Fourth Dr. C.M. Singh Memorial Lecture

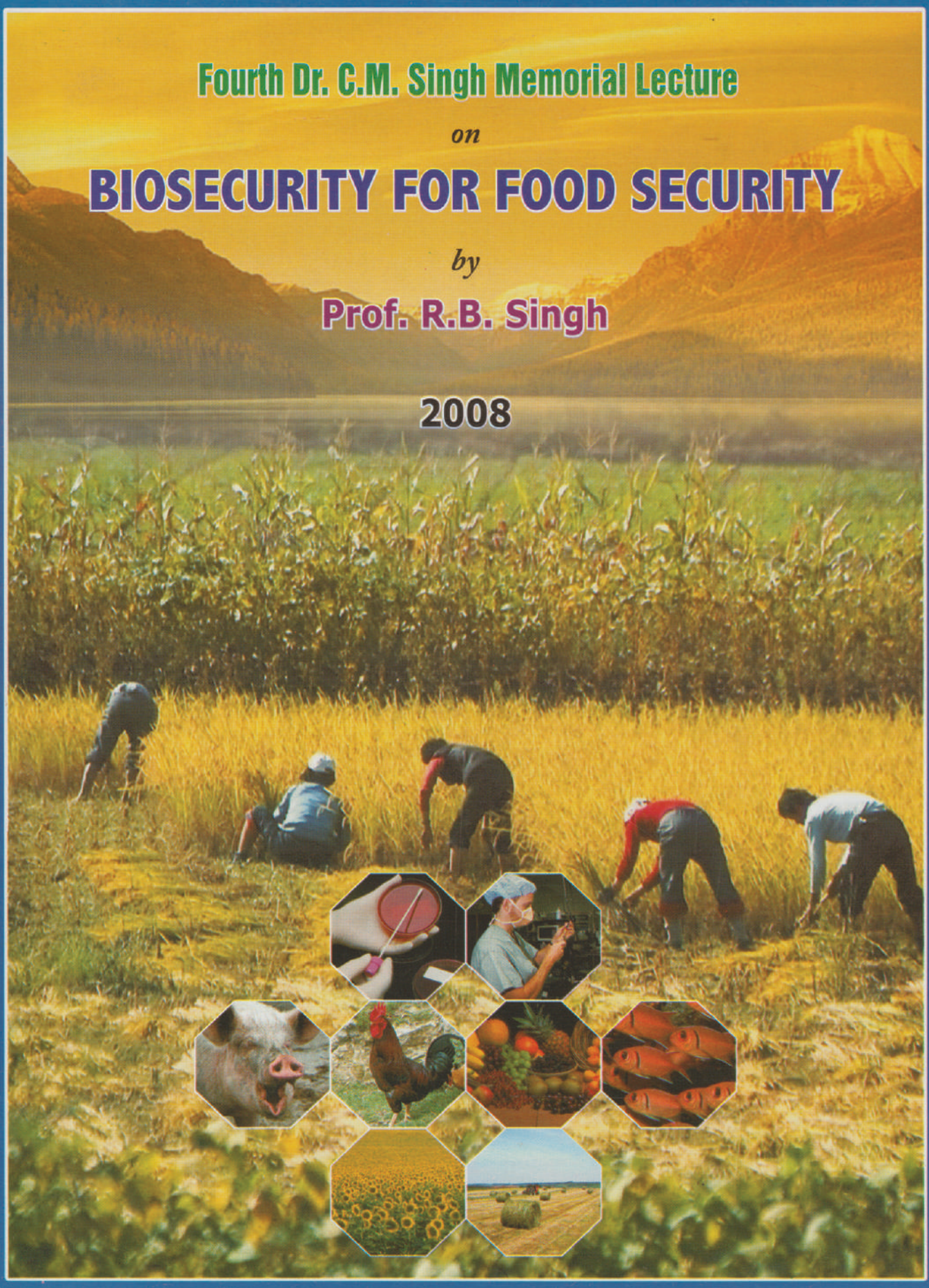
on

BIOSECURITY FOR FOOD SECURITY

by

Prof. R.B. Singh

2008



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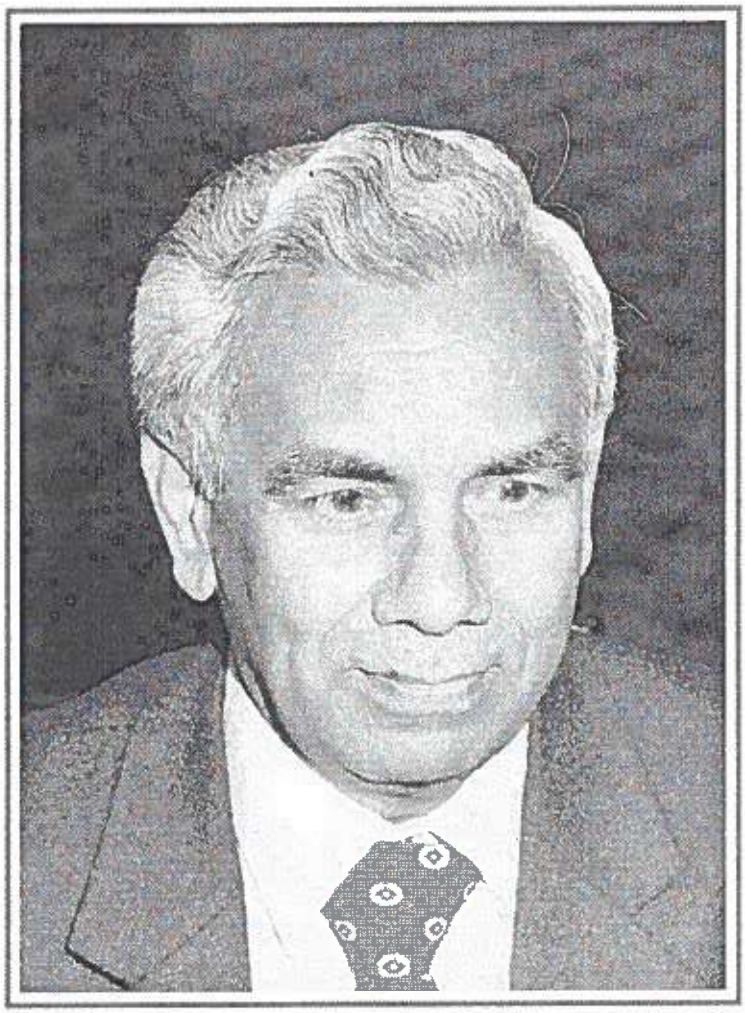

Dr. C. M. Singh

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Contents

1. Concept and Definitions 1-5
   - Biosecurity 1-2
   - Food Security 3-5
     - Food Availability 3-4
     - Food Access 4
     - Food Utilization 4
     - Vulnerability 4-5

2. State of India's Biosecurity System 5-15
   - Animal Biosecurity 5-10
   - Plant Biosecurity 10-14
   - Fish Biosecurity 14-15

3. State of Food Security in India 15-19

4. Recent Food Security "Crisis" and Global Solidarity to Alleviate Hunger 20-21

5. Major Challenges and Policy Options and Actions for Food Security 21-23

6. Global Convergence Towards Biosecurity 23-25

7. Establishing a National Agricultural Biosecurity System for Food Security 25-30
   - Functions 26-28
   - Organizational Structure 28
     - National Agricultural Biosecurity Council (NABC) 28
     - National Centre for Agricultural Biosecurity (NCAB) 28
     - National Agricultural Biosecurity Network (NABN) 29
   - Agricultural Biosecurity Compact 29
   - Administrative Management 30
   - National Agricultural Biosecurity Fund 30

8. Conclusion 31

9. References 31

BIOSECURITY FOR FOOD SECURITY

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I. Concepts and Definitions

Biosecurity

Biosecurity is a strategic and integrated approach that encompasses the policy and regulatory frameworks (including instruments and activities) that analyse and manage risks in the sectors of food safety, animal-life and health, and plant-life and health, including associated environmental risk. Biosecurity covers the introduction of plant pests, animal pests, diseases, zoonoses, the introduction and release of genetically modified organisms (GMOs) and their products and the introduction and management of invasive alien species and genotypes. Biosecurity is a holistic concept of direct relevance to the sustainability of agriculture, food safety and the protection of the environment, including biodiversity.

Biosecurity is a process of managing biological risks associated with food and agriculture in a holistic manner. Besides enhanced productivity, sustainability and profitability, interest in biosecurity is increasing as national regulatory and export certification systems are being challenged by large increases in the volume of food and agricultural products being traded internationally by the expanding variety of imported products and by the growing number of countries from which these imports are originating. Increased travel is also creating more pathways to spread pests, diseases and other hazards that are moving faster and farther than ever before. Improved coordination is being sought among national bodies responsible for enforcing sanitary, phytosanitary and zoosanitary measures to better protect human, animal and plant-life and health without creating unnecessary technical barriers to trade.

The strengthening of policy and regulatory frameworks for biosecurity in food and agriculture must be among the highest priorities. These policies and legislative frameworks need to be extended to include biosafety needs within the overall framework of biosecurity. This will provide: (i) Optimization of scarce human and financial resources, (ii) Improving the cohesiveness of advice on all aspects of biosecurity, including biosafety, (iii) Recognition of the special importance of biosafety to food and agriculture as well as the special impacts of food and agriculture on biosafety. Further, this will seek the development of appropriate standards, guidelines and other recommendations for food safety and the protection of plant, animal and aquatic-life and health based on risk assessment and taking into account relevant aspects of biosafety, including environmental health.

Thus, risk analysis and management as a framework for biosecurity becomes the central binding force across various sectors. It provides an opportunity to harmonize terminology and methodology, while respecting the need for individual sectors to tailor risk

analysis procedures to the characteristics of the risks involved. It should be recognized that risk analysis procedures should provide an appropriate science-based and transparent basis for biosecurity. Fast expanding trade has intensified the need for effective risk analysis capacities and for bilaterally and multilaterally agreed standards.

There are several commonalities in risk assessment and management across the sub-sectors and organisms which must ideally be addressed by the National Agricultural Biosecurity System. And, in time to come, since Risk Analysis and Management will constitute bulk of the animal, plant, fish health management, biosecurity would automatically occupy the centre stage in this field.

