Oilseeds Scenario in India : Cost Effective Production Technologies

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India is among the largest vegetable oil economies in the world next only to USA, China, Brazil and Argentina with an annual turnover of about 80000 crores at present. In the agricultural economy of India, oilseeds are important next only to food grains in terms of hectarage, production and value. The diverse agro-ecological conditions in the country are favourable for growing all the nine annual oilseeds, which include seven edible oilseeds *viz*., groundnut, rapeseed-mustard, soybean, sunflower, sesame, safflower and niger and two non-edible oilseeds *viz*., castor and linseed. Apart from this, a wide range of other minor oilseeds of horticultural and forest origin, including in particular coconut and oil palm are grown in the country. In addition, substantial quantities of vegetable oil are also obtained from rice bran and cotton seed.

There has been continuous improvement in the production and productivity of oilseeds in India in the past six decades, despite wild fluctuations from year to year in response to mainly weather conditions. During 1950-2008, area, production and productivity of annual oilseeds showed a compound growth rate of 1.60, 3.02 and 1.41%, respectively. The domestic achievements in oilseeds production are unparalled when we observe that 5.7 times increase in oilseeds production during this period. It is worth recording that 4.6 times increase in production of total food grains was achieved with the highest national priorities to this commodity group and also that such production jump was recorded under relatively much more favourable farming environments, particularly irrigated lands.

There have been dramatic changes in the oilseeds scenario of the country since 1986. India changed from net importer status in the 1980's to a net exporter status during 1989-90 which was again reversed later during 1997-98 where the country had to spend huge foreign exchange to meet the domestic needs of edible oils. The gap between export earnings and import cost has been narrowing down during the last couple of years and again the oilseed sector has become a net foreign exchange earner during 2007-08. The main contributors to large success of oilseed sector in the late eighties and early nineties were (i) availability of improved oilseeds production technology and its adoption, (ii) expansion in cultivated area (iii) price support policy and (iv) institutional support particularly the establishment of Technology Mission on Oilseeds (TMO) in 1986. The remarkable success of TMO in the initial period was facilitated by a relatively protectionist umbrella of higher import duties on the import of edible oil of the order of 65% on palmolein, the commonly imported oil. The so called 'Yellow revolution' when the oilseed sector became a net earner of foreign exchange, symbolised the will of the country to solve a problem which evaded solution for a long time. It also symbolised the teamwork of a number of scientific and developmental institutions, industries, departments, farmers and policy makers. There has also been large regional variation in area, production and productivity changes in oilseeds during the last two decades. Only a few states like Haryana, Madhya Pradesh, Maharashtra, Rajasthan, West Bengal and North-eastern states increased their oilseeds production both through area expansion and productivity

improvement. State like Gujarat increased its oilseeds production mainly through productivity improvement. In state like Punjab, oilseeds production declined mainly in response to sharp decline in area while in state like Orissa, both area and productivity declined sharply leading to large decline in oilseeds production. Among different oilseeds, groundnut, rapeseed-mustard and soybean accounts for more than 80% of area and 90% of production in the country.

The *per capita* consumption of vegetable oils is rising continuously touching almost 14 kg/year in 2008-09 while that of foodgrains has leveled of and showing a declining trend in recent years. Vegetable oil consumption is both income and price-elastic. As per the recent projections by DAC-Rabo Bank, the *per capita* consumption of vegetable oils is likely to rise to 12.60, 14.57 and 16.38 kg/year by 2010, 2015 and 2020 respectively. Considering that *per capita* vegetable oil consumption has already reached 12 kg/year by 2007-08, the projected increase in consumption by 2020 is likely to become a reality. This amounts to vegetable oil requirement of 14.8, 18.3 and 21.8 million tonnes, respectively by 2010, 2015 and 2020. Assuming an average oil recovery of about 30% from major oilseeds and proportion of different oilseeds constant in the coming years, the country needs to produce at least 44.8, 55.5 and 66.0 million tonnes of oilseeds by 2020, 2015 and 2020 respectively. If one assumes 20% of vegetable oils from crops other than annual oilseeds, then country needs to produce about 55 million tonnes of oilseeds by 2020 to achieve near self-sufficiency in vegetable oils production. Given that oilseeds output in 2008-09 amounted to about 28.05 million tonnes, the country needs to almost double the oilseeds production in the next 11 years requiring an annual growth rate of nearly 6% which will indeed be a tall order, requiring efforts much beyond what is being ostensibly pursued until now. A multipronged approach including exploitation of heterosis, area expansion in traditional and non-traditional niches, ensuring quality seed availability, enhancing productivity through appropriate nutrient and crop health management, value addition and price support and policy support from government is required to achieve such a tall order.

Heterosis, here synonymous with hybrid vigor, is extremely important in producing sunflower hybrids, increasing in importance in rapeseed, and has potential for utilization in producing hybrid soybean. Soybean, rapeseed, and sunflower are the three largest oilseed crops in the world, accounting for approximately 78% of world vegetable oil production. Estimation of heterosis and its role in yield improvement have been made in all three crops. In addition, heterotic patterns and estimates of genetic diversity are equally important in breeding strategies of these oilseed crops.

