Seizing the opportunity

Despite India being the largest producer and consumer of pulses, the country has been importing an annual 3.44 million tons of pulses at a huge outgo of foreign exchange. Briefly reviewing the research and development efforts since the early 1950s, our author suggests that the momentum given by the International Year of Pulses be taken advantage of to set the right incentives to promote production and consumption of these nutritious crops.

India is the largest producer and consumer of pulses in the world. It accounts for 33 per cent of the global area under pulses and 22 per cent of production of pulses, with a share of 90 per cent, 65 per cent and 37 per cent of pigeon pea, chickpea and lentil respectively. Despite several Government initiatives to implement nationwide programmes to step up productivity, production and profitability, the country has to import pulses on an average of 3.44 million tons annually, amounting to more than 80 billion rupees (1.19 billion US dollars). And yet India has currently witnessed an unprecedented price-rise of pulses which could be controlled by capitalising opportunities – the country ought to make use of the momentum created by the International Year of Pulses to raise the output and better manage the stock and distribution system.

Healthy diets, healthy soils, healthy climate

Pulses contain roughly 23 per cent of protein, almost twice the amount of protein available in wheat and thrice that of rice. They are the major source of proteins for vegetarians, who account for more than 40 per cent of the Indian population, and supplement the staple cereals in the diets with health-sustaining ingredients such as essential amino acids, vitamins and minerals. They are nutritious and are known to reduce the impact of several non-communicable diseases, including colon cancer and cardiovascular diseases, and avoid calorie-catastrophe through balancing intake of carbohydrates and protein. Therefore the consumption of pulses should be increased as an integral part of nutritional food security.

Pulses also offer a considerable range of advantages for crops. They can be grown on a wide variety of soils, under many climatic conditions and in different farming systems, such as crop rotation and mixed and intercropping. As legumes, they help fixing atmospheric nitrogen into soil and release soil-bound phosphorus. They add organic matter into the soil in the form of leaf mould; some pulses are suitable as green-manure crops. They can thus improve soil fertility and counter soil erosion.

Most pulse crops are of short duration, which facilitates growing a second crop on the same land in a year; they can serve as industrial crops and deliver material to industries, such as the pulse industry, roasted grain industry, etc., and they serve as a rich source of nutritious fodder for cattle.

More importantly, pulses have low carbon emissions. The production of one kilogram (kg) of legumes emits 0.5 kg carbon equivalent as compared to 9.5 kg carbon equivalent for the production of one kg of meat. To produce one kilogram of pulses, 359 litres of water is needed, against more than 1,000 litres each for soybeans and groundnut, which makes them ideally suitable for India's farming system. As per recent estimates, water needs for the production of one kilogram of meat are five times higher than those of pulses.

The result of years of neglect

There is a significant yield gap between farmers' yield in India (750 kg/ha) and other developed countries (2,000 kg/hectare in Canada and Australia) and also between farmers' yield and research stations' yield (1,800 kg/hectare) in India. What are the causes of this low productivity? Around 84 per cent of the area under pulses is rain-fed with soils of relatively low fertility. Whereas between 1966/67 and 2012/13, pulses under irrigation increased from 9 per cent to 16 per cent, the share of irrigated land grew from 38 per cent to 59 per cent for rice and 48 per cent to 93 per cent for wheat. Drought and heat stress regularly lead to a 50 per cent reduction in pulses' seed yields, particularly in arid and semi-arid regions of the country. Moreover, pulses are often grown in soils with a high level of salinity and alkalinity in the semi-arid tropics and the Indo-Gangetic plains. In the states of Uttar Pradesh, Bihar, West Bengal, Chhattisgarh, Madhya Pradesh and Jharkhand, poor drainage leads to water logging during the rainy season, causing substantial yield losses in pigeon pea in particular.

The Green Revolution in the 1970s and 1980s pushed pulses cultivation to marginal and sub-marginal lands, resulting in declining productivity. While small and marginal farmers more often prefer growing staple

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About 70 per cent of Indian farm subsidies provided for irrigation, fertilisers and pesticides are given to just three crops, paddy, wheat and sugarcane.
Photo: J. Boethling

cereals for home consumption, other farmers go for growing cash crops on a larger area rather than pulses. Small, marginal and tenant farmers have little access to institutional credit, which discourages them from purchasing and using seeds of high-yielding varieties and phosphatic fertilisers and adopting improved technologies. About 70 per cent of farm subsidies provided for irrigation, fertilisers and pesticides are given to just three crops, paddy, wheat and sugarcane, leaving an insignificant share for pulses. Moreover, pulse-growers did not benefit from crop insurance schemes.