The various international standards issued through several international conventions and agreements notwithstanding, in the wake of implementation of WTO/SPS Agreement and to meet TRIPS and TBT, the country is required to undertake the following actions:

1. Designating a single Central Government Authority as responsible for implementation of SPS measures,
2. Reviewing and updating of legislation and regulations related to SPS to give effect to international agreement and establishing a nodal point for enquiries and information exchange,
3. Establishing national standards on SPS measures in line with international standards,
4. Establishing a notification procedure,
5. Undertaking pest risk analysis and identifying and maintaining pest-free areas for plants and animals as per international standards and safety assessment for food,
6. Providing scientific justification of high level protection in the absence of pest risk assessment,
7. Recognising of equivalence of specific measures through bilateral or multilateral agreements,
8. Identifying researchable issues and strengthening back-up research,
9. Capacity building in terms of infrastructure and expertise,
10. Awareness building and catalyzing attitude change and
11. Developing functional public-private-NGO partnerships.

Requirements of several of the other international, regional and bilateral agreements and of national regulations on various agricultural commodities and ago-ecological and socio-economic regimes, whether on plants or animals or fisheries or microbes, are analogous. Establishing and operationalising separate facilities for each of the requirements amounts to not only gross duplication of scarce resources and efforts but also erosion of effectiveness, efficacy and synergy which are essential for achieving sustainable, sound and competitive outcomes. A National Agricultural Biosecurity System, which involves the management of biological risks in a comprehensive and synergistic manner, is a strong force of convergence of the various paths of sustainable development a win-win situation for all partners of development.

Food Security

Comprehensive food security and nutritional adequacy means physical, social and economic access to all people at all times to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (FAO, WFS, 1996, 2002; endorsed by Millennium Summit, 2000 and reiterated by World Bank, 2008).

Arising from the above, thus, there are four key aspects of food security: availability, access, utilization and vulnerability (Fig. 1).

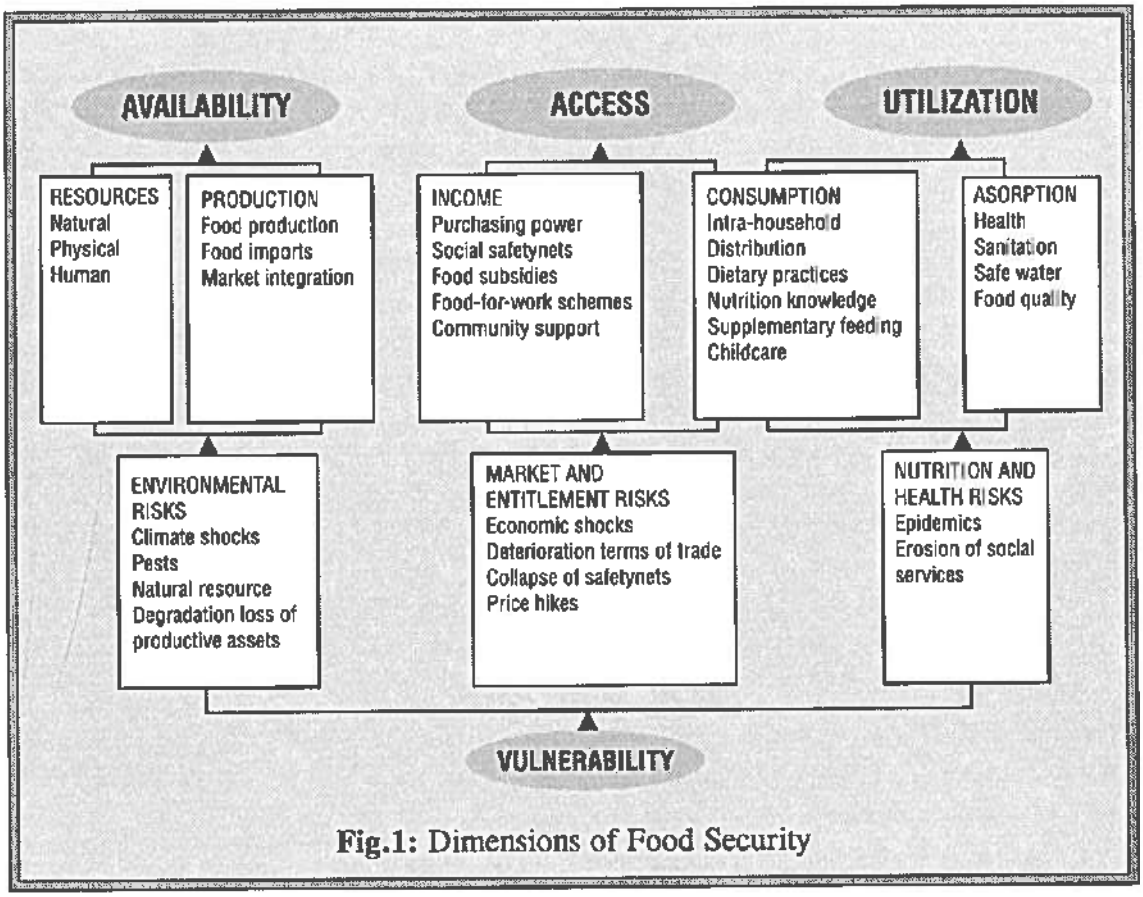

Fig.1: Dimensions of Food Security

Food Availability : It is the sum of domestic production, imports (both commercial and food aid) and changes in national stock. An important reason for the recent relative neglect of food availability has been a sense of near-complacency regarding production issues, induced by the success of the Green Revolution in boosting output of basic cereals. This was manifested in deceleration in investment in agriculture, shrinking and deteriorating natural production resources, namely, land, water, biodiversity, declining total factor productivity (TFP) growth rates, stagnating and declining farmers' income and livelihood security.

In addition, a number of additional factors have more recently come into play and these have had the combined effect of restricting supply and raising demand with the result that

global food prices have been rising steadily and rapidly since 2006. While the FAO food price index rose, on average 8 per cent in 2006 compared with the previous year, it increased by 24 per cent in 2007 compared with 2006. The average of the index for the first three months of 2008 compared to the same three months in 2007 increased by 53 per cent (FAO 2008). International nominal prices of all major food commodities reached, in the first three months of 2008, their highest level in nearly 50 years (in real terms nearly 30 years).

Food Access: This is a measure of a household's entitlement to food, which is the amount it can produce, purchase or otherwise receive (e.g. through public food distribution systems). Lack of access to food is primarily a function of poverty but poverty can affect individuals differently depending on variables such as gender, age, caste and class. Individuals are thus the focus of food security concern.

Food Utilization: This relates to the capacity of an individual to make use of food, the food to which s/he has access. It has two facets. One is food handling, which is important because it can affect both food safety (e.g. poor methods of storing and handling food can result in contamination or infection) and nutritional value (e.g. over-cooking can result in the loss of water-soluble vitamins). The other facet is biological utilization, i.e. how adequately the nutrients in food intake are absorbed by the body. This is determined by a wide range of factors, such as dietary balance (without which some nutrients can be wasted) and state of health (e.g. diarrhoeal disease causes nutrient leaching, while infestation with internal parasites leads to nutrient diversion). Proper food utilization requires adequate education on nutrition and child care as well as adequate sanitation and clean water supply.

Vulnerability: Vulnerability to food insecurity can be either chronic or transient. There are four basic reasons why people can be vulnerable to chronic food insecurity: Physiological, economic, social and political (Swindale, 2004):

- Physiologically vulnerability to malnutrition affects certain age groups (children and the elderly), pregnant and lactating women and sick and convalescent individuals.
- Economic vulnerability affects poor areas, groups, households or individuals, those facing livelihood threat or loss, households with high dependency ratios, those that have lost productive members and those living in environmentally marginal regions.
- Socially vulnerability impinges primarily on unsupported old people, widows, orphans and people with disabilities, on the socially excluded and in many cases, female-headed households and
- Political vulnerability affects, for example, refugees and internally displaced persons or communities exposed to violence or conflict, together with groups or households exposed to discrimination on grounds such as religion, ethnicity and caste.

Transient food insecurity can result from factors such as epidemics, natural catastrophe and man-made disasters. It may also be a regular and predictable, as in areas subject to a recurring annual hungry season, usually in rural areas which have a single annual rainy season.

All the above four components of food security as well as the various forms of food insecurity, namely, chronic, transient and hidden, are directly impacted by bio-risks, thus reiterating the importance of biosecurity for food security.

II. State of India's Biosecurity System

Animal Biosecurity

The biosecurity problem is most acute in livestock, particularly the threat from transboudary animal diseases (TAD). It is also relevant to take stock of changing disease patterns within the country especially diseases which are endemic-like *Peste des petits ruminants* (PPR), bluetongue, classical swine fever, infectious bovine rhinotracheitis/infectious pustular vulvo-vaginitis (IBR/IPV), caprine arthritis/encephalitis (CAE), maedi-visna, equine piroplasmosis, equine rhino-pneumonitis, bovine viral diarrhea (BVD), bovine immunodeficiency (BIV), theileriosis, caprine mycoplasmosis, enzootic abortion (Chlamydia), babesiosis, cysticercosis, anaplasmosis, infectious bursal disease and infectious hydropericardium syndrome of poultry. These diseases are responsible for enormous economic losses and, therefore, need biosecurity plans to be in place. Thus, biosecurity efforts can be categorized into (a) external measures (external biosecurity) - those directed at prevention of entry of new diseases into a group and (b) internal measures (internal biosecurity) - those directed at prevention of spread of disease within a group (Dargatz *et al.*, 2002).

A number of diseases have emerged in recent times. Many of them have zoonotic (Table 1) and bioterror potential (Table 2). Consequences of emergence of these diseases are well known and, therefore, biosecurity is essential.

Emerging infectious diseases (EIDs) can be defined as diseases that have recently moved into new host populations, increased in incidence or geographic range and/or have been discovered or caused by newly-evolved pathogens. This broad definition encompasses a range of infectious diseases which form a significant threat to medical and veterinary public health. Many EIDs are "Transboundary Animal Diseases" (TADs). The TADs are defined as those epidemic diseases which are highly contagious or transmissible and have the potential for very rapid spread, irrespective of national borders, causing serious socio-economic and possibly public health consequences. Almost all the diseases affecting animals have the potential to adversely affect human population as these diseases might result in reduction in the: (i) Quantity and quality of food and other products (like-hides, bone, skin and fibres) of livestock origin, (ii) Draught animal power (traction, tilling and transport) obtainable from resources available and (iii) People's assets. Of all the animal diseases, TADs resulting in high morbidity and mortality in susceptible animal populations have the potential for most serious adverse consequences. The consequences due to TADs are of very high magnitude and as such occurrence of any TAD could have a

Table 1: Timeline of Epidemic Zoonoses of the 20th and 21st century: Lessons learnt.

