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Food production & availability - Essential prerequisites for sustainable food security

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Food and nutrition security are intimately interconnected, since only a food based approach can help in overcoming malnutrition in an economically and socially sustainable manner. Food production provides the base for food security as it is a key determinant of food availability. This paper deals with different aspects of ensuring high productivity and production without associated ecological harm for ensuring adequate food availability. By mainstreaming ecological considerations in technology development and dissemination, we can enter an era of evergreen revolution and sustainable food and nutrition security. Public policy support is crucial for enabling this.

Key words Food availability - food production - sustainable food security

Food production is the base for food security. The internationally accepted definition of food security is that given by the Food and Agriculture Organization of the UN (FAO) in the Rome Declaration on World Food Security, 1996, further refined in the FAO's State of Food Insecurity in the World, 2001. "Food security [is] a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life"[1].

Swaminathan (1986)[2] has stressed the need for shifting to the concept of 'Nutrition Security', which he has defined as "physical, economic and social access to balanced diet, clean drinking water, environmental hygiene, primary health care and nutritional literacy"[2]. Three dimensions *viz*. availability, access and absorption are encompassed in the definition ─

(i) Availability refers to the physical availability of food stocks in desired quantities. Using food grains as a proxy for food (reasonable enough in a context where food grains account for a large share of food intake), availability of food grain is given by domestic production net of feed, seed and wastage plus net imports plus draw-down of stocks. Physical availability in any location within a nation depends on storage and transport infrastructure and market integration within the national territory.

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(ii) Access is determined by the bundle of entitlements, related to people's initial endowments, what they can acquire (especially in terms of physical and economic access to food) and the opportunities open to them to achieve entitlement sets with enough food either through their own endeavours or through State intervention or both.

(iii) Absorption is defined as the ability to biologically utilize the food consumed. This is in turn related most crucially to the availability of safe drinking water, sanitation, a hygienic environment, primary healthcare and also to nutritional knowledge and appropriate practices.

The starting point is however, food production that determines the base of food availability. According to Swaminathan[3], given that India's population is likely to reach 1.5 billion by 2030, the challenge facing the country is to produce more and more from diminishing per capita arable land and irrigation water resources and expanding abiotic and biotic stresses. India currently produces about 230 million tones of cereals to meet the needs of a population of 1.15 billion. While calculating food requirements, the needs of farm animals are often overlooked. The current situation in India is that cereal production has to be doubled by 2050 in order to meet the needs of the expected population of 1.8 billion, in addition to meeting the needs of livestock and poultry[3].

A similar concern had been voiced by the National Commission on Farmers (NCF) in late 2006[4], "To double annual foodgrain production from the present 210 million tonnes to 420 million tonnes within the next 10 years, (by 2015), will call for producing at least 160 million tonnes of rice from 40 million ha, and 100 million tonnes of wheat from 25 million ha. Pulses, oil seeds, maize and millets will have to contribute another 160 million tonnes. In addition, the national goal is to raise the production of vegetables and fruits to over 300 million tonnes by 2015. Since land is a shrinking resource for agriculture, the pathway for achieving these goals can only be higher productivity per unit of arable land and irrigation 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. The average farm size is going down and nearly 80 per cent of the farm families belong to the marginal and small farmer categories. Fortunately, the ownership of livestock is more egalitarian. Enhancing small farm productivity, increasing small farm income through crop-livestock integrated production systems and multiple livelihood opportunities through agro-processing and biomass utilisation, are essential both to meet food production targets and for reducing hunger, poverty and rural unemployment".

Over 60 per cent of the Indian population continue to depend on agriculture and allied activities for their livelihood. Hence, growth of this sector is an essential perquisite for overall economic growth. According to the Economic Survey 2012-13[5], the agriculture and allied sector accounted for 14.5 per cent of the gross domestic product (GDP) in 2010-11 at constant 2004-05 prices. The livestock and fisheries sector accounted for 28.4 per cent to the value of output from total agricultural and allied activities in 2010-11. Whereas overall GDP has grown by an average of 8.62 per cent during 2004-05 to 2010-11, agricultural sector GDP has increased by only 3.46 per cent during the same period. The role of the agriculture sector, however, remains critical as going by the 2001 census it accounts for about 58 per cent of employment in the country[6].