Promising cropping systems

According to the Indian Institute for Pulse Research, by 2030 and 2050, demand for pulses will be around 32 million tons and 50 million tons respectively. This would require an additional 3 to 5 million hectares of land, and productivity per hectare will have to rise from the present 750 kg/ha to 1,361 kg and 1,500 kg respectively. In fact, India would need to produce 40 million tons of pulses annually in order to meet the per capita requirement of 80 grams/day of pulses recommended by the World Health Organization (WHO) as against present consumption of 27.2 grams/day/capita for 1.282 billion people. This can be achieved by extending promising cropping systems which researchers have evolved and which have successfully demonstrated their economic benefits to farmers:

Chickpea in rice fallows. Rice fields in the prosperous agricultural Indo-Gangetic Plains remain fallow during the winter season. Large-scale on-farm trials from agriculture universities in five States have shown that short-duration varieties of chickpea and lentil can be successfully grown after rice harvest and can yield from 1,000 kg to 2,500 kg per hectare. Short-duration indigenous and *kabuli* chickpea varieties were found to be suitable. More recently, a heat tolerant chickpea variety named JG 14 has proved highly adaptable to late-sown conditions in the rice fallow area.

Pigeon pea in rice-wheat cropping systems. Rice-wheat cropping systems are managed on 10 million ha in the Indo-Gangetic Plains of India. However, the practice of continuous rice-wheat rotation over several years has impacted adversely on soil fertility and water availability and increased incidence of pests and diseases, posing a serious threat to the sustainability of the system. The inclusion of legumes promises to restore soil fertility and reduce other associated problems. Experiments on research stations and field trials on farmers' fields using extra-short duration pigeon pea varieties (e.g. ICPL 88039) in two States confirmed that pigeon pea can be grown profitably instead of rice during the monsoon season (sown in late May and harvested in late October or early November), allowing timely sowing of wheat crop. Pigeon pea yields per hectare were 1,500 kg to 3,000 kg. As pigeon pea adds nitrogen through a biological nitrogen fixation process accompanied by leaf fall (contributing about 40–50 kg N to the system), the succeeding wheat crop needs less nitrogenous fertilisers. The net economic returns under the pigeon pea-wheat system were higher compared to those of the rice-wheat system.

Pigeon pea at high altitudes. Extra-short duration pigeon pea can be successfully cultivated up to the elevation of 2,000 metres above sea level in Uttarakhand state in Northern India. A pilot study along with several on-farm trials across different elevations in Uttarakhand during 2007/08 by the Agricultural Research Institute, Almora, and the department of agriculture, Uttarakhand, showed that the pigeon pea variety ICPL 88039 can be grown successfully in low and medium hill regions. This variety proved to be highly adaptable in regions with high elevations and has yielded 1,800 kg/ ha of grains. As the long duration of cold and frost can severely damage the foliage and flowers of pigeon pea, its cultivation should be confined only to regions with low and mid hill regions. Farmers' willingness to extensively cultivate this extra-short duration pigeon pea cultivar in Uttarakhand can be profitably capitalised.

The State of Andhra Pradesh shows the way

Andhra Pradesh, once considered unsuited for chickpea cultivation due to its warm and short-season environment, has now ushered in a chickpea revolution. Farmers in this south-eastern state of India started growing short-duration and wilt-resistant chickpea varieties in rain-fed rice-fallow lands. From 2000 to 2009, the state increased the area under chickpea five times from 102,000 hectares to 602,000 hectares and raised yields 2.4 times, from 583 kg/ha to 1,407 kg/ha, the synergic effect of which was a nine-fold increase in output from 95,000 tons to 884,000 tons. Such a phenomenal rise in output can be attributed to various factors:

- the development and on-time availability of high-yielding, short-duration, fusarium wilt-resistant varieties suited to short-season and warmer environments of southern India;
- the motivation and willingness of a large number of farmers to adopt improved varieties in combination with easy access to production technologies;
- successful commercial cultivation by mechanising field operations and efficient management to minimise the incidence of pod-borer infestation;
- the availability of grain storage facilities to farmers at local level at affordable cost.

