Strategic Assessments and Development Pathways for Agriculture in the Semi-Arid Tropics

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Vision for Rainfed Agriculture in South Asia

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Rainfed agriculture in South Asia: Reemerging issues

The last four decades have seen impressive gains in food production, food security, and rural poverty reduction in South Asia. Heightened intensification of agriculture through the use of irrigation, fertilizers, and pesticides along with high-yielding varieties (HYVs) in more-favored high-potential zones was the major driving force for this success. However, many regions in less-favored rainfed areas like much of the semi-arid tropics (SAT) have not benefited from this process. Low productivity of rainfed agriculture coupled with widespread poverty, water scarcity, degradation of productive resources (land and biodiversity), and a changing global environment are threatening to further marginalize agriculture and livelihoods in the rainfed areas of South Asia.

Higher rates of growth and poverty reduction will require the development of infrastructure, improvement of marketing systems, access to location-specific technology, and conducive economic and trade policies based on farmers' needs and resources, with greater focus on women and landless labor.

The emerging evidence of higher impacts on poverty as well as higher marginal productivity gains from public investments, particularly in roads, markets, and research in the less-favored regions suggests the need to prioritize these hitherto overlooked areas in terms of technology, institutions, and policy. Evidence from literature also suggests there have been sweeping changes in the village economies of the more favored regions of Asia in the last few decades, justifying a reassessment of research and development (R&D) priorities in regions that have been bypassed. Food security and productivity growth in agriculture in South Asia are increasingly dependent on improved utilization of new technology and productivity growth in rainfed areas. If future agricultural growth is to benefit the poor, the overlooked potential of the rainfed areas must be explored, and suitable strategies and policies designed to stimulate sustainable productivity growth.

Many of the old problems of the rainfed areas persist. Rural poverty, intensity and frequency of droughts, and rural-to-urban migration continue to increase, while the natural resource base is becoming more and more degraded. Meanwhile, the balance between higher farm productivity and incomes on the one hand, and ecological sustainability on the other remains critical. Hence, development planners and policymakers are increasingly looking towards hitherto less-favored rainfed areas.

In December 2002, the Indian Council of Agricultural Research (ICAR) and ICRISAT jointly organized a workshop on "Vision for rainfed agriculture in Asia: Targeting research for development" to stimulate discussions on alternative scenarios, and share views and experiences for developing a vision. With the involvement of national agricultural research systems (NARS) partners, sister centers of the Consultative Group on International Agricultural Research (CGIAR), and others, the workshop sought to

- assess and review the recent changes in rainfed agriculture in Asia;
- foresee the potential impacts of investments, prospective technologies, policies, and institutions; and
- develop a vision for rainfed agriculture in South Asia targeting research for development.

The workshop concluded with the development of a vision statement for rainfed agriculture in South Asia. This policy brief summarizes the discussions and outputs from the meeting.

The context and consequences of change in rainfed agriculture

Rainfed agriculture has shown appreciable dynamism. Growth rates in agricultural production and total factor productivity have been moderate, if not high. Modern technologies (such as HYVs) are increasingly being used. Cropping pattern shifts are taking place and coarse cereals are being replaced with sunflower, soybean, pigeonpea, and lentil, and in some places maize. Tree farming is being taken up in some pockets. Significant dietary changes are taking place across all income brackets. This dynamism notwithstanding, risks, poverty, natural resource degradation, and biodiversity loss persist and are projected to worsen under the impacts of globalization, modernization, climate change, disintegrating community organizations, and inadequate and ineffective public sector interventions in terms of investment, service, and support systems. Increasing population and higher expectations in terms of lifestyles have placed greater pressure on increasing crop/animal production and raising incomes.

Water is the key to agriculture. However, it is reported that by 2020 the Asian region will face the greatest water shortage, and agriculture will find it difficult to compete with industry and other users for this scarce commodity.

