Role of Legumes in Poverty Reduction in Asia: A Synthesis

S Pande and CLL Gowda[1]

Abstract

More than two-thirds of the world's poor are in Asia, and poverty is disproportionately concentrated in the rural areas of the region. Higher productivity in agriculture is important for improving incomes of the poor. Particularly important are policies and investments to improve infrastructure and support services. Concerted research and development efforts supported by government policies have brought a paradigm shift in favor of rice and/or rice-wheat based cropping systems (RWBCS) in the last three decades in majority of the Asian countries. As a result of this shift, legumes were relegated to marginal environments or eliminated from the cereal-based cropping systems. There are increasing concerns about land degradation and declining productivity of the high input rice-wheat cropping systems. It has become necessary to rehabilitate legumes for the sustainability of the RWBCS. The projections of future poverty incidence have also highlighted the need and importance of intensification in RWBCS in Asia. Besides their role in maintaining soil fertility, legumes are important in attaining food security, alleviating poverty, raising the income and improving livelihoods of resource-poor rural farmers. Legumes easily grow with minimum tillage and provide high quality protein in food and feed. Crop diversification with legumes as component of intercrop, crop rotation or relay crop is identified as one of the strategies to maximize the agricultural productivity and farm incomes. Strengthening the research and extension system will enhance legume productivity and facilitate on-farm diversification. Improved rural infrastructure will reduce transport costs, and increase accessibility of markets and public services. Therefore, sustained R&D activities, concerted efforts of government and private sectors, and sound economic policies to encourage crop diversification with legumes need to be addressed to boost the legumes industry in Asia.

1. International Crops Research Institute for the Semi-Arid Tropics, Patancheru 502 324, India.

The Context

Asia harbors majority of the poor population in the world

Low income, malnutrition, poor health care, poor education, unemployment and food insecurity are some of the reflections of poverty (Pinstrup Andersen et al. 1997). Poverty in Asia affects close to 900 million people, ie, ~75% of the poor in the world, with South Asia alone accounting for nearly half of them (Table 1, IFAD 2001, IFAD 2002). Poverty is disproportionately concentrated in rural areas in the region (Table 2) and the gap between rural and urban poverty has been widening over time in many Asian countries. Poverty incidence, as measured by the headcount ration in 1998, was higher in South Asia than in any other region of the world, except sub-Saharan Africa.

Agricultural growth is the engine for poverty reduction in Asia

Poverty, the dwindling natural resource base and human-induced land degradation in Asia are highly correlated. Majority of the Asian poor are mainly dependent on agriculture and crop livestock for their livelihood. Therefore, agricultural growth is the engine for poverty reduction in Asia. Higher farm yields contribute to reduction in poverty directly through higher farmer income and reduced food prices, and indirectly through higher rural wages. For example, in China, rural poverty declined during 1978–84 because of rising grain yields, a fairly equal redistribution of land among households,

Table 1. Regional comparison of income poverty in developing countries.

	People living on less than USD 1 a day (in millions)				
	1987	1990	1993	1996	1998
East Asia and the Pacific	417.5	452.4	431.9	265.1	278.3
South Asia	474.5	495.1	505.1	531.7	522.0
Asia and the Pacific	891.9	947.5	937.0	796.8	800.3
Europe and Central Asia	1.1	7.1	18.3	23.8	24.0
Latin America and Caribbean	63.7	73.8	70.8	76.0	78.2
Middle East and North Africa	9.3	5.7	5.0	5.0	5.5
Sub-Saharan Africa	217.2	242.3	273.3	289.0	290.9
Total	**1183.2**	**1276.4**	**1304.3**	**1190.6**	**1198.9**
Asia and the Pacific as % of the world	75.4	74.2	71.8	66.9	66.8

Table 2. Distribution of poor in rural and urban households in Asia (%).

Country/year	Distribution of Poor	
	Rural	Urban
Southeast Asia		
Indonesia, 1990	83.4	16.6
Laos, 1992/93	87.8	12.2
Malaysia, 1987	86.0	14.0
Thailand, 1992	84.7	15.3
Vietnam, 1992/93	89.1	10.9
East Asia		
China, 1995	98.9	1.1
Mongolia, 1995	43.0	57.0
South Asia		
Bangladesh, 1995/96	57.8	42.2
India, 1994	86.2	13.8
Nepal, 1995/96	94.0	6.0
Pakistan, 1990/91	75.0	25.0
Central Asia		
Kazakhstan, 1996	57.0	43.0
Kyrgyzstan, 1996	59.8	40.2

rising producer prices, better access to free-market sales, and phasing-in of market prices for food grains.