With an average yield of 1,400 kg/ha Andhra Pradesh now has the highest chickpea yields in the country. More than 80 per cent of the chickpea area is under improved short-duration cultivars.

Expand cultivation, improve market potential

An additional area of 2.5 million hectares could be brought under pulses – for example through the integration of crops like Bengal gram (chickpea) or green gram (mung bean) as catch crops in the summer season under cereal-based cropping systems or inter-cropping with short-duration pulses like green gram, Bengal gram and cowpea in sugarcane, millets, cotton etc. In the northern region of the country, new cropping systems such as pigeon pea-wheat bear a considerable potential; in the eastern region, rice-lentil and, in the southern peninsula, Bengal gram-rice are suitable.

Of course, in addition to expanding cultivation, the market potential of cultures needs to be improved. Here, a value chain approach right from the production at farm level (and encompassing post-harvest, processing, packaging, transportation) to marketing is essential for small and marginal farmers to reduce losses/wastages and increase income. Furthermore, price discovery and transparency has to be improved. This could be accomplished e.g. via electronic trading of pulses, and corresponding facilities have been created in a few Agricultural Produce Market Committees in Karnataka, Andhra Pradesh and Telangana. The recently envisioned National Common Market also offers a potential (see box).

Supporting the International Year of Pulses with the right policies

The United Nations' General Assembly has declared 2016 the International Year of Pulses. India ought to take advantage of this and adopt measures to promote the growing and consumption of nutritious crops in the country. Significantly improving the country's technical capabilities to forecast nearer to correct season-wise estimates of the area under pulses and output of pulses through investing in and better use of state-of-the-art technology and refining methods of estimation could be an initial step, for this is still an area with considerable deficits. Furthermore, a result-oriented campaign should be launched to transfer already proven and demonstrated technologies in farmers' fields accompanied by efficient systems of linking institutional credit with on-time availability of quality seeds and marketing services that can guarantee expected yield. To prevent wastage, a need-based buffer stock with accountability for proper management is necessary. A close watch would be desirable on crop growth in the 30 pulse-exporting countries to India through effective co-ordination with the FAO and India's embassies that could help India negotiate favourable terms for timely import as and when imminent. And last but not least, an efficient system to make pulses easily available in the open market throughout the year should be put in place – through rigorous enforcement of the Essential Commodities Act. Entering into force in 1955, the Act empowers the Union and state governments concurrently to control production, supply and distribution of certain commodities in view of rising prices. Its provisions include entitlement to licensing, distribution and imposing stock limits; furthermore, the governments have the power to fix price limits, and selling the particular commodities above the limit will attract penalties. Warranted distribution through the Public Distribution System or direct benefit transfer schemes would also be suitable measures to boost the consumption of pulses.

More market transparency envisaged

Markets for agricultural products in India are highly regulated under the *Agricultural Produce Market Committee* (APMC) Act by the respective state governments. The first sale in these commodities can be conducted only under the aegis of APMC through the licensed commission agents. Various taxes, fees/charges and cess are levied on the trades conducted in each of the 586 APMC markets. The APMCs charge multiple fees of substantial magnitude that are non-transparent. In 2003, the Union Government has developed a Model APMC Act to make farmers free to sell their produce directly to the contract-sponsors or in the market. But the Model Act is only being partly implemented by the state governments, which have also amended some of its contents.

The *National Agriculture Common Market* (NACM) slated to be launched on 14th April 2016 is envisaged as a pan-India electronic trading portal which seeks to network the existing 586 APMCs and other market yards to create a unified national market for agricultural commodities. It would increase farmers' access to markets through warehouse-based sales and thus obviate the need to transport his produce to the APMC. For the local trader, the NACM offers the opportunity to access a larger national market for secondary trading. Bulk buyers, processors, exporters, etc. shall benefit from being able to participate directly in trading at the local market level through the NACM platform, thereby reducing their intermediation costs. The gradual integration of all the major markets in the States into NACM is to ensure common procedures for issue of licences, levy of fee and movement of produce. In a period of 5–7 years the Government expects significant benefits through higher returns to farmers, lower transaction costs to buyers and stable prices and availability to consumers.