This paper focuses on the food production issues facing India today and gives suggestions on measures needed to increase food production and the policy support required. The National Commission on Farmers (NCF) chaired by Dr M S Swaminathan in its series of five reports[4,7-10] from December 2004 to October 2006 had made several recommendations in this direction that continue to be relevant. The paper draws largely on this reservoir already available with us in the section on 'Strategies to increase Food Production and Productivity' and hopes that the suggestions made will get the priority and attention they deserve.

Current situation of food production (includes cultivated food crops, livestock, poultry and fishery production)

Globally, India is the third largest producer of cereals, with only China and the USA ahead of it. India occupies the first position in milk production and is the third largest producer of fish and second largest producer of inland fisheries in the world. The fisheries sector also provides livelihood to some 11 million people involved fully/partially in fisheries and on subsidiary activities connected with the sector. India ranks first in respect of cattle and buffalos and second in goats, third in sheep and seventh in poultry population in the world and nearly 90 million people work in the livestock sector[10]. The dairy industry provides employment to 18 million people (9.8 million primary and 8.6 million subsidiary

employment), not including persons employed in sale, re-processing and transport of animal products at secondary market level[11]. Of these, 70 per cent are women and 67 per cent have no access to land, credit or technology. Of the 70 per cent rural households that own livestock, the vast majority are either landless or marginal farmers[11].

Between 1950-51 and 2006-2007, production of foodgrains (comprises production of rice, wheat, coarse cereals and pulses) in the country increased at an average annual rate of 2.5 per cent compared to the growth of population, which averaged 2.1 per cent during this period[12]. Warding off doomsday predictions of hunger and famine, India came to be in a situation following the Green Revolution in the late sixties, where we hardly had to resort to foodgrain imports between 1976-1977 and 2005-2006, except occasionally.

An estimate suggests that without a green revolution, about 30 million children would have died in the developing world between 1970 and 2000, with more than two-thirds of these children being in Asia alone[13]. The rate of growth of foodgrains production however decelerated to 1.2 per cent during 1990-2007, lower than the annual rate of growth of population at 1.9 per cent. The per capita availability of cereals and pulses consequently witnessed a decline. The per capita consumption of cereals was observed to have declined from a peak of 468 g per capita per day in 1990-1991 to 412 g per capita per day in 2005-2006, indicating a decline of 13 per cent during this period[14] (GoI 2008). Foodgrain availability declined by 4.5 per cent between the two periods 1991-2000 and 2001-2005, after having a lower rate of increase in the period 1991 -2000 as compared to that in the period 1981-1990. A point of concern is that moving from the position of self sufficiency that the green revolution helped us attain, we have had to resort to import of foodgrains in recent years.

Per capita availability of milk increased from 124 g/day in 1950-1951 to 176 g/day in 1990-1991 to 290 g/day in 2011-2012, a figure comparable with the global trend[15]. Our total milk production is the highest in the world, but productivity per animal is extremely low by international standards. Per capita availability of eggs increased from five eggs per head per annum at one time to 55 eggs per head per annum in 2011-2012. Meat production from the recognized sector increased from 1.9 million tonnes in 1998-1999 to 4.9 million tones in 2010-2011. Constituting about 4.4 per cent of the global fish production, the fisheries sector gives employment directly and indirectly to about 145 million people[15].

The growth of foodgrain production during the 1970s and 1980s was largely due to institutional efforts in raising the levels of technology used in agriculture through research and extension, investments in rural infrastructure and human capabilities, credit support, procurement at minimum support prices and the strengthening of supportive institutions like the Food Corporation of India (FCI). From the early 1990s, however, there has been a focus on expenditure reduction, resulting in decline in public investment in and other forms of support to the agricultural sector. As a result of the decline in public investment, expansion in irrigation, growth in input usage and technological improvement, have all slowed down during the 1990s[16]. This has as expected impacted on production. It calls for stepping up investment in agriculture, both by the private and public sectors to ensure sustained target growth of 4 per cent per annum. At a broader level, the trend in India may be seen as a reflection of the global decline in food output[17]. The per capita world cereal output reportedly declined from 335 kg per year in 1980-1985 to 310 kg by 2000-2005. Among developing countries, China and India, which together accounted for over 30 per cent of world cereal output in the early 1990s, contributed significantly to this global decline. The eleven developing countries - China, India, Indonesia, the Philippines, Thailand, Vietnam, Iran, Egypt, Pakistan, Bangladesh, and Sri Lanka which together contributed 40 per cent of world cereal output accounted for only a 15.6 per cent increase in cereal output over the thirteen year period between 1989-1991 and 2003-2004, a rate of growth of only 1.1 per cent per year, well below the nearly 2 per cent population growth rate of these countries. At the same time, the output of their export crops rose up to ten times faster than foodgrains, owing to the diversion of land and resources to export crops. The developed countries, which together accounted for about 40 per cent of world cereal output accounted for only an 18.6 per cent rise in cereal output over the same period, or an annual growth rate of 1.3 per cent, ahead of their own population growth, but insufficient to meet their own rising domestic needs and to provide an adequate surplus for meeting the increasing deficit of the developing world[17].