Year	Event	Lessons learnt/actions initiated
1900	Yellow fever in Cuba	Killed more than 5000 soldiers, only 968 died in war.
1918	Spanish flu	Killed more than 18 million people.
1941	Rubella in Australia	Significant childhood mortality.
1952	Polio in USA	7000 deaths and 37,000 affected in one of the worst epidemics of polio.
1962-65	Rubella (German Measles)	12.5 million children affected causing deafness and blindness.
1981-	AIDS, HIV	Nearly 100 million people affected world over by a present virus that apparently jumped from Monkeys to human beings.
1989-91	Measles	Neuro virulent variant capable of causing SSPE started occurring at higher frequencies.
1994	Plague in India	Plague may arrive any time in any country.
1994	Hendra virus in Australia	Strict biosecurity measures contain disease in Australia only.
1996	New variant of CJD in UK	Microbial evolution is a continuous process.
1997-98	Nipah virus outbreaks in pigs and humans in Malaysia which later spread to Bangladesh in 2001	Strict biosecurity measures contained disease; but spread to Bangladesh in 2001 and its continued presence till 2005 indicated some lapse in biosecurity measures.
1999	WNV arrives in New York	Greater coordination of PH services, Improved R&D.
2001	FMD hits UK	Worldwide biosecurity concerns; Power of media to direct public opinion.
	Anthrax bioterror in US	World feels vulnerable; Bioterror preparedness.
	Monkey pox	Importance of wildlife zoonosis; Import restriction or health checks?
	BSE	Awareness of international sensitivity and Trade.
2006-08	HPAI (H5N1) in poultry in India	All of the above except human deaths.

Source : Adopted from Gibbs, E.P.J. (2005); many serious outbreaks (not necessarily global) not included

significant detrimental effect on economy and public health not only of the affected nation(s) but a serious threat to whole of the world.

TADs have the potential to:

(i) Threaten food/feed safety and nutritional security through loss of animal protein as well as draught animal power for agriculture.

(ii) Increase poverty of nations which are highly dependent on livestock farming for sustenance.

(iii) Significant production losses for livestock products reducing farm incomes.

(iv) Restrict opportunities for augmenting the animal productivity by local livestock industries as they may not be able to utilize exotic high producing breeds since they may be more susceptible to TADs in a new niche.

(v) Add significantly to the cost of livestock production through the necessity to apply expensive disease control measures.

(vi) Seriously disrupt or inhibit trade in livestock and livestock products either within a country or internationally.

(vii) Adversely affect the public health system when TADs are of zoonotic nature and can be transmitted to humans.

(viii) Burden the environment with undesirable gases and elements in the atmosphere due to large die-offs of domestic animals and their disposal by either burial or incineration and die-offs in wildlife populations disturbing the ecosystem and

(ix) Pain and suffering for affected animals; and ultimately emotional distress to human population as a consequence of TADs.

Table 2: Importance and Epidemic Potential of Emerging diseases.

Priority Disease	Animal Health Impact	Zoonotic	Bioterror potential	Concern
● West Nile Virus disease	+++	+++	No	Spread to Europe? Future in South America?
● Foot-and-mouth disease (FMD)	++++	+?	Yes	Reappearance of FMD in Europe /USA when and how?
● Rinderpest (RP)	++++	--	Yes	Reappearance of RP in any place, when and how?
● SARS-Corona	--	+++	Yes	Can Asia re-wake up?
● Monkey pox	+	++	Yes	Could it be smallpox next?
● Bovine Spongiform Encephalopathy	+++	++	Yes	Diminishing epidemic in cattle and human?
● Bluetongue	+++	--	No	Global warming and spread of virus into Europe?
● Avian Influenza (H5/N7)	++++	++++	Yes	An enemy at the gate of the world in Western world?
● Unknown agent-biotechnology creation	++++	++++	Yes	Technically feasible.

Source: Modified from Gibbs, E.P.J. (2005).

Box 1. India's Poultry Industry Faces Unprecedented Crisis

India's Poultry Industry, which contributes Rs. 35,000 crores to the GNP and provides employment to over 3 million persons - the only segment of our agriculture economy which has been growing consistently at about 17% per annum is facing the worst ever crisis in its history, and a situation of total breakdown and collapse, due to the recent outbreak of Avian Influenza caused by H5N1. This has dealt a severe blow, not only to the farmers but practically to every input industry related to poultry farming, such as hatcheries, breeder integrators, feed mills etc.

If the breeders decided not to continue in the business (due to the setback from the outbreak), it will have an extremely adverse impact on the indigenous pure-line research and breeding activity and the country will be exposed to total dependence on imported breeding stock which will be nothing short of a negation of all the good work done by indigenous genetic research for the past 3 decades. More than 1,000 hatcheries in the country will face total closure.

Study by a renowned economist from USA has revealed that in terms of competitiveness, India ranks No. 1 in the world : USA was placed at No. 4, China at No. 15 and Netherlands at No. 36. The study has further shown that India which presently ranks No. 2 in the cost of chicken production will soon become the cheapest source of chicken production in the world and this will even overtake Brazil.

It is projected that if the present rate of growth in the industry is sustained, in the next 5 years, poultry can be second largest industry in our country, next only to the automobile industry. It will be very unfortunate, if this industry, which has been painstakingly built based on indigenous research over 3 decades, is destroyed (by the H5N1) and the country is forced to depend on import of eggs and chicken. An all out effort, including interim relief measures by the Government to the affected parties, should urgently be made to save this vital industry and put it back on the track.

Source: Anuradha J. Desai, Chairperson, National Egg Coordination Committee, April, 2006.

The recurrent outbreaks of Avian Influenza (bird flu) caused by viral strain H5N1 threatens collapse of Indian poultry industry (see Box 1), let alone the threat to human health.

Nearly 40 exotic animal diseases of economic importance are known. All effort, proactive and preventive, must be made to keep them away from the country. These exotic diseases as a matter of principle should not be handled in any of the existing open laboratories without containment facilities. The High Security Animal Disease Laboratory (HSADL), IVRI, Bhopal, M.P. has BL-4 facility to safely handle high-risk pathogens/List "A" diseases of OIE and authorized by Govt. of India to handle exotic animal pathogens.

Zoonoses have prompted the concept of "one-medicine" for human and animal diseases, as practiced by Jenner and Pasteur (Gibbs, 2005). A particular zoonotic viral infection in animals and human results due to the same virus which, in general, will not have any significant genetic change which might adversely affect the immune response after giving a vaccine which has been developed using the same organism isolated either from animal host or human. For example, H5N1 virus caused disease in poultry and humans and can remain in many species of water fowls without causing any disease. A vaccine developed using virus isolated from either bird flu affected poultry, human or water fowl should be able to protect both birds as well as human. Avian flu, Hendra, Nipah, and SARS-Corona are the best examples of TADs of public health significance where if a vaccine is developed using one of the virus isolates either from human or animals/birds can definitely be used as "One-vaccine" for human and animal diseases. Similarly, many other vector-borne viral zoonoses can be controlled just by developing vaccine(s) using one of the viruses isolated either from human, animal host or vector.

Recently, the Department of Animal Husbandry and Dairying (DAH&D) has designated one central and four regional disease diagnostic referral laboratories under the Animal Disease Management and Regulatory Medicine Scheme at Pune, Kolkata, Bangalore and Jalandhar. The Centre for Animal Diseases Research & Diagnosis (CADRAD) of the Indian Veterinary Research Institute, Izatnagar (U.P.) has been identified as the referral apex laboratory. There are about 100-district level diagnostic laboratories in the country.

Four Animal Quarantine Certification Stations (AQCS) are functioning at Delhi, Mumbai, Chennai and Kolkata. The DAH&D is contemplating setting up two more Quarantine Stations at Bangalore and Hyderabad, as these are now international airports at which requests for imports are frequently received. There are no facilities available at the seaports, which are very important import points.

India is also establishing Diseases Free Zones for selected animal diseases by zoning and buffer zoning keeping international view of OIE and WTO, with strict enforcement of phytosanitary and zoosanitary requirements, yet another new initiative. But, effective surveillance and survey facilities are essential for this purpose. Further, surveillance is critical not only for detecting outbreaks, but also for improving veterinary practices and treatments. The country is not well equipped to do this job. The requisite infrastructures for diagnosis, surveillance, reporting etc. are not in place in many States.

There are several other points which should be considered while adopting the quarantine practices. These include:

- What is the probability that vaccinated animal will not spread any infection when they are permitted to move?
- Should there not be a decontamination policy?
- Will the Government (Central/State) allow import of any vaccinated animal in the country without quarantine? If not, how is it proposed to meet the contradiction between the international and intra-national policies in this regard, especially if it

is raised in international forums? If allowed, what will be the role of all the Quarantine Stations established by the Government.

- As detention of animal or animal products would affect the economic conditions as well as livelihood of the owner/livestock farms adversely, it is desirable that the executive order for slaughtering of infected/suspected animals is issued by the highest authority-like the President of India or the Governor of the State only for some selected diseases.
- There is considerable migratory or nomadic livestock activity that still exists in the country which requires a different approach and strategy and the provisions of the Act need to be suitably amended to recognize this reality.
- Interplay between Central and State/Local Laws and clarity about the role of Central, State and Local Authorities, which would simultaneously have separate but concurrent legal quarantine power in a particular situation.
- The consistent production of high quality, safe, potent and efficacious vaccines requires quality assurance procedures to ensure the uniformity and consistency of the production process.
- Vaccine quality, safety, potency and efficacy must be ensured by consistency in the production process; control procedures selected should be those that best fit the conditions under which vaccines are produced and should comply with good manufacturing practices.
- Worldwide harmonization of standards for veterinary biologicals will be of help to chief veterinary officers who must follow the instructions given in the OIE International Animal Health Code, as they apply to all biological products for use in international trade; worldwide harmonization of registration rules should be ensured to simplify and facilitate international marketing of the products.

