



Strategy for Sustainable Agriculture

Agricultural policies need to be revamped to meet the growing demands for food and fibre in most countries. Such an imperative is felt particularly in the developing countries where agriculture seems to be facing impending crisis. Can the new strategy be a mere extension of green revolution strategies – input intensive farming for higher outputs? Or would the ‘evergreen revolution’ approach, put forwarded by Dr. M S Swaminathan, the father of green revolution in India, provide a sustainable solution for the development of agriculture? The evergreen revolution approach emphasizes on the conventional farming practices such as organic farming and green manure as well as on the use of modern biotechnology. Emerging evidence suggests that the evergreen approach would undoubtedly help the sustainable growth of the agrarian sector, but needs to be complemented by major changes in the institutions that govern the agricultural sector.

Thinking towards Sustainability in Agriculture

The food price crisis of the last decade provided an impetus to the discussions on sustainable development of agriculture. The G-8 countries in 2009 launched the L’Aquila Food Security Initiative (AFSI), endorsed by 40 heads of states and international organizations, which envisages mobilization of \$20 billion in next three years to boost agriculture. AFSI joint statement clarifies that the initiative would evolve a comprehensive strategy focused on ‘sustainable development of agriculture’. The Global Agriculture and Food Security Programme (GAFSP) coordinated by

the World Bank is an offshoot of AFSI and has been funded by US, Canada, Spain, Republic of Korea and Bill and Melinda Gates Foundation (\$900 million). The programme aims to put developing countries in the driver’s seat so they can have funds to boost agricultural production and productivity and provide food security for their peoples. The scope of GAFSP includes connecting farmers to markets, reducing risks and vulnerability to income shocks and weather events, improving off-farm livelihoods for people in rural areas, and providing technical assistance to help governments deal with food insecurity. In Africa, the New Partnership for Africa’s Development (NEPAD), has initiated the Comprehensive Africa Agriculture Development Programme, (CAADP) aiming at the elimination of hunger and abatement of poverty through improvement in agriculture. It envisages an average annual growth rate of 6 per cent in agriculture by 2015. The programme is being implemented under four pillars of agriculture - sustainable land and water management, market access, food supply and hunger and agricultural research. DFID, Bill and Melinda Gates Foundation and Biotechnology and Biological Sciences Research Council (BBSRC) of UK jointly with the Government of India have recently initiated the Sustainable Crop Production Research for International Development (SCPRID) to tap into agricultural innovation outside traditional development community. The programme would allow scientists to research stressors, ranging from pests to climate change, on five key crops - cassava, maize, rice, sorghum and wheat - with a view to boosting sustainable crop yields. SCPRID

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This Policy Brief has been prepared by Mr. Reji K. Joseph, Consultant, RIS.

envisages a greater role for India in collaborating with other South Asian countries and countries in the Sub-Saharan Africa in facilitating transition to sustainable agriculture.¹

What is the global understanding of sustainable agriculture? There is no single definition for this term. In the US, the Farm Bill (Food, Agriculture, Conservation, and Trade Act of 1990) defines sustainable agriculture “as an integrated system of plant and animal production practices having a site-specific application that will, over the long term: satisfy human food and fiber needs; enhance environmental quality and the natural resource base upon which the agricultural economy depends; make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls; sustain the economic viability of farm operations; and enhance the quality of life for farmers and society as a whole”.² The UK Department for Environment, Food and Rural Affairs (DEFRA) defines sustainable agriculture as “ensuring the continuing availability to the consumer of adequate supplies of wholesome, varied and reasonably priced food, produced accordance with generally accepted environmental and social standards; maintaining a flexible and competitive industry which contributes to an economically viable rural society; ensuring effective protection of the environment and prudent use of natural resources; conserving and enhancing the landscape, wildlife, cultural and archaeological value of agricultural land; and respecting a high level of animal welfare”.³ This understanding of sustainable agriculture calls for production of nutritious food, economic wellbeing of those engaged in farming, minimization of the use of non-renewable resources, and an ecosystem perspective to agriculture.