Meeting the challenges

To meet the challenges of oilseed production in the post-WTO regime, there is need to adopt multi-pronged strategy which involves enhancing oilseeds production through area expansion and productivity improvement through better adoption of improved technology, value addition to oilseeds and oils to increase their competitiveness, higher recovery of oil through efficient processing of oilseeds and oils, overcoming the constraints of domestic marketing of oilseeds and its products and finally liberalising trade in India's oilseed economy.

Expansion in oilseeds area

Besides exploiting limited opportunities for expansion of area under oilseeds as sole crops, large potential exists to introduce oilseeds as intercrops in several major crops. In India, about 45 million hectares of land is available with widely spaced crops, where

introduction of oilseeds as intercrop is possible. Even in crops like wheat, introducing a row of mustard after 8 or 9 rows of wheat has proved more profitable than sole wheat in most of the irrigated wheat-growing regions. Even in high rainfall regions of Eastern India, intercropping groundnut and soybean in rice in uplands, during kharif season, has proved highly remunerative. In addition, oilseeds can also be introduced as intercrop in less remunerative, traditional staple food crops like rainfed wheat, chickpea, etc. whose complete replacement is not possible.

The expansion in area under oilseeds was hither to a major source of growth in oilseeds production. Since 1986, nearly 38% of the increase was contributed by area expansion and 62% by productivity improvement. The area increase came where the oilseed crops were superior options to traditional crops. Farmers always searched for technological options and practices which brought them higher returns and readily responded to various economic incentives. The expansion in area has occurred in those oilseed crops which have either shown a higher growth rate of productivity due to technological development or whose relative prices with competing crops have moved in their favour or higher growth rates in yields were combined with higher prices resulting in sharp increase in total productivity.

Identifying newer areas and seasons for cultivation of oilseeds can help increase oilseeds production. Rice-fallows, especially in Eastern India, are the potential general areas for many oilseed crops like sunflower, rapeseed-mustard, groundnut and sesame. Oilseeds, being more salt tolerant than pulses and many cereals, have better chances of success in large tracts of saline areas. Likewise, under situations of limited water availability for the second crops of rice or in tail-end areas of canals, oilseed crops are better options; with less than a third of water needs of rice, a good crop of oilseeds like sunflower, sesame and groundnut can be harvested.

In general, there is hardly any scope to bring additional area exclusively under oilseeds as the demand for land for producing other remunerative crops will continue to rise. However, it becomes imperative to search for newer approaches to expand their cultivation under different cropping/farming situations. Extending cultivation to underutilized farming situations such as in rice fallows of eastern India where 15 million hectares are under low land rice is one such possibility. Oilseeds like sunflower and sesame may also be better options under contingency planning where season for regular crops is not conducive or when these have failed. Value addition to some of the main and byproducts of oilseed crops will further increase their profitability and help expand the area. This will also arrest constant decline in area observed in some minor oilseed crops in recent years. It must be possible to reach 33 to 35 million hectares under oilseeds by 2015 if efforts are made for their promotion in all potential areas with appropriate policy and institutional back up.

Improving oilseeds productivity

With limited scope to bring additional area under oilseeds, bulk of the future increases in oilseed production have to come primarily from land saving technologies, highlighting a combination of high yielding plant types, standard crop management practices, protective irrigation to insure against, weather aberrations, balanced nutrition attained through integrated nutrient supply and management system. In this, crop ecological zoning, quality seed supply and effective technology transfer can also play a major role in enhancing oilseed productivity. The country must aim to increase oilseed productivity to atleast 1.5 t/ha by 2015 through a combination of multi-pronged strategies and policy support. Considering the results of large number of frontline demonstrations

conducted in different crops in farmers' fields in various agro-ecological and crop growing situations, the productivity level of 1.5 tonnes by 2015 from the current level of about 1 t/ha is certainly achievable.

Value addition to oilseeds and oils

Oilseeds are sources of oil, protein, sugar, minerals and even vitamins. Although oilseeds in general have good composition and quality, their domestic utilization as well as larger exports are hindered due to certain limitations and toxic factors. There is need to overcome these limitations for better value realization in oilseeds. Instead of exporting direct items like oilseeds, oil and oil cakes, India should strive to export value-added products. Full value addition to castor oil before exports alone can fetch additional earnings of about Rs. 20000 crores from the present level of Rs. 1000 to 1200 crores annually. There are uncommon opportunities to add value to different oilseeds and oils which must be fully exploited which will eventually enhance the competitiveness of these crops.

Need to have cost effective production technologies

Oilseeds are cultivated for commercial purpose and the by-products of these crops are of little value, with the exception of groundnut. An oilseed grower is supposed to make arrangements for his food requirements by either producing them in a separate area, or purchasing them out of earnings from oilseed production. In either case, profit maximization is the prime motive for oilseed production. Profitable oilseed production lies in efficient crop management practices, many of which involve non-cash or low-cost inputs.

