive technology must be the basis of food and nutrition security. As agriculture provides most of the jobs in many developing countries, the import of food by these nations would be equivalent to importing unemployment.

A ten point scientific and public policy agenda for sustainable food and nutrition security

The following ten-point agenda can provide the basic scientific and policy framework for achieving sustainable food and nutrition security at both national and international levels.

1. *An Evergreen Revolution must increase output in an economically viable, socially equitable and environmentally sustainable manner*, focusing on the food and nutritional supply system as a whole. Beyond investing in new scientific technologies, this will require public policies which provide a supportive economic and social environment.
2. *Science and technology for public good is the key to improving agricultural productivity* among the poor. With the spread of free-market and intellectual property rights culture, it is essential that science designed for the public good receives adequate political and financial support. Scientists working in the areas of food and health security should regard themselves as trustees of their intellectual property.
3. *Sound environmental policies must provide the foundation of agricultural sustainability.* Therefore, a national Natural Resources Conservation and Enhancement Strategy will be fundamental to a National Food Security System. High priority must go to combating desertification and deforestation, and to restoring degraded land.
4. *Entitlements, asset reform and technological empowerment of the poor will be essential in ensuring economic access* to balanced diets, and would help address the triple goals of natural resources conservation, poverty alleviation and food security.
5. *The gender perspective must be integrated into technological development and dissemination.* A gender code, to identify and evaluate actions that ensure equity in food and nutrition security, should become an integral part of agricultural research programmes.
6. *Agriculture must serve as an instrument of income and livelihood opportunity* as well as of food production. Therefore, it is important that the economic benefits of agroprocessing and agribusiness are taken to poor families through rural value added enterprises and partnerships with the private sector.
7. *Macro-economic policies in the areas of pricing, trade and investment should be based on both environmental sustainability, as well as gender and social equity.* A systems approach must be taken, with a holistic view of production, distribution and consumption.
8. *The information age has provided tools such as the Internet and GIS mapping to promote a learning revolution in agriculture.* Extension information should be disseminated through computer-aided information shops operated by village youth. Vocational polytechnic institutes may be established for the rural poor.
9. *Existing global conventions must be implemented*, including those on climate, biodiversity, desertification and the oceans, as well as Agenda 21 of UNCED and the global plans of action on population, gender, habitats, social development and plant genetic resources.
10. *Public polices for sustainable food and nutrition security must institutionalize procedures to focus on both production and access.* To achieve the above, it will be prudent to develop legislation based on the following principles:

A. *National Sustainable Food and Livelihood Security Act*, including provisions for:

- Promoting policies which can help to achieve a balance between human and animal populations and the supporting capacity of the eco-system.
- Promoting conservation and enhancement of the natural resource base.
- Rehabilitating degraded soil, forests and aquatic resources, and introducing scientific land and water use policies.
- Ensuring economic and social access to food through steps which can enhance the livelihood security of the rural and urban poor, with special attention being given to children, orphans and women.
- Improving the biological absorption and retention of food through attention to sanitation, environmental hygiene and primary health care.
- Ensuring universal literacy and techniracy (i.e. imparting new technical skills through learning by doing) for both men and women at the village level.
- Promoting the development and dissemination of ecotechnologies at the production and post-harvest phases of farming, with special attention to waste treatment and recycling.
- Improving post-harvest technology including storage, non-CFC-based refrigeration, packing with biodegradable material and efficient transportation and delivery.
- Establishing input and output pricing and credit and insurance policies which can help all farm families, irrespective of their innate input-mobilizing and risk-taking capacity, to benefit from new technologies and marketing opportunities.
- Building and maintaining grain reserves and operating an efficient public distribution system for making essential commodities available at affordable prices to the poor.
- Developing a *Hunger-Free Area Programme* in cooperation with local communities in order to demonstrate that chronic hunger and malnutrition can be overcome speedily by creating an enabling environment, where every individual *earns* his or her daily bread.