Plant Biosecurity

India has been striving to become a biosecure nation. But our facilities for sanitary, phytosanitary and zoosanitary measures are inadeaquate. The Avian Flu menace notwithstanding, India's consignments of farm exports are rejected in hundreds (often being on the top of the list of rejections) every year on grounds of mycotoxin, salmonella, pesticide residues, etc. The situation is likely to worsen in the coming years since health safety standards as presented by *Codex Alimentarius* are getting increasingly stringent and the goal posts in developed countries have been shifting fast. Food safety standards will become the most important non-tariff barrier. Therefore, we must not lose any further time in rendering India biosecure, both from within and outside. A quality food safety and biosecurity literacy campaign must be launched at all levels from farmers to policy makers.

Our biosecurity infrastructure needs to be vastly strengthened. As regards plants, according to the National Bureau of Plant Genetic Resources (NBPGR), several invasive alien species have been introduced into the country along with grain, seed and planting material imports. These introduced pests include bunchy top of banana, banana bract and

BOX II. Sounding the Alarm on Global Stem Rust

Stem rust is a catastrophic disease because of its ability to cause complete annihilation of wheat crops over wide areas. The widespread use of PBW 343 wheat variety possessing 1BL.1RS translocation with Sr31 and its continuing stem rust protection over about 6 million ha in India alone had led to complacency throughout the wheat community. The discovery of race Ug99 with virulence for Sr31 and other important genes in Uganda in 1999, and possibly earlier in Kenya, was a reminder of the pathogen's ability to respond, but little seems to have happened in breeding programs until the emergence of current concerns following the continued incidence and spread of race Ug99 in Eastern Africa. The prospect of a stem rust epidemic in wheat in Africa, Asia and the Americas is real and must be stopped before it causes untold damage and human suffering. Fortunately, resistant sources against Ug 99 have been identified and the desirable agronomic bases are being used for developing resistant strains in collaboration with Kenya and CIMMYT.

Another disease of wheat that can be very important is Blast on wheat. This strain of blast was first found in Brazil and is now spread up to Bolivia. Very little is known about its likely effect to wheat crop in rice-wheat belt of India. If germplasm enhancement is initiated now (obviously selection will have to be done in Brazil or Bolivia), perhaps by the time diseases reaches India we may have resistant cultivars.

An Expert panel on "Global Rust Initiative", 2005 recommended that diverse genetic resistance be identified in global wheat germplasm by testing in Kenya and Ethiopia. Because modern cultivars currently grown in Northern Africa and Asia are susceptible to race Ug99, a breeding strategy be implemented to incorporate diverse genetic resistance to Ug99 into such germplasm before the race migrates to those areas. DNA-marker assisted selection should be utilized where feasible. The seed multiplication agencies and community-based organizations be encouraged to produce commercial seed of newly developed stem rust resistant varieties with stipulations that (1) Farmers and other stakeholders play a leading role; (2) Breeding programmes be supported in the maintenance and multiplication of Breeder's and Foundation seed; (3) Commercial seed be readily available to farmers and (4) On-farm demonstrations of elite varieties be conducted. The ex-ante and ex-post impact assessments should be undertaken, taking into account alternative crops and livelihood systems.

***Source:** Various CIMMYT Publications, and R.P. Singh of CIMMYT (Personal communication).*

streak viruses, vegetable/pea leaf miner, spiraling white fly, American serpentine leaf miner, peanut stripe virus, cotton leaf curl, potato wart, sunflower downy mildew, coffee pod borer, apple San. Jose scale, Biotype B of white fly and invasive weeds like-*Lantana camara* and *Phalaris minor*. Six of these were introduced in 1990s. With the increasing intensification of agricultural production, productivity and trade, such invasive alien

species will further threaten our crops. A new wheat stem rust pathotype Ug 99 is causing serious damage in Uganda, Kenya and a few other countries and threatens to reach India. Wheat being our main pillar of national food security and rural economy, India must take proactive steps to prevent entry and establishment of this race in country (see Box II).

Five major quarantine stations at New Delhi, Mumbai, Kolkata, Chennai and Amritsar have been modernized with sophisticated equipment and Post Entry Quarantine Facilities under a UNDP/FAO project. However, there are other 24 plant quarantine stations for the upgrading of which an initial effort has been made for need assessment in terms of laboratory and green house facilities required under a FAO-TCP proposal. The 24 stations were classified into three broad categories in the said project based on nature and volume of material received in each of the stations. The output of the project can be a starting point to initiate upgrading of these stations. It may however, be noted that apart from equipping with modern instruments and facilities, the means of communication (telephone, fax, e-mail, vehicle etc.) need special attention for efficient functioning of these stations.

The establishment of national standards on sanitary and phytosanitary measures in line with the international standards is of critical concern to meet the stiff challenges under the international agreements. During 1995 to 2005, 24 international standards have been developed (see Box III). During the past 15 years or so, India has developed the following eight National Standards, some of which conform to some of the International Standards but a lot more work is needed in this direction:

- National Standard for Pest Risk Analysis.
- Guidelines for certification of forced hot-air treatment facilities for wood packaging material.
- Quarantine treatments and application procedures: I.methyl bromide fumigation.
- Guidelines for assessment, audit and accreditation of fumination agencies for undertaking methyl bromide fumigation.
- Requirements for establishment of pest free areas for mango nut (seed) weevil (*Sternochaetus mangiferae*) and pulp weevil (*S. frigidus*).
- Requirement for establishment of pest free areas for tephritid fruit flies.
- Guidelines on certification of hot water immersion treatment facilities for mango fruits.
- Accreditation treatment for ISPM-15 Compliance.

The National Agricultural Biosecurity System may constitute a National Committee on SPS Standards and a suitable standard setting procedure needs to be developed and adapted at the Central and State levels.

So far no systematic efforts are being made for survey and surveillance of endemic pests, of new and emerging pests and of the exotic pests which have been

Box III. International Standards for Phytosanitary Measures.

• **ISPM 1**	Principles of plant quarantine as related to international trade.	1995
• **ISPM 2**	Guidelines for pest risk analysis.	1996
• **ISPM 3**	Code of conduct for the import and release of exotic biological control agents.	1996
• **ISPM 4**	Requirements for the establishment of pest free areas.	1996
• **ISPM 5**	Glossary of Phytosanitary terms.	2001
• **ISPM 6**	Guidelines for surveillance.	1997
• **ISPM 7**	Export certification system.	1997
• **ISPM 8**	Determination of pest status in an area.	1998
• **ISPM 9**	Guidelines for pest eradication programmes.	1998
• **ISPM 10**	Requirements for the establishment of pest free places of production and pest free production sites.	1999
• **ISPM 11**	Pest risk analysis for quarantine pests including environmental risks and LMOs.	2001
• **ISPM 12**	Guidelines for Phytosanitary certificates.	2001
• **ISPM 13**	Guidelines for the notification of non-compliance and emergency action.	2001
• **ISPM 14**	The use of integrated measure in a systems approach for pest risk management.	2002
• **ISPM 15**	Guidelines for regulating wood packaging material in international trade.	2002
• **ISPM 16**	Regulated non-quarantine pests: Concept and Application.	2002
• **ISPM 17**	Pest reporting.	2002
• **ISPM 18**	Guidelines for the use of irradiation as a Phytosanitary measure.	2003
• **ISPM 19**	Guidelines on list of regulated pests.	2003
• **ISPM 20**	Guidelines for Phytosanitary import regulatory system.	2004
• **ISPM 21**	Pest risk analysis for regulated non-quarantine pests.	2004
• **ISPM 22**	Requirements for the establishment of areas of low pest prevalence.	2005
• **ISPM 23**	Guidelines for inspection.	2005
• **ISPM 24**	Guidelines for the determination and recognition of Equivalence of Phytosanitary Measures.	2005

Source: Interim Commission on Phytosanitary Measures.

introduced and are spreading. An effective integrated pest surveillance system and organization devoted to performing field inspection and pest survey activities for the detection, delimitation or monitoring of established pests as well as system and organization devoted to the detection of new pests needs to be introduced. Specific systems may be required for identification, establishment and maintenance of pest-free areas as per the international standards. Similarly, systematically designed survey, surveillance and monitoring studies for the toxin incidence in food and agricultural commodities are required to identify less risk-prone areas for export and domestic use. For this, need-based additional support is needed to strengthen containment facilities, pest risk analysis capacity, pest diagnostic laboratories, residue and toxic laboratories, referral laboratories, emergency control and treatment facilities and accreditation laboratories.

Fish Biosecurity

In fisheries and aquaculture, alien species and genotypes (also known as introduced species and genetically altered species) both have a major role in increasing production. They are recognized as one of the most significant threats to natural aquatic ecosystems and thus to those who depend upon them.

Alien species are a valid means to improve production and the economic benefit from fisheries and aquaculture. About 17% of the world's finfish production comes from alien species. Asia produces more of the *African cichlid tilapia* (>700 000 t) than Africa itself (39 245 t). In Chile, introduced salmonids provide about 20% of the world's farmed salmon, in an industry directly employing some 30,000 people.

The issue is neither to ban alien species, nor to abandon regulation of their movement, but to assess the risks and benefits associated with their use and if appropriate, develop and implement plans for their responsible use. A lack of adequate information is often a major constraint: without such information it is difficult to determine the possible impact of a proposed introduction into a complex and dynamic aquatic ecosystem.

Internationally recognized treaties have recently been established to address the issue, calling for accurate assessments of the risks of introducing exotic species and promoting the creation of information sources and exchange of information on exotic species, including their biological and ecological attributes and possible positive and negative impacts. These include the FAO Code of Conduct for Responsible Fisheries, and CBD Article 8h and decision V/8 on "alien species that threaten ecosystems habitats or species". The International Council for the Exploration of the Seas (ICES) and the European Inland Fisheries Advisory Commission (EIFAC) have both created specific guidelines and procedures for dealing with alien species and GMOs.

As regards aquatic life forms, surprisingly, there are no quarantine facilities in this huge country of tremendous aquatic resources. A National Strategic Plan for Aquatic Exotics and Quarantine has been prepared. It addresses the following key issues:

1. Risk of introducing exotic species,
2. Criteria to finalise list of potential, approved and prohibited exotic species and criteria to finalise diseases of concern.

3. Evaluation of proposals for introduction in an objective manner,
4. Management of exotics already present in India and
5. Surveilliance and Disease Reporting and establishment of a network of diagnostic laboratories.