Researchers and policy makers are emphasizing highly productive commercial agriculture in place of low productive subsistence agriculture. Land available for cultivation is the lowest (0.1–0.2 ha) in Asia and scope for expansion of the area are limited, despite the expectations of doubling the population over the next half-century. The limits for expansion of irrigation have been largely reached and agricultural productivity of well-endowed areas is often static or declining. Cultivation of marginal lands is increasing, leading to degradation of the fragile ecosystem. Food security and income levels of Asian population will depend crucially on successful and sustainable intensification to reverse present trend of land degradation.

Rice and wheat are the major crops of Asia

The last four decades have witnessed a phenomenal growth of cereal crop productivity in the developing world, particularly rice and wheat in Asia,

triggered by the Green Revolution. Increased irrigation resulted in the rapid intensification and became the primary source of food supply for Asia's escalating population. Rice-wheat cropping system in South Asia emerged as the most important source of food supply (Kataki et al. 2001).

Importance of grain legumes in human diet and soil fertility

Significant number of infants (28.3%) and preschool children (44%) of Asia are severely affected by malnutrition and under-nutrition. It is also estimated that more than 50% women in the region also suffer from underweight. Grain legumes are the major source of inexpensive protein for rural poor in South and South-east Asia and are important in balancing human and animal diets. With the expansion of Green Revolution's pro-cereals technologies, legumes have either been eliminated from the cropping systems or were relegated to marginal environments. Grain legumes improve soil fertility via biological nitrogen fixation and improve phosphate utilization. Increased cultivation of legumes in the cereals-based cropping systems would not only raise the total productivity, but also stabilize the irrigated and rainfed agriculture.

The Need

Diversification of cropping systems

Continuous monocropping of cereal is causing deterioration of soil fertility and quality. There are greater opportunities for crop diversification with legumes to break the cereal monocropping, and to increase income per unit of cultivated area. Crop diversification provides continuous income and variety of food items for family consumption while ensuring the optimum utilization of fertilizer, labor and water. However, the progress of diversification depends mainly on its inputs and market constraints, and financial profitability to the farmer. The adoption of crop diversification schemes is dictated by a combination of physical factors, viz, land capability, rainfall patterns, water quality, crop suitability and available technology options and economic factors.

Legumes for crop diversification

There is a great scope for introducing legumes in the irrigated rice and rice-wheat based cropping systems, and in rainfed rice-fallows. At present, the production of legumes compared to cereals is ~20% in area and ~10% in production (Figure 1; FAO 2001). Rice-legume crop rotation can enhance the efficiency of land use by increasing productivity of land as well as production of grain legumes. Legumes require minimum tillage and provide high quality protein in food and feed.