B. *Implementing the equity provisions of the Biodiversity Convention*

Industrialized nations should contribute *0.01% additional ODA* for the purpose of being credited to a Global Fund for Biodiversity for Sustainable Food Security. Such a fund can be handled as a trust fund under the Global Environment Facility (GEF) for implementing the Global Plan of Action adopted at the International Technical Conference on Plant Genetic Resources held at Leipzig in June, 1996, and for recognizing and rewarding the contributions of indigenous and rural women and men to the conservation and enhancement of biodiversity, that is, Farmers' Rights. It should also be used to safeguard all mega-biodiversity areas as well as 'hot-spot' locations with reference to threats to biodiversity, ranging from landscapes to individual species. In addition, for this purpose developing nations rich in agro-biodiversity should levy a 1% cess on all agricultural produce for being credited to a National Community Gene Fund to be used to recognize and reward the contributions of tribal and rural families to the *in-situ* conservation and enhancement of agro-biodiversity. Such steps will help to restore and revitalize the on-farm genetic conservation and selection-traditions of rural communities.

The role of the international community

To maximize efficiency and return on investment in the Evergreen Revolution, south–south partnership and cooperation in research and development will be essential, especially among nations with related agroecologies. The CGIAR centres should support these emerging regional networks and national systems, pursuing a policy of subcontracting present responsibilities as appropriate. We, the Summit participants, resolve to establish an *International Scientific Steering Committee for Sustainable Food and Nutrition Security*, to provide political leaders with the scientific framework necessary to achieve food for all. Broader consensus can be fostered through a *Global Coalition for Sustainable Food Security* including farmers' organizations, civil society, academia, corporate sector, service organizations and mass media.

To convert the rhetoric of 'food for all' into reality within a specified time frame, we urge the G-7 and G-15 countries to jointly establish a high level *Steering Committee for Sustainable Food and Nutrition Security*, for which FAO could provide the Secretariat. This unique political body would be fundamental in reaching the shared goals of global food and environmental security, reduced need for emergency aid, enhanced political stability and the development of new markets for trade. This is a responsibility which the political leaders of the G-7 and G-15 countries must accept at the November, 1996, World Food Summit, if we are to enter the new millennium with hopes for a new humane world.

The 11th Himalaya–Karakoram–Tibet Workshop: Conference report

The Himalaya–Karakoram–Tibet (H–K–T) Workshops, held annually since 1985, are a timely response to the growing interest among the international geological community in the Himalaya-Tibetan region (see Sorkhabi[1] for a report on the 10th H–K–T Workshop in Switzerland). These annual meetings are part of an international 'boom', which has made the Himalaya-Tibetan region probably the most prolific field of geologic research among the mountainous terrains of the world. The recent boom in the Himalaya-Tibetan geology is a continual part of more than 150 years of geoscientific research in the Himalaya and south Asia. However, the present diversity and extent of international involvement in the Himalaya-Tibetan geology is unprecedented. The aim of this Himalaya–Tibet saga is no less than unravelling the 'biggest tectonic puzzle of Cenozoic Earth'.

Unlike Britain and continental Europe, whose tradition of geological research in the Himalaya dates back to the first half of the 19th century, North America is relatively a newcomer to the scene. The first and the only American to have lived and worked in the Himalaya during the 19th century was Alexander Gardiner (1785–1877). Gardiner worked as an army officer in the forces of several kings in Kashmir. His wanderings and missions took him to all of the mountain ranges of the western Himalaya and the Pamir before any European explorer knew of these places. However, Gardiner did not document his observations and travels as a contribution to geographic knowledge[2].

The 1930s may be regarded as the 'initial pulse' of American studies in the Himalayan region. Helmut de Terra, a German geologist who had immigrated to the US and joined the Carnegie Institution of Washington, carried out pioneering research on the Quaternary geology of the west Himalayan foothills. In the same decade, G. Edwards Lewis and Paul D. Krynine at Yale University began research on the Siwalik formations; the Yale tradition in Siwalik studies (such as the palaeontological work of David Pilbeam) continued through the 1980s. Also in the 1930s, Edwin Colbert examined the Siwalik vertebrate fossil collection at the American Museum of Natural History in New York.

The 'plate tectonic revolution' of the 1960s motivated tectonic studies of the Himalaya and Tibet as this region came to be regarded as a 'type example' of continent–continent collisional orogenesis. Initially these studies were of 'armchair geophysics' genre, using seismic data and tectonic modelling. Over the past two decades, several institutions in the US have carried out field-based studies in the Himalaya and Tibet, resulting in an increasing number of graduate dissertations. Some of these active groups are those at Dartmouth College (where the late Noye Johnson with his students and colleagues carried out intensive research on the Siwalik Group of Pakistan), Orogen State University, Cornell University, Massachusetts Institute of Technology, University of California and University of Southern California (both at Los Angeles), etc. In addition, there are many individual Himalayan researchers scattered throughout North America. In recent years,