Chapter eight of the Economic Survey 2012-2013 titled "Agriculture and Food Management"[5] gives a

comparative picture of the area, production and yield of crops during 1980-1981 to 1989-1990, 1990-1991 to 1999-2000 and 2000-2001 to 2011-2012. With regard to rice and wheat, while the compound annual rate of growth (CAGR) in area was marginal at 0.41 and 0.46 per cent, respectively during the 1980s, growth in both production and yield was above 3 per cent. The CAGR of area improved to 0.68 per cent for rice and 1.72 per cent for wheat between 1990-1991 to 1999-2000, but it fell for both production and yield in the case of rice and yield in the case of wheat. The subsequent decade 2000-2001 to 2011-2012 saw an improvement of area under wheat but the CAGR of production fell for both rice and wheat. This suggests that in these two crops there is need for renewed research to boost production and productivity. Further, it is necessary to note that these two crops together constituted 78 per cent of total foodgrains production in 2009-2010[5].

In the case of coarse cereals which accounted for 15 per cent of the foodgrain production in 2009-2010, there has been no major technological innovation. The growth rate in area of total coarse cereals comprising *jowar, bajra, ragi*, maize, small millets and barley, was negative in all the three periods 1980-1981 to 1989-1990, 1990-1991 to 1999-2000 and 2000-2001 to 2011-2012. This could have been either due to shift to other crops or relatively dry areas remaining fallow. However, growth in production and yield for coarse grains which was 0.40 and 1.62 per cent, respectively in the 1980s improved significantly to 3.01 and 3.85 per cent, respectively in the 2000-2001 to 2011-2012 period, largely due to the improvement in maize. With regard to pulses, while during the 1980s there was negative growth in total area under pulses and growth in production and yield was 1.52 and 1.61 per cent, respectively, during 2000-2001 to 2011-2012 whereas area and production grew by 1.6 and 3.69 per cent, respectively, growth in yield at 2.06 per cent was almost stagnant. There has been progressive decline in per capita availability of pulses; it fell from 69 grams in 1961 to 32 grams in 2005. The requirement was estimated to be 21.3 million tonnes by 2012[12]. The Economic Survey 2012-2013[5] reports the estimated production of pulses in 2011-2012 as 17.09 million tonnes, indicating a wide gap in demand and supply.

On the oilseeds front, per capita annual consumption of vegetable oil in the country at 14.10 kg is far below the global average of 23.60 kg[18]. The production of oilseeds, though has increased in recent years from 184.40 lakh tons in 2000-2001 to 297.99 lakh tons in 2011-2012, has not kept pace with the demand for edible oils in India. A substantial portion of our requirement of edible oil is met through import of palm oil from Indonesia and Malaysia. Any disruption in the supply of palm oil from these countries will put the country in a difficult situation, especially since a large quantity of the global production of vegetable oils is being utilized for production of bio-diesel in Europe and North America. Such non-food use of edible oils ultimately reduces their availability and pushes up their prices[18].

With regard to the requirements of the livestock sector, it is estimated that current levels of fodder production are sufficient to feed only half of our animal population. Green fodder shortage is estimated at 34 per cent. The gap between demand and supply of animal feed is alarming.