Necessary infrastructure and human resources should be urgently provided for effective implementation of the above Plan.

III. State of Food Security in India

Since independence, spanning the last 61 years, India has made steady and significant progress in terms of food security and economic growth, especially during the Green Revolution era, 1965 to 1995, when foodgrain yield and production had almost tripled, resulting in halving of the percentages of undernourished and poor people despite doubling of the population during the same period.

Yet, in number terms, the country is home to one-fourth of the world's hungry and poor (Fig. 2). During the last one decade, despite having achieved national level (macro) food security and the boost in the overall GDP growth, agricultural production and rural income growths have slowed down considerably and outstripped by the population growth rate. With little reduction in the number of undernourished and poor people, the country is far behind in achieving the Millennium Development Goals and the targets set at the World

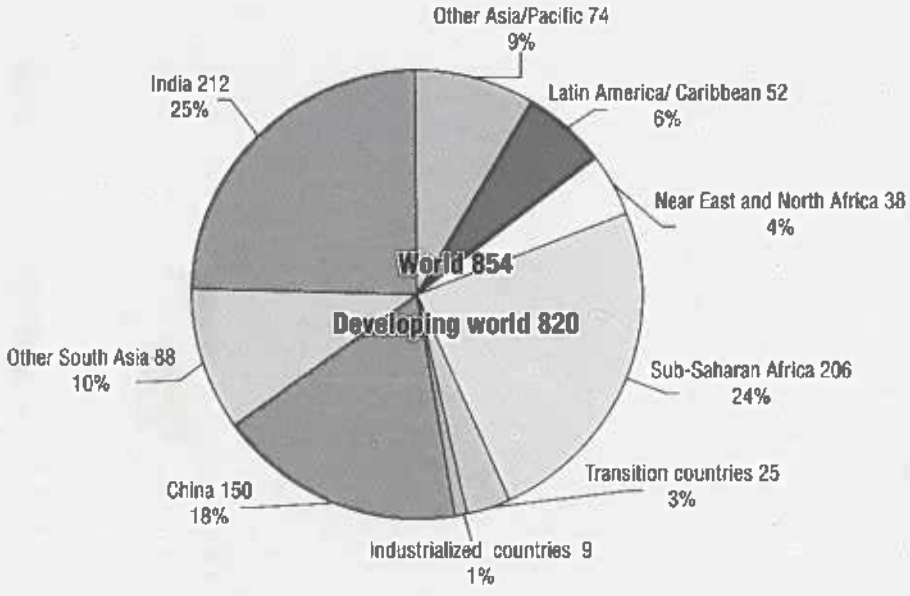

Fig.2: Undernourished 2001-03 (millions).

Source: FAO, 2006

Food Summit. One fifth of the country's population, about 220 million people, are undernourished (Table 3).

Table 3. Number and percentage of undernourished people in India since the base year (1990-92 World Food Summit).

Year	Total Population (Million)	Undernourishment	
		Number (Million)	Per cent
1990-92	863	215	25
1995-97	949	202	21
2001-03	1050	212	20
2005-07	1116	221	20

Source : Ministry of Agriculture, GoI and FAO 2007.

As regards nutritional security, as per FAO's latest food insecurity report, micronutrient and vitamin A deficiencies posed greatest health problems in India. Nearly 57 per cent of the pre-school children in India suffered from vitamin A deficiency against 41 per cent in Sub Saharan Africa and 16 per cent in China. In 2005, in India infant mortality rate (under 1) was 56. As per NFHS 3, 19 per cent of our children are wasted, 38 per cent are stunted and 46 per cent are underweight, accounting for 39 per cent of world's underweight children (Fig. 3).

The high and increasing population pressure notwithstanding, slow down in production growth and the distributional and economic access problems have aggravated

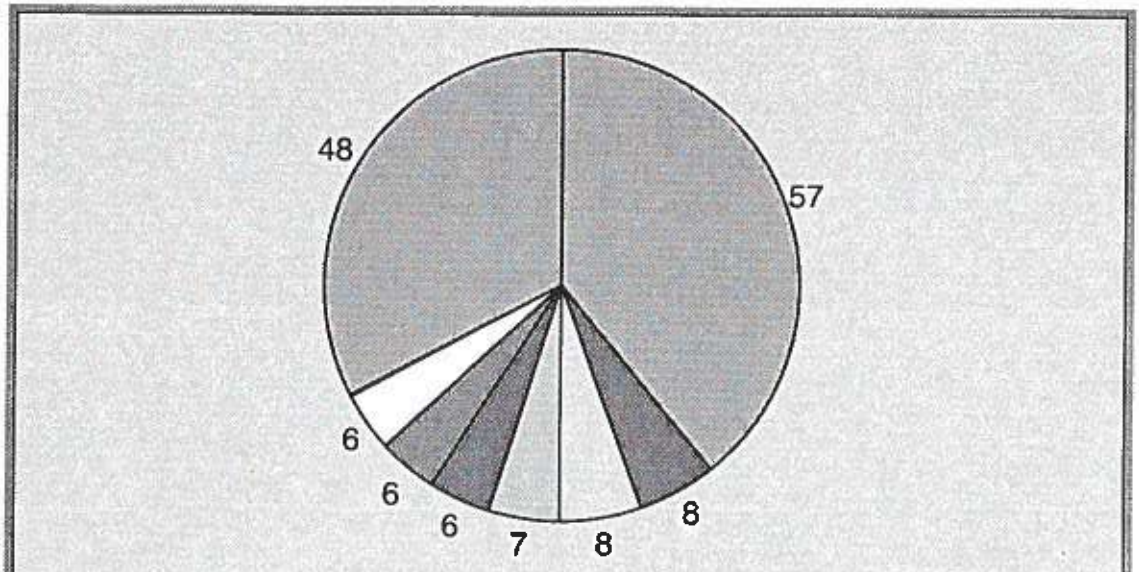

Fig.3: Occurrance of underwheight children (Total in Millions): 146.

Source: FAO, RAP, 2007

the household and individual level (micro level) food insecurities. The deceleration in GDP agriculture and the boost in GDP non-agriculture had widened farmer- non farmer income and the huddle of under-nourished rural people has increased in recent years. Further, the absorption food security, especially in rural areas and urban slums, continues to be unsatisfactory.

Between 1962-63 and 2006-07, foodgrains production increased from about 82 million tonnes to 208 million tonnes, primarily due to the increase in cereals production, particularly rice and wheat, from 70 million tonnes to 194 million tonnes (Table 4). Oilseeds and sugarcane productions had also increased substantially. But, the production of pulses remained more or less stagnant, around 12 to 13 million tonnes.

Table 4: Production of main food commodities, 1962-63 to 2006-07.

Commodity group	Unit	TE 1962-63	TE 1972-73	TE 1982-83	TE 1992-93	TE 2003-04	TE 2006-07
Foodgrains	Million tonnes	81.6	103.5	130.8	174.8	199.7	208.0
Cereals	Million tonnes	69.6	92.6	119.5	161.7	186.5	194.1
Pulses	Million tonnes	12.0	10.9	11.3	13.0	13.2.	13.6
Oilseeds	Million tonnes	7.2	8.6	10.5	19.1	20.3	14.6
Sugarcane	Million tonnes	101.9	121.6	176.7	241.0	293.5	256.7*
Potato	Million tonnes	2.9	4.7	9.9	15.6	24.2	23.8*
Milk	Million tonnes	20.2	23.0	34.0	55.8	87.7	89.4*
Eggs	Billion nos	3.2	6.6	10.8	21.7	40.8	45.2**
Fish	Lakh tonnes	12.2	18.3	24.1	41.2	61.8	63.0**

Source : Agricultural Statistics at a Glance, 2006 and Agricultural Research Data Book, 2007
** for biennium 2004-05 & 2005-06. ** For 2004-05 only. TE- Triennium Ending.*

Per capita production of foodgrains increased from 183 Kg during the early 1970s to 207 Kg by the mid-1990s (Table 5), even as the country's population increased by more than 50 per cent. After the mid-1990s, foodgrain production failed to keep pace with population growth. Per capita production of cereals has declined by 17 Kg and pulses production by 3 Kg during the last decade. "This could pose a serious threat to food security as the country identifies its food security with foodgrain security" (Chand, 2007).

As regards livestock, milk production multiplied from 23 million tonnes in the triennium ending (TE) 1972-73 to 88 million tonnes in the TE 2003-04. Today, with an annual production of nearly 100 million tonnes, India is the largest milk producer in the world. Eggs production had multiplied almost 15 times. It is important to note that the ownership of livestock is more egalitarian and the sub-sector's contribution to GDP agriculture has increased from 18 to 26 per cent during the past 15 years. The livestock production outlook for the 11th Plan is extremely encouraging (Table 6).

With the present fish production of 6.6 million tonnes (3.8 million tonnes inland and 2.8 million tonnes marine), increasing from 1.2 million tonnes in 1962/63, India ranks third in total fisheries production and second in aquaculture in the world, accounting for 18% of national agricultural exports worth about Rs. 8000 crore and employing nearly 7 million people annually.

Table 5: Per capita production of foodgrains (1971 to 2007) (in Kg)

Period	Cereals	Pulses	Foodgrains
1971-75	164	19	183
1976-80	172	18	190
1981-85	179	17	196
1986-90	182	16	198
1991-95	192	15	207
1996-2000	191	14	205
2001-05	177	12	189
2004-07#	175	12	186

 # Figures for the year 2006-07 are based on fourth advance estimates which place foodgrain production at 216 mt.
Source: Economic Survey, GoI, New Delhi.

The stagnating or declining production of pulses and oilseeds has seriously distorted the supply-demand balance and the country has to meet about 15 and nearly 50 per cent of the domestic consumptions of pulses and edible oils through imports, respectively, pointing to the urgency of raising productivity and production of both pulses and oilseeds. The "sunrise" food sectors, namely, livestock, fishery and horticulture registered about 4 per cent growth rate during 1996-97 to 2003-04 (Table 7) which needs to be accelerated to about 6 per cent during the 11th Plan period to achieve the targeted overall agricultural growth rate of 4.1 per cent.

Table 6: Livestock production projection towards the end of the 11th Plan.