R&D prospects for rainfed agriculture

The application of biotechnology to rainfed agriculture is expected to lead to better food security, development of novel products, improved environmental quality, sustainable production systems, decreased use of chemical pesticides, improved quality of products, and profitable utilization of germplasm. Advances in genomics and bio-informatics will help realize the value of germplasm. We can expect varieties with tolerance to drought/waterlogging and resistance to insect pests/diseases to be developed in the near future. Marker-assisted breeding procedures may accelerate these processes. There are already several products of biotechnology such as Bt. Corn, Bt. Cotton, herbicide resistant soybean, papaya with resistance to ringspot virus, amaranthus gene in potato for protein enhancement, golden rice enzymes modifying fatty acids, and drought resistant genes. Although the cost of these products may seem to be high as in the case of Bt. Cotton, experience has shown that over time their costs will come down. Higher yields and reduction in pesticide use may lead to benefits that may exceed the additional costs of the new products. How soon some of the bio-engineered products may become available after testing and taking needed safeguards would depend on the quantum of resources devoted to the effort. Biotechnologists estimate that the products resistant to abiotic stress and those with better nutritive values may become available in the next three to five years. Once available, the prevailing regulatory regimes would determine speed of adoption.

Geographic Information System (GIS) tools can be used to generate soil maps and to develop action plans for sustainable development of land and water resources. Space research applications are useful in estimating land-use and cropping patterns, soil moisture availability, soil salinity, pest incidence, vegetation cover, crop yields, and drought impacts.

Innovations in information technology can be used to develop farmer-centered information systems. Development of village hubs and the use of distance learning techniques can help mitigate the effects of drought by reducing the extension lag.

Alternate land use systems can provide stability of production and income through alley cropping, agro-forestry, medicinal plants, horticulture, etc., in place of annual crops on marginal lands. They help in better soil and water conservation. Some promising alternate land use systems are shrub farming (henna, curry leaf, *jatropha, karanji*), horticulture systems (guava, *ber*, pomegranate, custard apple), and fodder species (*lucaena, glyericidia, stylo*).

Markets in the developed world are evincing a keen interest in organic farming. Rainfed agriculture involves fewer external inputs, and provides good opportunities to adopt organic farming in these areas. To do so, on-farm production and mobilization of biomass as well as the utilization of all the available farm waste have to be given top priority. Identification of specific as well as wide spectrum biopesticides, their commercial production, and timely availability should receive greater attention to achieve decent yields from organic farming.

The public sector needs to pay greater attention to rainfed agriculture as profits from small, fragmented markets are too low to attract private sector attention. Improving the efficiency of both input and output markets would help rainfed farmers in a big way. Diversification of enterprises which can enhance profit-earning opportunities will help rainfed farmers

improve their income and employment levels. Extension systems should develop capacities to render advice to farmers on new opportunities such as alternate land use systems, livestock enterprises, horticulture, and organic farming.

Key issues

The following issues and strategies need to be reckoned to accelerate the pace and change the pattern of development of rainfed agriculture.

- The scope, limit, and support to pulses and oilseeds, coarse cereals, fodder, fuel, pasture and grazing lands, high-value enterprises like livestock, dryland horticulture, tree farming, sericulture, and organic farming have to be decided.
- Community organizations and self-help groups and their confederation, and cooperatives which are in tune with the socio-cultural values of rainfed farmers have to be revived.
- Up-scaling and mainstreaming of already available proven technologies and successful institutional, individual, and policy initiatives.
- Targeting research and policy interventions using proper rainfed typology, multi-disciplinary, participatory, and interactive mode in rainfed agriculture to enhance their effectiveness in improving the livelihoods of the people.
- Use of modern sciences like biotechnology, modeling, ICT, GIS, and others in conjunction with amply available traditional wisdom to improve yield, reduce risk, enhance quality, and ensure preparedness for climatic aberrations.
- Employment opportunities in and outside rainfed agriculture in rural areas to be assessed and enhanced to make them income secure, remunerative, and attractive.
- Land and water development and management to be emphasized with new watershed approach, precision farming, farm mechanization, and stress on low monetary inputs to make rainfed agriculture competitive on sound ecological foundations.
- Options in interfacing rainfed agriculture with intervention (e.g., R&D, watershed) programs to be determined.
- Coping mechanisms, market interventions, and institutional mechanisms and innovations that will be appropriate for the effective functioning of intervention programs.

The development of rainfed areas has to be pursued by establishing synergies between technologies, input supplies, credit, marketing systems, policies, and institutions. Political will and appropriate policies are needed to not only lift rainfed agriculture from stagnation but also put it on to a higher growth trajectory.