From many perspectives, agriculture in the country today is in a state of crisis. A national survey some years back revealed that given a choice, 40 per cent of farmers in India would not like to be in farming[19]. Farming is increasingly seen as an unviable activity, characterized by rising input costs and un-remunerative prices. It has to be understood that nearly 80 per cent of the land holdings in India are below 2 hectares in size. Unlike in industrialized countries where only 2 to 4 per cent of the population depends upon farming for their work and income security, agriculture is the backbone of the livelihood security system for two-third of India's population. In effect, farmers also constitute the largest proportion of consumers. Hence, improving small farm production and productivity, as a single development strategy, can make the greatest contribution to the elimination of hunger and poverty[7]. Experience of countries that have succeeded in reducing hunger and malnutrition shows that growth originating in agriculture, in particular the small holder sector is at least twice as effective in benefitting the poorest as growth from non-agriculture sectors[20]. The World Bank's World Development Report 2008[21] that focused on 'Agriculture for Development' had also emphasized in a similar vein, "Using agriculture as the basis for economic growth in the agriculture-based countries requires a productivity revolution in smallholder farming". As stated earlier, higher

productivity requires higher investment in agriculture and agriculture research - a fact that needs to be heeded by the policy makers.

Strategies to increase food production and productivity

It is clear that India will remain a predominantly agricultural country during most of the 21st century, particularly with reference to livelihood opportunities. Therefore, there is a need for both vision and appropriate action in the area of shaping our agricultural destiny. Our major agricultural strengths are our large population of hard working farm women and men, our varied climatic and soil resources, abundant sunshine throughout the year, reasonable rainfall and water resources, a long coast line and rich agro-biodiversity. Converting these into jobs and income is the challenge. There are however, several available areas of improvement for increasing the levels of production and productivity and improving the lives of the people dependent on agriculture and allied activities. An integrated crop livestock/fisheries farming system has to be the way forward for the country.

The Green Revolution had been largely confined to irrigated farming areas and to rice and wheat. The per unit area productivity of Indian agriculture today is much lower in India as compared to other major crop producing countries (Table I). There are also wide gaps in the yield among and within States. China has yield rates far ahead of India in all the three major foodgrain crops cultivated. As the Economic Survey of 2012-2013[5] has observed - "improvement in yields holds the key for India to remain self sufficient in foodgrains". Factor productivity in relation to fertilizer application is low and this enhances the cost of production without the desired impact on yields. Proper attention to soil health, access to water, quality seeds and other inputs and package of practices suited to the crop and the agro-ecological region are part of the package needed to enhance farm productivity. As a single agronomic intervention, supply of the needed micronutrients to address the hidden hunger in the soil has the greatest impact on increasing yield. Mandatory water harvesting and recharge of wells and groundwater resources can enhance water availability. Access to timely and adequate credit and effective crop insurance are two other crucial factors. There is also the issue of remunerative price. Ideally, given that the majority of our farmers are small and marginal in nature with land holdings of less than five acres, organization of small farmers' horticulture, cotton, poultry, aquaculture and other estates, to promote group farming and economies of scale both at the production and post-harvest phases of farming will help to enhance the productivity, profitability and sustainability of small holdings.

Table I. Yield of principal crops in different countries in 2008 (kg/ha)

Country	Crop		
	Paddy	Wheat	Maize
Brazil	4229	NA	4086
China	6556	4762	5556
India	3370	2802	2324
Indonesia	4895	NA	4078
USA	7672	3018	9658
Japan	6488	NA	NA
Egypt	9731	6501	7977
Canada	NA	2852	9062

Source: Ref. 22. Table 7.2, Agriculture Statistics at a Glance - 2010, Directorate of Economics & Statistics, Ministry of Agriculture, Government of India.
http://eands.dacnet.nic.in/Adv_Esti_2010.htm
NA, not available

An evergreen revolution[23] (*i.e.* increase in productivity in perpetuity without associated ecological harm), focused on rainfed farming areas and crops suited to these areas is what is called for. Given the need to respond to climate change, short-term and medium term weather forecasting and advisories on crop and varietal choice become crucial. Small farmer friendly technologies have to be disseminated. Research on technology for dry-land farming should be encouraged and these technologies made available to small and marginal farmers.

The technology strategy for an evergreen revolution should have the following three components[4].