Sl. No.	Livestock Products	Growth Rate (in per cent)	Unit	Projection for the Year 2006-07	2011-12
1.	Milk*	5	Million Tonnes	99.05	126.42
2.	Meat**	10	Million Tonnes	6.50	10.47
3.	Egg	10	Billion nos.	49.00	78.91
4.	Wool*	2	Million Kg.	43.33	50.04

*Source : * Department of Animal Husbandry and Dairying, GoI, 2007*
*** FAO, Food Outlook Global Market Analysis, No. 1, June 2006*

Table 7: Growth rates in output of various sub-sectors of agriculture at 1993-94 prices.

Period	Crop Sector	Livestock	Fishery	Fruits & vegetable	Non-horticulture crops	Cereals
1980-81 to 1989-90	2.71	4.84	5.93	2.42	2.77	3.15
1990-91 to 1996-97	3.22	4.12	7.41	5.92	2.59	2.23
1996-97 to 2003-04	0.61	3.76	4.28	3.66	-0.31	-0.11

Source : Planning Commission, 2007

In order to achieve balanced nutrition and inclusive growth, considering the trend of diversification of the food basket and experience on the factors underlying growth during the past decade, attaining and maintaining a steady growth in cereals, pulses and oilseeds is essential and an accelerated growth of livestock, fishery and horticulture sub-sectors will be required. On this basis, desired growth rates must be attained in food items to achieve comprehensive food and nutritional security. In addition, in order to capture new export opportunities in the globalised world and also to achieve the targeted growth rate of 9% overall national GDP, as suggested by the Planning Commission for the 11th Plan, agriculture GDP must attain an overall growth rate of 4% or more (Table 8).

Table 8. Proposed, growth rates for different sub-sectors of agriculture during XI[th] Plan.

Sub-sector	Output share %	Proposed growth rate (% per annum)
Crops	46	2.7
Foodgrains	26	2.3
Oilseeds	6	4.0
Other crops	14	3.0
Horticulture	21	5.0
Livestock	25	6.0
Fisheries	4	6.0
Total		4.10

Source : Planning Commission, 2007

Focusing on foodgrains (cereals and pulses), Chand (2007) has projected that the total demand for cereals will grow to 218.9 million tonnes by the end of the 11[th] Plan and it would reach 261.5 million tonnes by the year 2020-21. Demand for pulses in the same period would grow to 16.1 and 19.1 million tonnes. Domestic demand for foodgrains is projected to reach 235.4 million tonnes by the end of 11[th] Five Year Plan and 280.6 million tonnes by the year 2020-21 and these do not include export demand. He further observes that despite the declining trend in per capita direct consumption of foodgrains, total demand is projected to increase at 2 per cent per annum in the medium term on account of an increase in the population and the need for grain as feed and in related purposes. This implies that to guard against an adverse impact on food security, the growth rate in domestic foodgrain production needs to accelerate three to four times the growth rate attained during the last decade (1997-98 to 2006-07) which was a meager 0.48 per cent.

The Prime Minister has rightly emphasized the need to double annual foodgrain production from the present about 210 to 420 million tonnes within the next 10 years. Since land is a shrinking resource for agriculture, the pathway for achieving these goals has to be higher productivity per units of arable land and water. Factor productivity will have to be doubled, if the cost of production is to be reasonable and the prices of our farm products are to be globally competitive. On an average, rice and wheat yields will need to be enhanced by about 40 per cent and pulses, oilseeds, maize, millets, sorghum and horticultural commodities yields by about 50 to 100 per cent.

IV. Recent Food Security "Crisis" and Global Solidarity to Alleviate Hunger

The FAO-convened World Food Summit I (1996) and WFS II (2002) and the Millennium Summit (2,000) and its eight goals (MDGs) notwithstanding, in order to address the present food crisis, a FAO-convened High Level Conference on World Food Security (HLCWFS), held on June 3 to 5, 2008, Rome, a sort of emergency summit, took stock of the deteriorating food security situation and resolved to seek ways of achieving world food security particularly in context of challenges of soaring food prices, climate change and bioenergy which are threatening to erode the gains made in the alleviation of hunger and poverty over the past decades. The Conference urged for global solidarity and support to fight hunger.

Attended by over 180 countries, the Conference noted that globally the number of hungry had increased to 862 million and it is growing. President of the World Bank had cautioned that failing urgent action, the number may soon swell by 100 million. The poor are the hardest hit as the price rise is further curtailing their economic access to food, let alone the debilitating effects of climate change and market volatilities.

The Conference had pledged to undertake immediate as well as medium- and long-term measures to de-fuse the situation. It had further pledged to enhance food security as a matter of permanent national policy and resolved to use all means to alleviate the suffering caused by the current crisis, to stimulate food production and to increase investment in agriculture, to address obstacles to food access and to use the planet's resources sustainably.

The HLCWFS, working closely with the High Level Task Force set up by the UN Secretary General in May, 2008 to prepare a Comprehensive Framework for Action against the food crisis, had committed itself to eliminate hunger and to ensure food for all today and tomorrow by launching the following immediate as well as long-term measures:

Immediate and Short-Term Measures ("Emergency Package")

- Respond urgently to requests for assistance from affected countries.
- Provide immediate support for agricultural production programmes in key areas.
- Smoothen trade, eliminate agricultural export ban and export restrictions.

Medium- and Long-Term Measures ("Resilience Package") :

- Embrace people-centered policy framework and invest in social protection.
- Increase investment in agriculture and in agricultural research, science and technology development, transfer and dissemination.
- Assign appropriate priority to smallholder farmers and fishers, including indigenous people and ensure flows of technology and financial and institutional support to the poor.
- Implement the Mauritius Strategy for Island countries particularly in context of the challenges of climate change and food security.
- Reduce trade barriers and market distortions and uncertainties and link farmers, especially small scale holders, with local, regional and international markets.

- Ensure that production and use of biofuels is sustainable in context of sustainable development and global food security.
- Reduce agriculture's large environmental footprint, render farming systems more resilient and less vulnerable to climate change and harness agriculture to deliver more environmental services.

India had responded to the present upsurge in food insecurity in various ways, namely, (i) Increased food grain procurement prices and enhanced procurement for buttressing the food reserves and public distribution systems. (ii) Banned or restricted export of certain food commodities and (iii) Launched Special Food Security Mission.

V. Major Challenges, Policy Options and Actions for Food Security

With the above backdrop, the issues and challenges in food security in SAARC countries could be grouped in the following five interdependent groups (Singh, 2008):

Alleviation of Hunger and Poverty

- Overcoming unacceptably high levels of hunger and poverty through sustaining and accelerating growth in agricultural productivity,
- Reducing the productivity gap between marginal and favoured areas,
- Bridging huge yield gaps and
- Overcoming the technology fatigue and collapse of extension services.

Productivity, Profitability, Sustainability and Inclusiveness

- Enhancing productivity, profitability and income of the overwhelmingly large proportion of small, marginal, sub-marginal and landless farmers through developing, transferring and providing appropriate technologies, inputs and services and improving input use efficiency,
- Sharing successful experiences in genetic improvement of plants, animals and fish and undertaking germplasm sharing and joint breeding programmes,
- Creating a regional biotechnology consortium involving public and private sectors for accelerating research and technology development for food, nutrition and energy security and
- Environmental protection, conservation and sustained use of natural resources.

Climate Change and Risk Management

- Reducing high vulnerability to natural and man-made disasters causing serious fluctuations in production and implications of climate change and sea level rise,
- Preventing transboundary movement of animal and plant diseases and pests,
- Establishing a regional biosecurity umbrella equipped with early warning system, risk assessment research and forecast and database on biosecurity components,

- Undertaking anticipatory plant breeding, creating and distributing of gene pools to be selected upon by local farmers and scientists for identifying promising lines for floods, drought, salinity, water logging, sea rise and other climate change-related agro-ecologically distressed areas,
- Implementing the Bali Roadmap on climate change management and
- Interlinking cross boundary management of land, water and biodiversity.

Farmer-Market-Value Chain-Employment Linkage

- Linking farmers with markets,
- Managing trade distortions in the globalised world and effecting necessary market, trade and distribution reforms,
- Strengthening post-harvest management, agroprocessing and value addition,
- Augmenting food safetynets and ensuring harmonized food safety, quality and standards,
- Negotiating the policy space to meet the objectives of food security in the WTO regime,
- Undertaking joint policy research on markets and trade and informing the policy makers to evolve policies as per the specific needs of the country and the region for a win-win situation,
- Operationalising the Regional Food Reserve (Bank),
- Catalysing the SAFTA for promoting intra-regional agricultural trade and
- Creation of multiple livelihood opportunities and enhancement of integrated on-farm non-farm employment and income.

Policy Reforms and Governance

- Enhancing and sustaining investment in agriculture, agricultural research and technology development and transfer as well as in social capital augmentation and increasing farmers' income,
- Improving the access to productive resources and institutional supports such as credit, insurance and employment for vulnerable sections,
- Strengthening and widening the safetynets to reach the un-reached and linking smallscale holders with markets and
- Ensuring integrated natural resource conservation and sustained utilization and strengthening national and regional capacities for agro-ecologically differentiated development.

Policy Responses and Actions

In order to address the above challenges, the following policy option/actions, including SAARC cooperation, are suggested :

- Accelerate agricultural growth and inclusiveness,
- Bolster public and private investment in agriculture,

- Bridge yield and employment gaps,
- Strengthen integrated management of natural resources and inputs,
- Promote participatory research and eco-technologies,
- Ensure fair trade and manage market volatilities,
- Institutionalise regional food self-sufficiency and food self-reliance operationalise the Regional Food Reserve and the South Asian Free Trade Agreement (SAFTA),
- Share technology and policy options,
- Undertake information empowerment,
- Establish a regional umbrella on biosecurity,
- Undertake a regional programme on food quality and safety,
- Strengthen conservation and utilization of natural resources and
- Establish climate change management programmes.

VI. Global Convergence Towards Biosecurity

There is a growing global recognition that biosecurity will profit from a more integrated approach. Closer cooperation among institutions responsible for implementing and the rationalisation of infrastructures, where appropriate, will be synergistically beneficial. Models to rationalise regulatory functions among sectors in the quest for improved effectiveness and efficiency have appeared in a number of countries. For example, New Zealand has had a Biosecurity Act since 1993 and a biosecurity Minister and Council since 1999. In Belize, food safety, animal and plant quarantine and environmental issues are dealt with by a single authority, the Belize Agricultural and Health Authority. USA, China and Australia have also followed this path.