Increased food production is necessary to meet future needs, but it is not sufficient. Hunger and malnutrition will be reduced only if incomes and livelihoods of rural populations, especially the small scale farmers in developing countries, are improved. It is possible to improve productivity significantly where it has been lagging behind and thus improve production where it needs to be most raised. However, short-term benefits would be offset by long-term losses if they lead to further degradation of agro-ecosystems

undermining future ability to maintain current levels of production. Hence, pumping of money into agriculture alone will not have the desired outcomes unless measures are in place to facilitate transition to low carbon and resource preserving type of agriculture that benefits the poor farmers.

Most efforts in the past on improvement in agriculture have been focused on improving seeds and supplying chemical inputs which could augment the yield and scant attention was paid on the need of improving the sustainability of agro-systems. The green revolution approaches have primarily focused on boosting cereal crops – rice, wheat and maize. The shift from diversified cropping system to simplified cereal based system has resulted in micronutrient malnutrition in many developing countries. Despite the availability of over 8000 plant species for humans, the three cereals supply bulk of our protein and energy needs (Frison, *et al*, (2006). Poverty discussions now increasingly focus on the need of having more diversified farming systems and agro-ecosystems in order to ensure a more diversified nutrient output.⁴

The green revolution technologies were successful in meeting the short-term objective of increasing yield, but it proved to be disastrous on the soil and environment. The magnitude of soil degradation has been such that soils in certain patches can no longer support crops. Another problem induced by green revolution technologies and relevant more in developing countries contexts is the deskilling of farmers - stripping farmers of their farm management skills (Stone, 2011). The introduction of new technologies in absence of proper agricultural extension services proved to have deleterious consequences in the developing countries. Moreover, the new strategy in agriculture cannot lose sight of the negotiations going on in climate change and carbon emissions. The primary sources of greenhouse gases in agriculture are the production of nitrogen-based fertilizers and the combustion of fossil fuels such as coal, gasoline, diesel fuel and natural gas. The Intergovernmental Panel on Climate Change (IPCC) estimated that 10-12 per cent of human caused green house gas emissions⁵ came from agriculture in 2005 (IPCC 2007). The IPCC also estimated the global technical mitigation potential for agriculture (excluding fossil fuel offsets from biomass) at 5.5 to 6 Gt of CO₂

¹ http://www.scidev.net/en/south-asia/india-uk-fund-to-boost-agro-innovation-in-africa-and-asia.html?utm_source=link&utm_medium=rss&utm_campaign=en_southasia

² <http://www.nal.usda.gov/afsic/pubs/terms/srb9902.shtml>

³ www.defra.gov.uk

⁴ See Schutter (2010) for details.

⁵ Estimated emission of 5.1 to 6.1 GtCO₂-eq/yr in 2005.

equivalent per year by 2030. So, the new strategy for rejuvenating agriculture should have a broader approach that accommodates various farming systems, ensures wellbeing of those engaged in the farming, minimizes the dependence on non-renewable energy resources, is friendly with the environment, and is conducive for the conservation of biodiversity.

Elements in the New Strategy

There have been a number of experiments in parts of the developing world based on agro-ecosystem perspectives. Integrated nutrient management reconciles the need to fix nitrogen within farm systems with the import of inorganic and organic sources of nutrients and the reduction of nutrient losses through erosion control. Agro-forestry incorporates multifunctional trees into agricultural systems. Water harvesting in dry land area allows for the cultivation of formerly abandoned and degraded lands, and improves the water productivity of crops. Integration of livestock into farming systems provides as a means for fertilizing the farm and a source of protein for the family. Studies indicate that such interventions have been very effective in increasing the productivity. Jules Pretty, *et al.* (2006) compared the impacts of 286 sustainable agriculture projects in 57 countries, covering 37 million hectares (3 per cent of cultivated area in developing countries) and found that these interventions increased productivity in 12.6 million hectare farms with an average crop increase of 79 per cent, while improving the supply of critical environmental services. UNCTAD and UNEP reanalyzed the data to find the impact separately for Africa and found that the improvement in productivity in Africa is much better as compared to the global average – 116 per cent increase in productivity for all African projects and 128 per cent increase for projects in East Africa.⁶ Experiments in parts of the globe enable one to have an understanding on the key elements in the new strategy.