1. Defending the gains

The Punjab-Haryana belt is regarded as the bread basket of the nation. Punjab farmers provide 60 per cent of wheat and 40 per cent of rice to the public distribution system and national buffer stocks. Net productivity of rice and wheat increased in the Punjab from 1.2 and 1.1 t/ha in 1960-1961 to 4.3 and 3.9 t/ha, respectively in 2004-2005. However, in recent years there is stagnation in productivity improvement due to declining farm size and income, depleting natural resources base, as for example a steep fall in ground water table and impaired water quality, increasing input costs, particularly diesel and adverse economics

of farming, deficiency of micro-nutrients in the soil and deteriorating soil health, inadequate harnessing of post harvest technology, high indebtedness of farmers, uncertain market prospects except for wheat and rice. Similar conditions prevail in Haryana and Western Uttar Pradesh. Thus, the heartland of the green revolution is in grave trouble. These areas need conservation farming which will help farm families to conserve and improve soil health, water quantity and quality and biodiversity. There is vast scope both to promote Green Agriculture and to reduce the cost of production through enhanced factor productivity.

Eternal vigilance is the price of stable agriculture. The National Commission on Farmers had recommended the establishment of a science-based 'National Biosecurity System' in its third Report[9]. This will safeguard the country from invasive alien species, which could cause potential harm to crop and animal husbandry, fisheries and forestry. The steps taken to defend the gains already made should therefore include pest surveillance and management and gene deployment for checkmating the spread of pathogens. This is equally important in the case of poultry and animal enterprises.

In every State, the agricultural "bright spots" and "hot spots" will have to be mapped. The State should develop a strategy for enlarging the extrapolation domain of bright spots. Similarly, every State should develop a Good Weather Code to maximize the benefits of adequate moisture availability, a Drought Code to minimize the adverse impact of drought, and a Flood Code both to prevent excessive distress and damage, and to promote a post-flood production plan. In the desert areas of Rajasthan, the Good Weather Code should include provision for raising nurseries of appropriate plants, so that in years of excessive rainfall, an extensive tree planting and sand dune stabilization drive can be launched. The Drought Code should include the adoption of crop life saving technologies and contingency plans to change the cropping pattern according to moisture availability.

Contingency Plans and Compensatory Production Programmes have to be prepared. Adaptation to climate change is an urgent task. The Climate Management Unit of the National Rainfed Area Authority should develop computer simulation models of the likely impact of different weather patterns on the major crops coupled with the public policy and agronomic responses needed to meet diverse possibilities. It is important to build seed reserves for crop security just like grain reserves for food security. Second, in wheat there is a vast untapped production reservoir available in Uttar Pradesh (UP), Madhya Pradesh (MP), Bihar and Rajasthan. The ICAR (Indian Council of Agricultural Research) Wheat Directorate in Karnal[4] had calculated that an additional quantity of about 24 million tonnes of wheat can be produced immediately by bridging the gap between potential and actual yields, with technologies and varieties now on the shelf (Table II).

Table II. Achievable targets by bridging yield gaps through available technologies under irrigated conditions (based on National Demonstrations)

State	Current area 2003-2004 ($x10^3$ ha)	Current yield gap t/ha	Additional production possible (10^3 t)
Uttar Pradesh	8418.0	1.346	11330.5
Madhya Pradesh	2831.8	2.071	5864.7
Rajasthan	2103.1	1.646	3461.7
Bihar	1483.0	1.196	1773.6
Haryana	2303.0	0.581	1338.0
Gujarat	660.7	0.714	471.7
Maharashtra	581.1	0.656	380.0
Karnataka	97.0	0.998	96.8
Punjab	3444.0	0.241	82.9
			24800.0

Source: Reproduced with permission from Ref. 4

There is vast scope for increasing rice production in West Bengal, Assam, Orissa, Andhra Pradesh, Tamil Nadu, Karnataka and even Kerala during the *rabi* season. The yield of *boro* rice is high in Assam and West Bengal. Over 27 high yielding rice hybrids are now available to suit different agro-climatic and growing conditions, as well as grain quality requirements[4]. They are from both the public and private sectors. States with an unutilized yield reserve in their Agricultural Production Bank should be encouraged immediately to initiate action with the guidance of experienced farmers and scientists to utilize the yield reserve wisely to improve production and productivity. The precise agronomic package will have to be developed on a location specific basis with the help of agricultural universities[4].