The Australian Government, State and Territory Governments, industry and other key stakeholders are describing and reviewing the Australian Biosecurity System (ABS) with a view to further improvements and integration. The development of a consistent national framework of policy and processes within which to approach national biosecurity issues is of major importance. Primary Industries Ministerial Council commenced development of an ABS to address the broader, longer term biosecurity issues with regard to terrestrial animal pests and diseases, terrestrial plant pests and diseases, aquatic animal pests and diseases and terrestrial and aquatic weeds. The ABS will assist in identifying gaps in biosecurity arrangements as to strengthen the country's approaches, minimise pest, weed and disease impacts and demonstrate, nationally and internationally, Australia's commitment to biosecurity. The ABS aims to:

- Prevent pests entering and establishing in Australia,
- Ensure appropriate preparedness and response capacity which is internationally recognised and meets Australia's trading obligations and international treaties and
- Maintain or improve the status of Australia's biosecurity system.

The ABS provides a description of the roles of the various contributors and aims to improve the efficiency of investments in the system. While the same model will not fit everywhere and each country should institutionalise its synergy path as per its capacity, need and goal, the Australian model appears closest to the proposed Indian approach. Thus, along with other partners, India may wish to work closely with Australia to share relevant experiences and expertise.

Several initiatives of the United Nations' Organisations, other international organisations and institutions are actively promoting biosecurity as per their mandates. The Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) of the World Trade Organization disciplines SPS measures in relation to international trade. The Codex Alimentarius Commission (Codex), the International Plant Protection Convention (IPPC) and the Office International des Epizooties (OIE) provide international standards for food safety, plant health and animal health, respectively. A further relevant instrument is the Cartagena Protocol of the Convention on Biological Diversity (CBD) which applies to the transboundary movement, transit, handling and use of Living Genetically Modified Organisms (LMOs). Guidelines on the management of invasive alien species have been developed under the CBD. These international agreements, standards and programmes are parts of a loose international framework for biosecurity and reflect the historically sectorial approach to regulation in this area.

The Food and Agriculture Organisation of the United Nations, recognizing the growing importance of biosecurity, has made this area as one of its sixteen Priority Areas for Inter-disciplinary Action (PAIAs) which aims at "promoting, developing and reinforcing (biosecurity) policy and regulatory frameworks for food, agriculture, fisheries and forestry." The FAO programme clearly sees the advantages of a more coherent, holistic approach to biosecurity that sought synergies between the sectors at national and international levels, without creating new or centralised, unified and rigid structures. The traditional focus on regulating individual production systems was shifting to one of ensuring confidence in the overall regulatory framework which would automatically seek interdisciplinarity, partnership and convergence. Many countries were revising their biosecurity arrangements to take into account the SPS Agreement, at the same time seeking greater efficiencies.

FAO/Norway project on strengthening countries capacity to implement biosecurity measures has recently been launched. Its main objective is to improve biosecurity and strengthen national capacities to meet domestic and international marketing requirements, reduce risks of and increase preparedness for food system shocks associated with disease and related outbreaks that increase the risk of food insecurity and market collapse. Eight Core Partner Countries, namely, Ethiopia, Ghana, India, Kenya, Nicaragua, Senegal, Uganda and Vietnam are participating. The Donors' contribution is US$ 1 million per year, with a maximum of US$ 5 million over five years. The first phase starts this year. The project will address food safety, animal health, plant health, fish product safety, socio economic analysis, policy development and law and regulations. India should urgently avail of this opportunity by completing the necessary formalities and

launch the project without losing any time.

The programme elements of the project are:

1. Biosecurity capacity needs assessment using existing tools,
2. Developing new tools to assess.
3. Baseline ability to implement international agreements.
4. Assessment of legal framework.
5. Animal health emergency response capacity analysis and Plant health emergency response capacity analysis.
6. Socio-economic studies on interaction of disease, livelihoods and markets and development of policy guidelines.
7. Studies on mitigating the impact of (or preventing) market collapse and development of policy guidelines.
8. Development of guidelines in fish product handling incorporating the FAO code on responsible fisheries and other internationally agreed codes of practices.

Fortunately, India is participating in the FAO/Norway Project. As this Project is encouraging the development of methodologies and economic analysis in relation to biosecurity, India may select cases where pest eradication campaigns, or the implementation of improved food standards, had resulted in quantifiable export increases, thus suggesting the way to replicate the success stories. One possible methodology could be developed around an analysis of the values of goods transiting through control and inspection systems, in relation to the costs of such systems. These could be extended to regional biosecurity standards and procedures. Methodologies were required to document the economic advantages flowing from cross-sectorial cooperation and of documenting and analysing the costs and the benefits of public-private sector cooperation, as well as where investments in biosecurity measures had been most successful. A further methodology could consider market opportunities in relation to the biosecurity investments that would be required to realize them. This effort will provide India a greater visibility in the international era in the field of biosecurity.

VII. Establishing a National Agricultural Biosecurity System for Food Security

Biotic insecurity (losses caused by pests, diseases, weeds, toxins, antinutritional factors and overall degenerating quality of food and agricultural products) impacts all the elements of food security, namely, production and availability, access, utilization and vulnerability. This relationship is getting increasingly intensified in the globalised world, as communications, transports, trade and travels are ever intensifying in the global village. Moreover, biosecurity concerns in the food and value chain may arise at any point in the production post harvest handling agroprocessing value addition retailing distribution product storage consumption/utilization chain.

The direct human health implications due to zoonoses, the health and environmental impacts of biotechnologically genetically modified unsafe organisms, biodiversity erosion and microbial imbalances and even bioterrorism notwithstanding, each of the nodes along the production-processing-marketing-consumption are variously impacted by the biological insecurity agents and their management systems. Therefore, it is essential to establish an effective National Agricultural Biosecurity System (NABS) which will minimise, if not completely eliminate, biorisks to production, trade, health and environment and lead to sustained and enhanced livelihood security. Functions, organizational structure and management of the proposed NABS are described below :

Functions

The NABS should determine the potential for synergies and harmonization within the national and sub-national regulatory frameworks that would result from a holistic and coordinated approach to biosecurity. Policy-makers should recognize the importance of biosecurity as a key element of sustainable development and the benefits, including in trade, that can be gained from comprehensive approaches to biosecurity. They should also appreciate the cost of not fully recognising the role of biosecurity. Full awareness on part of all stakeholders is essential for sustaining and further strengthening this national movement.

Strategy of the NABS should be to synergise linkages among science and technology, education and training and commercialization and utilization in the different subsectors capturing both commonalities and specialities for synergistically addressing the four main biosecurity components, namely, Preparedness and Prevention, Diagnostics, Surviellance and Input Management (Figure 4).

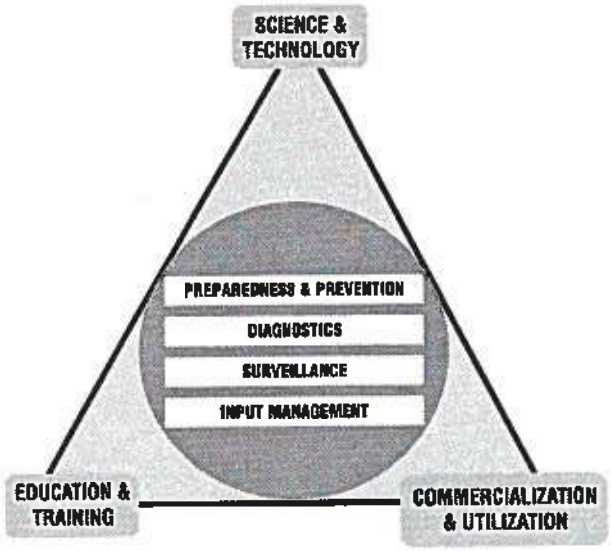

Fig.4: Programme Strategies and Linkages.

In a large country-like India, NABS should recognize the efficiencies that may emanate from regional and sub-regional approaches to risk analysis, particularly in relation to animal and plant-life and health and living modified organisms and re-organise or establish agro-eco-regional facilities as per specific challenges and opportunities. The various quarantine, SPS and zoosanitary facilities should be updated and adequately staffed to be in an ever-ready condition. The Plant Protection staff should be duly rewarded with befitting incentives.

Risk analysis and management frameworks are essential to achieve biosecurity. In the past, such frameworks have been mostly sectorial or used to address specific technical issues. In future, such frameworks should seek to improve collaboration among diverse interests and institutions (particularly agriculture, public health, environment, trade and their associated stakeholders) to achieve biosecurity in a mutually supportive manner, thus avoiding duplication and possible inconsistencies. There are several such opportunities which should be grabbed.

General principles for biological risk analysis in food and agriculture are the same, although procedures may differ depending on the hazards addressed. The IPPC, the Codex Alimentarius, the OIE, the CBD and its Cartagena Protocol, where appropriate, should apply coherent risk analysis methodologies in different sectors by jointly analysing differences and commonalities in approaches and use of terms in risk analysis. FAO may play an archestrating role in this area and help develop tools, including tools to extend the Phytosanitary Capacity Evaluation to other sectors, to assist the country to analyse her capacity-building needs that take account of the full scope of biosecurity, including the communicational, legal, institutional, scientific and technical aspects.

The roles and responsibilities of both the public and private sectors should be considered in planning biosecurity capacity-building initiatives. In India, agriculture related industries should play greater positive role in strengthening the national biosecurity umbrella. The System should devise innovative measures to build partnerships involving all stake-holders.

Appropriate linkages and coordination mechanisms among existing and planned biosecurity capacity-building initiatives should be established to enhance complementarity and avoid duplication of efforts and to ensure that capacity building is directed at identified priorities.

The System should give highest attention to obviate the serious shortcomings in quantity and quality of necessary databases. The need to share information and to ensure better understanding of the requirements for achieving biosecurity can hardly be over emphasised. The need for an Internet-based biosecurity portal to facilitate information exchange on biosecurity is a priority. The importance of information access and exchange in developing biosecurity capacity should also be recognised. India can play a leading role in .developing appropriate mechanisms for information exchange in biosecurity and to participate in the development of information Portals.