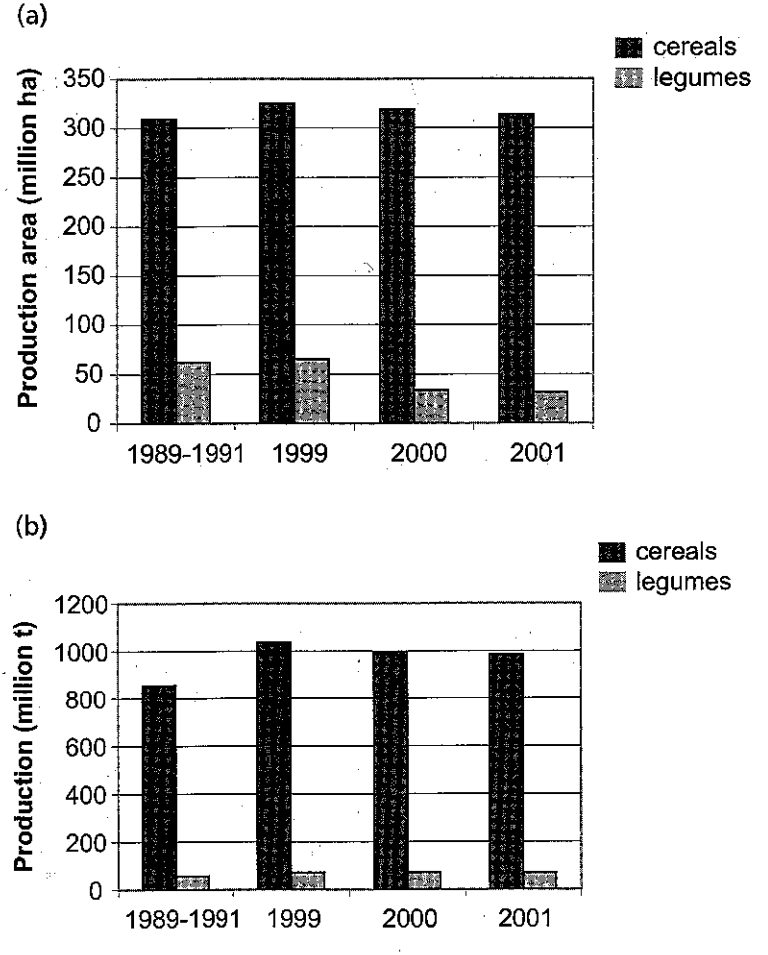

Figure 1. (a) Harvested area and (b) production of legumes in comparison to cereals in Asia.

The Opportunities

In South Asia, a substantial proportion of land is under a single crop, usually rainy season rice, with the land remaining fallow during the following postrainy season. This largely occurs for rainfed rice, where irrigation facilities for rice or a post-rice crop are not available. Nevertheless, residual soil moisture can support growth of a legume crop after rice. There are greater opportunities for popularization of legumes in the cereal-based cropping systems (CBCS) by farmer-participatory development of integrated crop management practices (ICM) [integrated pest management (IPM), integrated disease management (IDM), and integrated nutrient management (INM)] and farmer-preferred cultivars of legumes (lentil, mung bean, soybean, chickpea, pigeonpea and groundnut) that are adapted to local growing conditions. Possible niches for the inclusion of legumes in rice-based cropping systems in Asia are summarized in Table 3. Faster agricultural growth and a structural shift towards legumes are key for poverty reduction. The present status of poverty and grain legume production in different countries, and country specific opportunities for greater inclusion of legumes and role of legumes in poverty reduction in Asia are synthesized as follows.

Vietnam

In Vietnam, rice and maize are the major crops among cereals. During the last 10 years, high growth rate in the agricultural sector (average 4.5% a year) contributed to stable social life, and create basic prerequisites for industrialization. However, still about 15% of which 7% households are food insecure, especially during fallow season and natural disasters. The rate of malnutrition among children under 5 years and pregnant women still exceeds 40%.

Groundnut is an important legume crop, which can improve and generate income for farmers, particularly in North-Central coast, and northeast Mekong River delta regions. Of the total groundnuts produced in Vietnam, ~35% is for export. Export volume was 78,000 t in 2001, which went up to 105,000 t in 2002.

Soybean is the second most important legume grown traditionally in Vietnam. In the last 25 years, area of soybean has increased continuously and reached 130,000 ha. Nevertheless, soybean production does not satisfy

Table 3. Possible niches for inclusion of legumes in the rice-based cropping systems in Asia.

Country	Cropping systems
Bangladesh	Aus rice/jute-fallow-winter legume; Aman rice-legumes; Aman rice-wheat; Mung bean-aman rice-legume (upland)
China	
Central China	Groundnut-rice; Rice-groundnut-soybean; Groundnut-wheat or rape seed; soybean-rice in second year
Southern China	Groundnut-rice-soybean-rapeseed; faba bean, pea, or sweet potato; Rice-groundnut-wheat or sweet potato; Soybean-rice seedlings-groundnut
India	
Northern India	Rice-wheat
Eastern & peninsular India	Rice-chickpea/grass pea/lentil/pea; Rice-rice
Southeastern coastal regions	Rice-mung bean/black gram; Rice-rice
Indonesia	Rice-rice-groundnut; Rice-groundnut-groundnut; Rice-soybean-groundnut or groundnut + maize
Myanmar	Rice-legumes (chickpea, lentil, groundnut); Mung bean-rice-legume; Sesame-rice-legume
Nepal	Rice-legume (chickpea, lentil, grass pea)-fallow; Rice-legume-early rice; Rice-wheat-mung bean; Rice-fallow-groundnut (spring)
Pakistan	
Sindh	Rice-wheat; Rice-chickpea
Baluchistan	Rice-chickpea/grass pea; Rice-flax-coriander/pea
Punjab	Rice-wheat; Rice-chickpea/lentil/pea/berseem clover
The Philippines	Rice-mung bean/groundnut/soybean; Rice-tobacco/vegetables
Sri Lanka	Rice-other field crops; Rice-cowpea/mung bean; Rice-vegetables (onion, chillies, etc.); Rice-cowpea/mung bean/other field crops
Thailand	Sesame/mung bean/groundnut/soybean/jute-rice; Rice-mung bean/black gram/groundnut
Vietnam	Rice-groundnut; Rice-mung bean