In the case of wheat, the following nine steps will help to improve wheat production: *(i)* In the case of late monsoon floods, regions like Gujarat, South Rajasthan, MP and Maharashtra, which account for nearly seven million hectares of land under wheat,

will need wheat varieties that will mature in 120 days during *rabi*. Farmers would like to sow more wheat due to attractive ruling prices and availability of good soil moisture. Preparedness for timely supply of seeds is necessary, along with other inputs.

(ii) Adequate and timely availability of credit is essential, particularly due to the financial loss suffered during *kharif*.

(iii) Wheat should be sown before November 15 in the North Western Plains to get maximum yield and to escape from potential heat stress in March.

(iv) Use of seed drill to capture soil moisture, adopt proper seeding depth and complete sowing in time should be recommended. Resource conserving tillage agronomy should be subsidized to save water and improve yield.

(vi) Avoid sowing wheat during late October in Punjab as such early sown wheat often suffers if temperatures during December are above normal.

(vi) Balanced use of fertilizers including zinc should be promoted and overuse of urea should be curtailed.

(vii) Pre-emergence weed control or a post-emergence chemical weed control should be recommended across the Indo-Gangetic plain.

(viii) Varietal diversity should be ensured all over the wheat growing region and farmers should grow three of four different varieties to avoid genetic vulnerability to diseases.

(ix) Wherever limited irrigation facility is available atleast one irrigation around crown root stage / early tillering should be recommended followed by need based weeding and fertilization.

Rabi and *boro* rice production can be enhanced considerably by giving attention to balanced application of fertilizers, particularly to the supply of the needed micronutrients like zinc, boron and sulphur. Together with plant protection the enhancement of soil health will help to improve productivity atleast by an additional tonne per hectare. The timely and adequate supply of credit, seeds and electricity, together with addressing the micronutrient deficiencies in the soil will help to offset the loss in production during kharif. The five pronged strategy recommended in brief consists of soil health enhancement, water harvesting and management, credit and insurance, technology and inputs and remunerative marketing.

2. Extending the gains

Eastern India (eastern UP, Bihar, Chattisgarh, Orissa, West Bengal, Assam and North Eastern States) have a large untapped production reservoir with the technologies now available. In these areas, poor water management, rather than water availability, is the major constraint. The Indo-Gangetic plains offer scope for becoming the major bread basket of India through an appropriate mix of technology, services and public policies. In many of these areas, the aquifer should be enriched during the south-west monsoon period, and extensive ground water use should be promoted during the October-April period. Given the right strategy, the 'Ganges Water Machine' could become the main anchor for our food security system. Olaf Erenstein[24] recorded the positive impact of adoption of zero-tillage cultivation practice by about 620000 wheat farmers in the Indo-Gangetic Plains and the need to use it as a stepping stone to conservation agriculture.

3. Making new gains

The immediate prospect for making new gains lies in the areas of post-harvest technology, agro-processing and value addition to primary produce. The NCF has made several recommendations in this area in its reports[4,7-10]. In the long term, there is a need for new yield and quality breakthroughs in major crops through genomics and gene pyramiding. For example, Super Wheats capable of yielding about 8 t/ha are now in the breeders' assembly line. Such wheats have a complex pedigree and illustrate the importance of genetic resources conservation and exchange. The other area seeking attention is production of pulses and oilseeds[4].

Water for agriculture is another problem area. The overexploitation of ground water is setting the ground for availability of irrigation water becoming a serious constraint. Farmer Participatory Action Research Programmes may be initiated throughout the country with the help of appropriate agricultural universities, institutes under the ICAR, International Crop Research Institute for the Semi Arid Tropics (ICRISAT) and Water and Land Management Institutes (WALMIs), in arid, semi-arid, hill, coastal and irrigated areas. The emphasis should be on rainfed areas where introduction of catalytic technological and management interventions can make a striking impact. The economic benefit to the farmer as a result of this programme should be measured. A well-planned, 'Water Literacy Drive' together with the revitalization of traditional systems of water conservation is also needed. Action Research

Projects in irrigated areas should aim at phasing out flood irrigation.