In addition, the research focus should shift from commodity to farming systems. Frontier technologies need to be harnessed to achieve drought proofing, drought tolerance, and drought avoidance. Indigenous technical knowledge (ITK) in the areas of seed and water management and bio-control agents should be fully integrated with modern knowledge. Location-specific diversification strategies should be promoted to attain better returns from rainfed farming. The technologies should be demand driven rather than supply oriented.

Any vision for rainfed farming has to rely on harnessing science and must center around people, productivity, profitability, partnership, and concern for the environment. It must consider a paradigm shift from a commodity to farming systems approach.

Capabilities to undertake policy analysis have to be developed at various levels to implement decentralized planning and execution so essential for rainfed areas. The legal framework to deal with land, water, and labor issues has to be redefined, simplified and put in place in tune with present realities.

Vision and strategy for the future of rainfed agriculture in South Asia and implications for R&D

Productivity increases and diversification of agriculture and rural economy in order to create employment and livelihood opportunities to alleviate poverty are key concerns of policymakers and researchers. Broadbased sustainable growth and development of agriculture in the rural sector can be a key strategy for addressing rural poverty in many Asian countries. In this strategic task, the rural sector faces a vastly changing landscape in a globally competitive environment. Increasing costs of capital and labor relative to output prices are the most visible concern of rural agriculturists. Industrialization and urbanization are drawing the younger, better educated, and more productive labor force out of agriculture, while globalization and trade liberalization call for higher efficiencies in agriculture through the application of modern science and technology. Finding the right formula to sustain agricultural growth in a rapidly changing and dynamic scenario requires a vision with forward looking and innovative approaches.

Preamble

We recognize that in rainfed areas

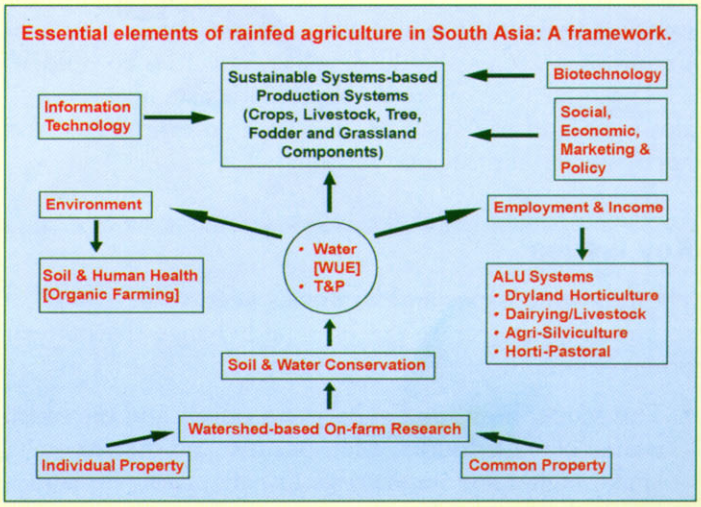
- poverty, food insecurity, and malnutrition are relatively high;
- the natural resource base which is already fragile faces considerable threat from increasing pressures of human and livestock needs;
- farmers and communities face tremendous risks and uncertainties; hence their livelihoods are at greater risk; and
- physical infrastructure and marketing systems continue to be weak, resulting in the underutilization of existing and prospective opportunities.

Vision

By 2020, farmers in rainfed areas in South Asia will be free of poverty, hunger, and malnutrition through accelerated and sustainable socioeconomic development by using human, natural, and other resources on sound principles of agro-ecology, and by harnessing advances in science, properly blended with indigenous knowledge, and combined with supportive institutions and policies. The essential elements of rainfed agriculture in South Asia are presented in a framework.

Strategy

To realize this vision, technology, institutions, markets, and governments will have to play important



roles. The specific strategic initiatives need to emphasize

- maximization of biomass per drop of water through an appropriate combination of crops, livestock, grasses, shrubs, and trees;
- community involvement in these initiatives and providing vulnerable sections access to land and water resources by an appropriate framework of 'rights' and responsibilities;
- investment in evolving and perfecting alternate technologies and in improving physical infrastructure coupled with domestic market reforms for markets to perform their role; and
- effective and economic utilization of land and water resources to improve the living conditions and livelihoods of the people in rainfed areas without causing irreparable damage to the environment.

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