1. Winter legumes include chickpea, lentil, grass pea and field pea.
2. 'Aus' rice is sown early in the rainy season; 'Aman' rice is sown after beginning of the main rainy season.

domestic demand. The country imports 400,000 to 500,000 t annually worth ~$100 m to meet material demand for animal feed and oil industry. The rapid increase of these industries contributes to create a stable market of soybean products.

On the upland (1) groundnut-soybean-potato, (2) groundnut-mung bean-groundnut, (3) groundnut-rice-groundnut, (4) soybean-rice-groundnut, (5) rice-rice-groundnut/soybean, and (6) rice-soybean-rice have been recommended for cropping systems diversification. Intercropping of short-duration soybean with maize in spring and winter, groundnut with maize in spring have good potential for legume expansion in northern Vietnam. Groundnut, soybean and mung bean obtained additional yields when intercropped with cotton, sugarcane, cassava, maize and fruit trees, and increased the net returns by $400–500 ha^{-1}.

Thailand

Soybean is the most important grain legume crop in Thailand. Soybean is sown in early rainy season or mid-rainy season or after rice harvest. Availability of high-yielding varieties combined with appropriate management technologies increased the productivity of soybean from 981 kg ha^{-1} in 1978 to 1,419 kg ha^{-1} in 2001.

Green gram and black gram are the second important grain legume crops in Thailand. The harvested area of these two crops progressively decreased from 0.45 million ha during 1988–91 to 0.29 million ha during 1998–2001. This reduction is mainly because of the continuous cultivation of rice in rainy and postrainy seasons in lowlands, and cultivation of sugarcane and sunflower in uplands.

Groundnut is grown in all the regions of Thailand. About 70% of the crop is grown in the uplands during early rainy season and late rainy season. Though the productivity of groundnut is steadily increasing during the past 25 years (18.1 kg ha^{-1} $year^{-1}$), its production area is declining. Groundnut needs to be rehabilitated on these lands to increase the sustainability of the lowland areas.

The Philippines

As the overall economy in the Philippines grew, the incidence of poverty has come down significantly from 41% in 1985 to 25% in 2002. In the Philippines,

52.85% are wetlands and the favorable environmental conditions of the country offer opportunities to expand existing legume crop production and stimulate development of industry. The major legumes, mung bean and groundnut constitute only 0.27% and 0.21%, respectively, of the total area planted to crops in 2002. As a result, the country remained as a major importer of grain legumes.

Crop diversification as a strategy was adopted by the country to promote and accelerate agricultural growth, maximize use of land and optimize farm productivity and availability. Pilot scale studies have been conducted on growing mung bean and groundnut in rotation or relay with upland crops. Results showed that these cropping schemes always had significant increase in yield, better labor-use pattern, and income distribution. Another crop diversification scheme studied was intercropping sugarcane with leguminous crops such as groundnut, mung bean and soybean (Eusebio 2004 in these proceedings, pp 126–140). This cropping system generated additional income, minimized weed population, and improved soil condition because of the decomposition of leguminous crop in the field. The experience of the Philippine Rice Research Institute (PRRI) shows that mung bean and groundnut planted after rice can produce 975 kg seeds ha^{-1} and generate a net income of USD 400 ha^{-1} and USD 456 ha^{-1}, respectively.