Different Modes of Farming

The revisit to agriculture requires flexibility in adoption of different farming practices – organic farming, non-pesticide management (NPM) practices, integrated pest management (IPM) practices, etc. to make best utilization of the resources and skills and to suit agriculture to

the local conditions. Potentials of biotechnology like tissue culture should also be tapped for the improvement of the agrarian sector.⁷ The new approach is very relevant for regions such as South Asia which is characterized by the vast diversity in soil type, climate, availability of water and dietary habits of people. This calls for a paradigm shift in the focus of agricultural research.

A New Approach to Agricultural R&D

Research by modern science on agro-ecosystems needs to be encouraged to complement the knowledge systems of the farming communities. The private sector may not be interested in this kind of research as their investment decisions are guided by creation of intellectual property and commercial prospects (Vanloqueren and Baret, 2009). Hence, the public sector will have to play a lead role in undertaking research to enable sustainable agriculture. Besides, more research needs to be undertaken on orphan crops like millets. Indeed, the growing awareness of the value of coarse cereals has caused surge in demand for coarse cereals. It is reported that India may have to resort to imports to meet the demand for millets.⁸ More importantly, the research efforts will have to become more participatory unlike the current ‘top down’ approach. The best of what scientists can offer and the valuable experience of farmers should be brought together. In West Africa, the citizens’ juries on governance of food and agriculture set up by the International Institute for Environment and Development (IIED) and Coordination Nationale des Organisations Paysannes (CNOP) made 100 recommendations after having heard experts on the models of agriculture, land tenure and property rights, microeconomic issues and governance of agricultural research (Pimbert, *et al.*, 2010). The new efforts should also encourage farmers to come up with innovative solutions. In Kenya, researchers and farmers developed the ‘push pull’ strategy to control weeds and pests. It consists of pushing away pests from corn by inter planting corn with insect repellent crop like *Desmodium* while pulling them towards small plots of *Napier* grass, a plant that excretes a gum that that attracts and traps pests. This system has other benefits also as *Desmodium* grass is used as fodder for the livestock. Also in research, more emphasis has to be placed on agro-ecosystems. Crop breeding and agricultural ecology are

⁶ Quoted in Schutter (2010).

⁷ Tissue culture is primarily used to eliminate viruses or other plant pathogens by selecting unaffected cells for regeneration.

⁸ ‘Growing appetite for coarse cereals points to imports, *Live mint*, March 29, 2011.

References

- Benin, Samuel; James Thurlow; Xinshen, Diao; Christen, McCool; and Franklin, Simtowe. 2008. *Agricultural Growth and Investment Options for Poverty Reduction in Malawi*, IFPRI Discussion Paper 00794, Development Strategy and Governance Division.
- Frison, EA; Smith IF; Johns T; Cherfas J; and Eyzaguirre PB 2006. “Agricultural biodiversity, nutrition and health: making a difference to hunger and nutrition in the developing world,” *Food and Nutrition Bulletin*, 27:2, pp. 167-179.

Gupta, Anil K. 2008. *Rethinking the Priorities for Indian Agricultural Research, Institutions and Policy: Learning from the Grassroots*, available at http://203.200.225.141/anilg/CONF.PAPERSpercent201979-2003/Rethinking_the_Priorities_for_Indian_Agricultural_Research.doc as on 19th November 2010.

IPCC. 2007. *Climate Change 2007: Mitigation of Climate Change*, Contribution of Working Group Three to Fourth Assessment Report.

Jules, Pretty; Noble AD; Bossio D; Dixon J; Hine RE; Penning De Vries FW; and Morison JI. 2006. "Resource-conserving agriculture increases yields in developing countries," *Environmental Science and Technology*, 40(4), pp. 1114-1119.