Accompanying these efforts is the need for integrated asset reform addressing aimed at equitable land distribution and aquarian reform for the equitable and efficient utilization of all community and government water bodies. Aquarian reform is also needed in respect of marine fisheries and coastal aquaculture. This should be high on the agenda of the National Fisheries Development Board. Because of population pressure, both land and aquarian reforms alone may not be adequate to provide productive assets. Land and aquarian reforms could form part of an integrated asset reform system designed to provide some productive asset to everyone in the village. Livestock rearing, training in market driven skills or any other form of income security should all form part of an Integrated Asset Reform Policy. Livestock provide good opportunities for strengthening both income and nutrition security. A 'Livestock Development Council' would help to promote integrated attention to all aspects of livestock care including fodder and feed availability and sustainable use.

Looking forward

The Eleventh Five Year Plan saw measures being taken to address the problem facing us. The National Food Security Mission (NFSM) launched in 2007-2008 to enhance the production of rice, wheat and pulses has been implemented across the country during the Eleventh Five Year Plan period. Extension of the Green Revolution to Eastern India comprising Assam, Bihar, Chhattisgarh, Jharkhand, Odisha, Eastern Uttar Pradesh and West Bengal under the *Rashtriya Krishi Vikas Yojana* received an allocation of ₹ 400 crore in the budget for 2011-2012[25]. The States of Madhya Pradesh, Uttar Pradesh, Karnataka, Andhra Pradesh, Gujarat, Chhattisgarh, Bihar, Maharashtra, Orissa, Rajasthan, and Tamil Nadu, constituting nearly 96 per cent of pulses area are being covered under the Pulse Village scheme[26]. It is estimated that India has the potential to cultivate oil palm in 1.03 million hectares to produce 4-5 million tonnes of palm oil which would be able to cater to the consumption requirement of 330 million people @15kg/capita/ per annum. But this would require appropriate public policy support. As the Economic Survey 2012-2013[5] rightly notes, "it is time to frame a price band for edible oils in a manner that harmonizes the interests of domestic farmers, processors, and consumers through imposition of import duty at an appropriate rate". Guidelines under the Rainfed Area Development Programme (RAPD) focus on the need for an integrated farming system strategy based on conservation agriculture that integrates multi-cropping, inter-cropping, mixed cropping and rotational cropping practices with allied activities like horticulture, livestock, fishery, apiculture, agro-forestry to maximise farm returns and mitigate impact of extreme weather conditions; this will cover districts with arid, semi-arid and sub-humid agro ecosystems and less than 60 per cent of the cultivated area under irrigation[27]. All these measures are timely and can greatly benefit by drawing further on the recommendations made in the NCF Reports. Lessons can also be learnt from the successful experiences across countries. A study by the International Food Policy Research Institute (IFPRI)[13], records the proven successes in agricultural development across Asia, Africa and Latin America.

The goal of food self sufficiency however, unfortunately seems daunting especially in the context of the issue of producing enough and agriculture *per se* not getting the priority attention it deserves. The issue can be effectively addressed only when this is set right. Public policy support is crucial for ensuring this. To conclude, drawing again on the NCF reports[4,7-10], "Food security with home grown foodgrains can alone eradicate widespread rural poverty and malnutrition, since farming is the backbone of the livelihood security system in rural India. This will enable the Government to remain at the commanding height of the national food security system. Building a food security system and containing price rise with imported foodgrains may sometimes be a short term necessity, but will be a long term disaster to our farmers and farming. A well-defined, pro-farmer and pro-resource poor consumer Food Security Policy is an urgent necessity".

Mainstreaming the nutrition dimension in agricultural development

Going beyond food production and availability, it is important that the government works with agricultural universities on mainstreaming nutritional considerations in the design of cropping and farming systems research. There is a need to bring about a paradigm shift from the concept of food security at the aggregate level to one of nutrition security at the level of every child, woman and man.

Articulating the public policies needed for achieving nutritional security, such as greater attention to pregnant women and infants (during the first 1000 days in a child's life), financial support to nursing mothers for enabling them to feed the baby at least for the first 6 months, holistic approach to nutrition involving concurrent attention to balanced diets, clean drinking water, sanitation and primary health care are crucial.

Drinking water security is an essential component of nutrition security. The School Noon Meal programme provides an opportunity for ensuring nutrition security to children. Dying wisdom and vanishing crops in relation to nutrition security should be protected. Food safety issues and codex standards should be widely known. Steps should also be taken to prevent food losses both in terms of quantity and quality through safe storage and post-harvest handling.

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