Pakistan

Major pulse crops grown in the country are chickpea, lentil, mung bean, black gram and khesari. As compared to cereals, area of pulses is 10–13% and production is 2–4% of the total area and production of cereal crops, respectively, and the country remained as an importer of legume grains. In addition to the biotic and abiotic constraints, socio-economic factors such as comparatively low return per unit area as compared to other crops, illiteracy of the farmers on new production techniques, inaccessibility of the farmers to inputs and marketing problems also hamper the production of legumes. Recently efforts have been made to reintroduce legumes in the CBCS under rainfed and irrigated conditions. In fact, mung bean has brought revolution as a summer crop in certain areas of Pakistan (Ali et al. 1997).

Nepal

Grain legumes occupy 10.38% of the total cultivated land in Nepal. Lentil, grass pea are winter pulses and cover 66% of the total area and production of legumes. Summer legumes such as pigeonpea, black gram, soybean, horse gram, mung bean and cowpea constitute 34% of legumes area and production in Nepal. Lentil and chickpea are the two major leugme crops of the country. Over the past one decade there has been 3.96% decrease in area under pulses cultivation in Nepal. Production rose by 31% and productivity gained by 36% over the same period. Non-adoption of improved package of practices by farmers, unavailability of seeds of improved varieties in time, inadequate extension services, inadequate number of varieties/packages of practices for cultivation for varied agro-climatic conditions, and a number of biotic, abiotic and socio-economic constraints are the causes for the wide gap between yields at research station and farmer's field. His Majesty's Government of Nepal under Agriculture Prospective Plan has given priority for the long term sustainability of the vast 0.5 million ha area of rice-wheat-fallow cropping system of Nepal by inclusion of short duration legumes. Efforts of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Nepal to rehabilitate chickpea in rice fallow lands during winter season, through increased farmers' awareness on IPM practices, supply of seed material, and continued interest of its scientists, increased the grain yields by 125%, net income by 200–400%. The successful rehabilitation of chickpea was evident by adoption of the recommended crop management practices by more than 11,000 farmers in 2003 compared to nearly 100 in 1998.

Myanmar

Myanmar is an agricultural country, and the agricultural sector is the backbone of its economy. The agricultural sector contributes 45.1% of GDP; 18% of total export earnings; and employs 63% of the labor force. Food legumes cover 20% of the total cultivated land area and contribute 64% of the total agricultural product export income. Due to the increasing demand for domestic consumption and export, cultivation of pulses has increased substantially from 0.73 million ha in 1988–89 to 3.28 million ha in 2001–2002. Among food legumes, black gram, green gram, pigeonpea, chickpea, cowpea and soybean are recorded as major crops. Export of food legumes increased from 270,000 metric t in 1988–89 to one million metric t in 2001–2002 and had an important role in earning foreign currency.

Rice followed by legumes is a popular cropping pattern in lower Myanmar and delta areas. Legumes are usually planted as an intercrop with sesame, groundnut, cotton or maize in central Myanmar and as a sequential crop with rice. Due to the availability of short-duration legume varieties, legumes can now be grown as a preceding or succeeding crop to rice in rice-based cropping system.

Myanmar offers a vast scope for enhancing legumes production under rainfed upland and post-rice conditions in the lowlands. The area extension can be covered both in time and in space because prevailing agroclimatic conditions favor production of legume crops year-round in different regions with appropriate improved varieties and technologies.

Iran

Iran is located in the world's cold desert belt in West Asia, and considered as arid to semi-arid region. The annual precipitation is about 250 mm which is 33% of the average world precipitation. Though the total land area of Iran is 165 million ha, only 18.5 million ha are used for crop production. Chickpea and lentil are the most important pulse crops in Iran and occupies nearly 64% and 23% of food legume area in Iran. These two crops are grown as rain-fed and in marginal areas during the spring. Productivity of chickpea and lentil are low (400 and 457 kg ha^{-1}) which are due to poor agronomic practices followed by the farmer such as broadcast sowing, use of furrow turning plough for covering the seed after sowing, low seed rate and late planting. Fungal diseases and insect-pests constitute a major threat for legume production. In the future years, research emphasis will be on identification of host plant resistance in collaboration with the International Agricultural Research Centres (IARCs), and farmers, training to adopt good agronomic and crop management practices.