In order to lead from the front, the NABS should develop a specific methodology or adopt the ones already used by other national and international programmes for identification, establishment and maintenance of a given strategic area and render it pest free as per the international standards. Such a project could be initiated involving State Governments, Farmers, Traders and other Stakeholders to "sensitize" and declare all areas under identified leading varieties of mangoes as pest free for export to USA under the recent Indo-USA agreement and also highlighted under the Indo-USA Knowledge Initiative.

NABS may initiate projects in a few hot spots in a highly scientific and professional manner-collection of ground facts and creation of database and benchmark information, undertaking detailed risk analysis and eradication of the risk (pathogen and pest) and monitoring the freedom of the eradicated area from the eradicated pest. It should also analyse impact of socio-economic and of agro-ecological and climate change on overall biosecurity situation in the area.

Organizational Structure

Necessary capacity must be put in place to establish and sustain the National Agricultural Biosecurity System and harmonised with international biosecurity standards for food and agriculture to take advantage of trade opportunities and technology sharing for enhanced and sustained agricultural production and farmers' income achieving biosecurity requires an understanding of and the ability to analyse diverse and complex risks and determine and apply measures in a coherent manner while respecting differences among sectors and organizations. Risk analysis and management, as mentioned earlier, is the most important unifying concept across different biosecurity sectors.

In order to achieve its goal of rendering Indian agriculture biosecure, the NABS should have the following three mutually reinforcing components:

National Agricultural Biosecurity Council (NABC)

Chaired by the Union Minister of Agriculture, NABC will serve as a platform for convergence and synergy among the on-going and new programmes of different Ministries and Departments of the Government of India, as well as appropriate international and State Government Agencies and Private Sector Organisations. NABC will serve as an apex policy making and coordinating body and will pay particular attention to strengthening the national capacity in agricultural biosecurity as related to crops, farm animals, forestry and aquatic organisms. The existing infrastructure for sanitary and phytosanitary measures will be reviewed and major gaps filled. Such a multistakeholder apex level NABC would be essential to ensure the livelihood security of nearly 70 crores of our population engaged in agriculture, animal husbandry, fisheries, forestry and agro-processing. While in developed countries, any disaster arising from invasive alien species like-H5N1 strain of the Avian Flu may be more of a human health problem, since hardly 2 to 3% of population is engaged in farming, agriculture is the backbone of the livelihood security system in rural India.

National Centre for Agricultural Biosecurity (NCAB)

This National Centre should have four wings dealing with crops, farm animals, living aquatic resources and agriculturally important micro-organisms. The major purpose of this Centre will be the analysis, aversion and management of risks, as well as, the operation of an early warning system. NCAB will maintain databases relating to potential threats to Indian agriculture and human health security from alien invasive species. It will also serve as a watch dog agency helping to initiate pro-active action in the case of impending biosecurity threats. NCAB will provide the Secretariat for the National Agricultural Biosecurity Council. Further, it will work on the standardization of surveillance and control methods and help to introduce the latest molecular techniques-like micro-arrays for disease diagnosis. NCAB will be largely a virtual organization with considerable capacity in computer aided monitoring and early warning systems. The four different divisions of NCAB could be located in appropriate existing ICAR Institutes/Agricultural/Animal Husbandry and Fisheries Universities, such as the High Security Animal Diseases Laboratory of ICAR at Bhopal, M.P.

National Agricultural Biosecurity Network (NABN):

NCAB will serve as the coordinating and facilitating center for a National Agricultural Biosecurity Network designed to facilitate scientific partnerships among the many existing institutions in the public, private, academic and civil society sectors engaged in biomonitoring, biosafety, quarantine and other biosecurity programmes. This will help to maximize the benefits from the already existing scientific expertise and institutional strengths. The National Agricultural Biosecurity Network could have four mini-networks relating to crops and forestry, animals including migratory birds, living aquatic organisms and agriculturally important microbes.

The establishment of a National Biosecurity Council, National Centre for Agricultural Biosecurity and a National Agricultural Biosecurity Network will help us to strengthen considerably our ability to undertake pro-active measures to prevent the outbreak of pandemics and the introduction of invasive alien species. Such an Agricultural Biosecurity Compact is an urgent national need since prevention is always better than cure.

Agricultural Biosecurity Compact

Among other areas which require urgent attention from the proposed National Agricultural Biosecurity Council, the following deserve priority:

- Review all existing Acts relating to biosecurity and identify and fill gaps in the existing regulatory framework. Based on such a review, develop a National Agricultural Biosecurity Policy for being placed before Parliament and the National Development Council.
- Education holds the key to prevent unconscious and ill-informed introductions of invasive alien species. There is need for launching a Biosecurity Literacy

Movement in the country. Human resource development is also exceedingly important. A course may be introduced in all Agricultural, Veterinary and Fisheries Universities on Agricultural Biosecurity. This should be done at the basic degree level. A Media Resource Centre should be established by the proposed National Centre for Agricultural Biosecurity to give authentic information to mass media, so that unnecessary panic is not created. The media require authentic and credible information from time to time.

- Agricultural biosecurity should be everybody's business and not merely that of a few Government Departments or Academic Institutions. It would be useful to train Grassroot Biosecurity Managers (atleast one woman and one man) in every *Gram Panchayat* and *Nagarpalika*. Towns and Cities require equal attention to enlist urban populations in the fight against biologically dangerous introductions and to create a well-informed public opinion in relation to agricultural risks and human health hazards.

Administrative Management

The three components of NABS, namely, NABC, NCAB and NABN should be professionally-led bodies, capable of providing scientific and intellectual leadership and strategic guidance. These should be lean and virtual bodies, having effective structures suiting to the mandate of NABC as an apex integrating force in the area of biosecurity. In order to be productive, these should have the necessary functional and financial autonomy and authority coupled with accountability. Also, the Chief Executives and other Staff should be eminent professionals and should work on a long tenure, without frequent changes.

National Agricultural Biosecurity Fund

A National Agricultural Biosecurity Fund of Rs. 1,000 crores should be establish with an initial contribution by the Government of India and appropriate international and bilateral donors as well as private sector companies. Such a Fund is urgently needed for the following purposes:

- Strengthening infrastructure for sanitary and phytosanitary measures.
- Upgrading facilities for plant, animal and fish quarantine and certification.
- Establishing an off-shore genetic screening center for animals for the purpose of identifying genes for resistance to serious disease epidemics arising from invasive alien species, such as the H5N1 strain of the Avian Flu in poultry. Fortunately, there are unmanned islands in Lakshadweep which can be developed as off-shore Genetic Screening Centres. The present policy of killing indiscriminately all native breeds of poultry will be harmful and we may lose the opportunity of identifying genetic resistance to serious diseases. At the same

time, off-shore screening in isolated areas will help to avoid risks within the country.

CONCLUSION

In order to be food secured, we must be bio-secured. As a matter of fact, unsafe food is no food. Therefore, whatever we produce and eat, we must ensure that it is free from bio-risks. It is hoped that the Government of India will take immediate action in setting up a National Agricultural Biosecurity Council, National Centre for Agricultural Biosecurity and a National Agricultural Biosecurity Network. The recommendations made above relating to strategic interventions and strategic partnerships also need immediate attention. Above all, a National Agricultural Biosecurity Fund will help to strengthen our infrastructure, introduce new molecular techniques of identification and verification, derive benefits from our animal genetic resources and provide needed and timely help to the affected families.

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PROFESSOR RAM BADAN SINGH

(July, 1940 -)

In recognition of his immense contribution to new knowledge, human resource capital and the science-led transformation of agriculture towards the alleviation of hunger and poverty in India and the Asia Pacific Region, Prof. Ram Badan Singh has been awarded the *Padma Bhushan* by the Hon'ble President of India - one of the India's highest civilian honours that recognizes distinguished service of a high order to the Nation in any field in 2003.

Prof. Singh, Ph.D. in Genetics (USA, 1964), possesses a career of leadership in improving agrarian livelihood, food, nutrition and ecological security, in cuting-edge research and technology development, in higher education and human resources development and in policy and programme formulation, execution and appraisal; each pursued in national, continental and global capacities.

During the past 45 years, Prof. Singh had held coveted positions both at national and international levels. He was Member of the National Commission on Farmers, constituted by the Government of India, 2004-06. He was Assistant Director General of FAO of the United Nations and Regional Representative for Asia and the Pacific from 2000 to 2002 and held other senior FAO positions for 15 years from 1979 to 1994 at Bangkok and Rome. In India, he was Chairman of the Agricultural Scientists Recruitment Board (ASRB, 1999-2000), Director and Vice Chancellor of the prestigious Indian Agricultural Research Institute (IARI), New Delhi (1995-99) and Dean, Head of Department, Sr. Professor & Chair/Member Executive Council a leading Universities (1964-1979). Presently, among other things, Prof. Singh is engaged as Distinguished Professor at IFFCO Foundation.

While with the FAO, Prof. Singh has assisted several developing countries in enhancing their human resource, research and technology development capacities, in augmenting productivity, sustainability and profitability of major farming system and in strengthening policies, strategies and enabling mechanisms through launching highly acclaimed national/international programmes.

At the national level, as Member of the National Commission of Farmers, he shared the responsibility to suggest the Government appropriate policy, strategy and programme interventions to enhance farmers' income and to alleviate hunger and poverty. As research and development leader, Professor Singh had developed widely adopted modern varieties of wheat, rice, pulses, oilseeds and cotton, which had contributed and continue to contribute immensely to food, economic and livelihood securities. He steered IARI towards its continued leadership in the New Millennium and prepared the roadmap for an evergreen revolution. As Chair, ASRB, Prof. Singh had steered a dynamic HRD outlook and as Vice-Chancellor/Director, IARI, he had forged public-private partnership in skill development.

Prof. Singh had made important original contributions in the field of Genetics, Plant Breeding and Biotechnology, guided doctoral research of 45 Ph.D scholars and authored over 300 research and policy papers and 12 books.

Along with the *Padma Bhushan*, his other recognitions include: Doctor of Science (*honoris causa*) from seven Universities, Gold Medal from the International Board for Plant Genetic Resources, Lal Bahadur Shastri Memorial International Scientist Award, *Vigyan Gaurav Samman, Bharatiya Paramparagat Vigyan Puraskar,* Dr. Zhu Shoumin International College of Nutrition Award and Distinguished Aluminus Awards. He is Fellow of the Indian Academy of Sciences, National Academy of Sciences and National Academy of Agricultural Sciences.