Pimbert, Michael, *et al.* 2010. *Democratising Agricultural Research for Food Sovereignty in West Africa*, Bamako/London, IIED quoted in Schutter (2010).

Schutter, Oliver De. 2010. *Report submitted by the Special Rapporteur on the Right to Food*, UN Human Rights Council, December 20, 2010, Document A/HRC/16/49.

Stone, Glenn Davis. 2011. "Field Vs Farm in Warrangal: Bt Cotton, Higher Yields and Larger Questions". *World Development*, 39 (3).

UNEP. 2009. *The Environmental Food Crisis – The environment's role in averting future food crises*, Geneva.

Vanloqueren, G and P.V. Baret 2009. "How agricultural research systems shape a technological regime that develops genetic engineering but locks out agroecological innovations," *Research Policy*, 38, pp. 971-983..

complementary. Crop breeding can provide plant varieties with better tolerance to drought, which is suitable to regions facing scarcity of water. This alone is not sufficient unless it is complemented by a drought tolerant agro-ecosystem (soil, plants, agro biodiversity, etc.) (Schutter, 2010). There is great potential for agricultural research benefiting from traditional knowledge on plant varieties, biodiversity and crop protection and traditional agricultural practices.

Protection of Farmers' Innovations

Given the importance of farmers' knowledge, the new strategy should aim at providing some mechanism for the protection of farmers' innovations. A farmer in Gujarat developed a herbal pesticide which had a unique property of preventing disintegration of neem compounds when exposed to sunlight. Scientists at the Institute of Himalayan Bioresource Technology (IHBT), Palanpur, found that when neem extract is exposed to sunlight for a period of 20 minutes, the effectiveness of its compounds decline steeply. But when combined with another plant, the degeneration of neem compounds stopped completely (Gupta, 2008). The knowledge developed by this farmer cannot be considered purely as traditional. His efforts, trial and error and keen observation need to be recognized. Any system on the protection of the knowledge in the informal sector need to 'appropriately differentiate' between what is traditional and what is contemporary and allocate entitlements accordingly.

Enabling Farmers to Join Supply Chains

The new strategy for agriculture should also aim at enabling small farmers to join supply chains by moving up in the value chain. Cooperatives can help farmers in achieving economies of scale in adding value. This can also be done through innovative partnerships with the private sector

(Schutter, 2010). This will also contribute in enhancing non-farm rural employment generation. However, farmers moving up in the value chain require improved access to market, which in turn requires better communication networks especially rural feeder roads. The marginal returns to public investment on rural feeder roads for agricultural outputs and poverty reduction have been estimated to be three to four times larger than the return to public spending on murrum and tarmac roads (Benin, *et al*, 2008). Adequate measures should also be in place for the storage and conservation to reduce the post harvest losses. It is estimated that post harvest loss is 12 per cent and 50 per cent for vegetables and fruits (UNEP, 2009).

Use of ICTs

Advancements in the information and communication technologies (ICTs) have come as a handy tool in the process of skill formation of farmers and information dissemination. The sustainable agricultural programmes in different parts of the world have used various methods for educating farmers – town meetings, farmer schools, radio broadcastings, etc. Penetration of mobile telephone in rural areas further enhances the scope of keeping farmers informed and networked.

To conclude, the new strategy has to be much broader and substantially different as compared to the green revolution strategy. It should recognize different farming systems and bring in a paradigm shift in the agricultural research where the approach becomes participatory in nature instead of the current 'top down' approach and the public sector plays a prominent role. It should also create mechanisms for incentivising farmers for innovating and enabling them to join supply chains. Importantly, the new strategy will facilitate the use of ICTs in the skill formation of farmers and information dissemination.

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Core IV-B, Fourth Floor
India Habitat Centre
Lodhi Road, New Delhi-110 003, India.
Ph. 91-11-24682177-80
Fax: 91-11-24682173-74-75
Email: dgooffice@ris.org.in
Website: <http://www.ris.org.in>