India

The process of widespread expansion of cereal-based cropping systems replaced most of the sustainable cropping systems over a period of time because cultivation of cereals turned out to be more remunerative than pulses under intensive management practices in Rice-Wheat Cropping Systems (RWCS). As a result, net sown area under pulses, which was at around 16% in 1967–68 has not only declined to 13.2% but also shifted to marginal and

fragile areas. Among the top ten popular cropping systems covering about 20 million ha area in the country, only two (rice-chickpea and maize-chickpea) contain a legume crop with less than 6% of the total 20 million ha area. Besides horizontal expansion through inclusion of pulses in cropping systems and introduction in new niches, the present emphasis is also on other critical inputs such as seeds, water, fertilizers, insecticides and pesticides. The research priorities for diversification in cropping systems through pulses in the country are (1) inclusion of short duration varieties of pulses as a catch crop in irrigated areas, (2) introduction in new niches, (3) substitution of existing low yielding crop in the prevailing systems, and (4) pulses as intercrop with wide space planted crops and relay crop.

Bangladesh

Agriculture is the main source of income and livelihoods of the major segment of the population in Bangladesh. Most farmers operate in smallholdings where poverty and malnutrition are widespread. Importance of agriculture in poverty reduction and economic development is recognized and a number of programs and projects are in operation. Area and production of grain legumes declined over the years and replaced with rice and wheat. Legumes occupy less than 5% of the total cropped area. The major legumes grown in Bangladesh are khesari, lentil, mung bean, groundnut, black gram, chickpea, cowpea, pea and pigeonpea. Lesser or no comparative advantage of legumes because of low productivity renders the crops vulnerable to crop competition with high yielding cereals and high valued crops. Low yield potential, vulnerability to weather changes and widespread incidence of diseases and pests are responsbile for drastic reduction in area and production of most legume crops. Cowpea has been introduced recently, but its cultivation expanded rather dramatically in southeastern coastal districts.

In recognition of the importance of the legumes in sustaining agricultural productivity and to increase the pulse production. His Majesty, Government of Bangladesh, is contemplating a massive campaign in the form of Action Plan to grow legumes in the cereal-based cropping systems. The plan targets to increase production by nearly 50% in the next three years relying largely on the improvement of yields by replacing old varieties with modern ones and through expanding area where pulses are not traditionally grown. The six crops included in the plan are mung bean, khesari, lentil, chickpea, cowpea and black gram.

China

Legumes are important in terms of poverty alleviation, food security and sustainable rural development in marginal arable land and resource poor farms of China. At present, only 10–11% of the total cropped area has a legume component with soybean (5–6%), groundnut (2–3%), and other legumes (~2%). The poor quality of grain legume products and low yield (only 30–40% of that of cereal crops), seriously lagged the production and market development of grain legumes in China. The long-term objective for food legume improvement is (1) to improve the legume grain yield, sowing area and production, (2) to meet the diet needs of poor areas for protein, (3) to export and increase the profits of crop production and utilization for poverty alleviation for resource poor areas, and (4) to protect agro-ecology.

The strong demand of consumer markets, promoted the cultivation of legume crops in China during recent years. Around 10% increase in legume area and production is expected in the coming years. Among cereals and legumes, groundnut emerged as the most profitable crop in the last three years. Concerning efficient diversified utilization of food legume crops, efforts are being made for (1) germplasm collection and evaluation; (2) varietal development for diversified use including food processing, vegetable, export and others; (3) production technology enhancement; (4) technology transfer to farmers; (5) processing technology development and market system; and (6) quality inspection of the products.

Constraints for Crop Diversification with Legumes

Legumes complement cereals in both production and consumption. Legumes improve soil fertility, require less water than cereals, and their rotation with cereals helps reduce the incidence of diseases and pests. Despite their value in production and consumption, the area under legumes in Asia has declined after the introduction of improved technologies for rice and wheat in mid 1960s. Several reasons and constraints for declining and status of legumes and production have been reported, which are summarized here:

- Production constraints – inadequate local production, lack of quality seeds, low productivity and high cost of production
- Biotic constraints – pests and diseases

- Abiotic constraints – soil salinity, water logging and frost injury
- Processing and utilization constraints – inadequate processing facilities and lack of product acceptability
- Policy constraints – pro-cereals national policies and inadequate minimum support price
- Marketing – Non-organized marketing system, lack of quality standards, and inadequate and inefficient infrastructure facilities (roads, transportation and communication systems)

Strategies for Enhancing Legumes Production

The strategies in the area of production, research, extension, farmers, government policies and marketing are as follows:

Research

- Development of pest and disease resistant varieties with high yield potential and suitable for cereal-based cropping systems
- Optimization of production technologies
- Establishment of farmer seed production and distribution systems for proper dissemination

Extension services

- Training farmers and extension workers in production technology
- Motivation of extension services for technology dissemination by providing them sufficient training, funds and mobility

Farmers community

- Increased awareness to the new improved varieties and production technologies
- Implementation of latest recommendations by the researchers/agricultural department for crop production

Government policies

- Establishment of improved seed production and dissemination systems
- Increase in support price for legumes
- Efficient market channels
- Involve private sector in seed production and distribution
- Availability and quality control of pesticides through legislation

National Policies and Emphasis towards Legume Production

Legumes play a key role in soil improvement and income generation. Government interventions play a key role to sustain R&D activities, which are vital to the production of legumes industry. Few Asian governments are currently promoting policies to prioritize and promote legume crops, ie, investing in R&D for improved varieties and agronomic management for legumes, and providing credit for legume farmers. Crop diversification as a strategy was adopted by few countries like the Philippines to promote and accelerate agricultural growth, maximize use of land and optimize farm productivity and availability. Countries such as India, Nepal, Bangladesh, Pakistan and the Philippines have included legumes in diversifying rice and wheat. The Ministry of Agriculture and Rural Development (MARD) of Vietnam is implementing a project on "Developing seed of groundnut and soybean in Vietnam during 2000–2005" with a layout of $1.5 million. This opens up a new orientation to legumes research and development program in Vietnam. The expansion of areas under legume production has been identified in the strategy of agricultural development for restructuring cropping systems in several Asian countries. Diversification with legumes should be considered as an important national policy so as to increase the factor productivity in low productive areas, because legumes need less water than rice and wheat.

Conclusion

Several programs were launched in the agricultural sector to increase domestic food production and reduce poverty. Yet most farmers in the rural communities remain poor and suffer from malnutrition. It is therefore imperative to develop a strategy to transform and modernize the smallholders and farms in the countryside into diversified rural agro-industrial economies, guided by a market-driven and technology-propelled research and technology promotion strategy for legumes. Thus, the full implementation of government policies could provide a favorable environment for the public sector with private sector participation and diversify crop production systems so that the battle against poverty could be won. Scientists should enhance efforts to

increase legumes productivity and total production to meet the increasing demand of legumes. This target could be achieved by integration of efforts by multidisciplinary teams of researchers. Development of varieties with resistance to major pests and diseases, and responsive to improved management practices could bring a highly significant change in the legumes production. Development of low cost, effective and eco-friendly production technologies to enhance grain legume production is desirable.

Research should also be aimed at producing high quality products for consumption that can be a driver for increased participation of food industry in the value chain. Partnership between national and international research institutions provides valuable opportunities for exchange of improved production technologies and human resource development needed to spur the legume production in Asia.

References

Ali M, Malik IA, Sabir HM and **Ahmad B.** 1997. The mung bean green revolution in Pakistan. Technical Bulletin No. 24. Shanliua, Taiwan, ROC. Asian Vegetable Research and Development Center. 66 pp.

FAO (Food and Agriculture Organization of the United Nations). 2001. Production Yearbook. 2001 Rome, Italy: FAO.

IFAD (International Fund for Agricultural Development). 2001. Rural Poverty Report. 2001. The challenge of ending rural poverty. Oxford, UK: Oxford University Press.

IFAD (International Fund for Agricultural Development). 2002. Assessment of rural poverty: Asia and the Pacific. Palombi, Rome, Italy: IFAD.

Kataki PK, Hobbs P and **Adhikary B.** 2001. The rice-wheat cropping system of South Asia: Trends, constraints and productivity – A prologue. Journal of Crop Production 3(2):1–26.

Pinstrup Anderson P, Pandya-Lorch and **Rosegrant.** 1997. The world food situation: Recent development, emerging issues and long-term prospects. 2020 Vision Food Policy Report. Washington DC, USA: International Food Policy Research Institute (IFPRI).