Efficient crops management practices, starting from adoption of proper crops rotation, timely planting, adequate plant stand through adjustment in seed rate and thinning, timely weed management, life saving irrigation, balanced plant nutrition and need-based plant protection : all these have great influence on the cost of cultivation of oilseed crops. Oilseed crops are far more susceptible to pests and diseases than cereals. Thus plant protection measures are also very essential for ensuring a good harvest of oilseed crops.

- Annual oilseeds support the livelihood earnings of small and marginal farmers of arid and semi-arid eco-systems of the country. It is estimated that 14 million farmers are involved in oilseed cultivation, while one million persons are involved in processing of oilseeds and oils (Hegde and Venkattakumar, 2007).
- The annual oilseed production of the country is faced with high degree of variation, as nearly 76% of the oilseeds area is under rainfed conditions and therefore subjected to uncertainties of moisture availability.
- The country's minimum support price (MSP) programme that has often favoured production of crops that compete with oilseeds for area. Hence, only by popularizing non-monetary, low-cost and cost-effective oilseeds production technologies among the resource-poor farmers, oilseeds can sustain their competition with the competing crops.
- The continuous cultivation of oilseed crops without proper crop rotation has led to depletion of soil nutrients as well as increase in pest and disease incidence causing upto 40% yield loss. This implies the need for use of cost-effective oilseeds-based cropping sequences and intercropping systems.

- Oilseed crops are prone to damage by more than 64 major diseases. For as many as 26 pests in different crops, no resistant source is available, vulnerability of majority of the cultivars of oilseed crops to insect pests and diseases continues to be one of the major factors responsible for the lower productivity and wider fluctuations in production. Thus, the need for use of low-cost and cost-effective integrated pest management practices in oilseeds cultivation is significantly important.
- Specific attention needs to be given to harness the residual effects of fertilizers containing P, K and S. Sound fertilizer management for intercropping systems involving oilseeds which can meet the nutrient needs of both main and intercrop will go a long way in enhancing the productivity of the system.
- Population growth, rising standard of living, aberrant weather for few years in succession and liberalization of export-import policy are the causes for rapid surge in imports. Over the last one decade, the irrigation coverage merely increased by 4% from 23 to 27%.

Some of the cost effective no cost / low cost production technologies are:

• Use of healthy and disease-tolerant seed varieties.

• Seed treatment to prevent seed-borne diseases.

• Pest surveillance and monitoring in endemic areas.

• Integrated pest control campaign.

• Arrangements for timely supply of pesticides, sprayers and dusting machines.

• Training of extension field functionaries on pest behaviour in endemic areas.

Adoption of recommended spacing: Adoption of recommended spacing between plants and rows, resulted in 5 and 15% seed yield increase under irrigated and rainfed conditions of castor respectively, with corresponding additional net returns.

Adoption of right method of sowing: Adoption of the recommended method of sowing gave an yield increase of 51% in sunflower, four times in safflower, 2.5 times in groundnut, 90% in sesame, 76% in niger and 36% in rapeseed-mustard.

Adoption of timely sowing: Right time of sowing resulted in 44 and 55% seed yield increase for sunflower and rapeseed-mustard respectively under irrigated conditions. Under rainfed conditions, the same technology resulted in 182 and 13% seed/ pod yield increase for niger and groundnut with Rs.3150 and 2889/ha additional net returns.

Adoption of right method of fertilizer application: Proper method of fertilizer application, under rainfed conditions, gave 42% seed yield increase with Rs.2771/ ha additional net returns for rapeseed-mustard.

Adoption of timely weeding: Considerable yield increase to the extent of 39% was observed in many of the oilseed crops when timely weeding was adopted under real farm conditions.

Selecting oilseed crops to competing crops: Selecting castor instead of maize, cotton and sorghum gave 104, 87 and 5% seed yield increase under rainfed conditions. Though tomato gave 21% seed yield equivalent increase than castor, there was Rs.675/ha additional net returns from castor, sine the labour requirement of castor is lower than that of tomato. Under irrigated conditions, sunflower was proved to be superior to finger millet by 86% in seed yield.

Adoption of improved varieties and hybrids of oilseeds: Choice of improved varieties of groundnut to locals and existing ones, gave 25% pod yield increase both under rainfed and irrigated conditions. In rapeseed-mustard, the technology gave seed yield increase to the tune of 58% under irrigated conditions. Improved dual-purpose linseed variety gave 68% seed yield, whereas, niger variety resulted in 120% seed yield increase. Similarly, improved varieties gave seed yield increase to the tune of 27 and 45% under rainfed conditions in soybean and castor, respectively

Adoption of recommended crop sequence: Adoption of recommended crop sequence has also resulted considerable yield increase in oilseed crops. In castor, it resulted in 33% seed yield increase under rainfed conditions and 11% seed yield increase under irrigated conditions. In case of rapeseed-mustard, the seed yield increase as result of adoption of recommended crop sequence was 46 and 87% in irrigated and rainfed conditions respectively. In sunflower also, under irrigated conditions, the technology resulted in 19% seed yield increase.

Adoption of seed treatment practice: Proper seed treatment with chemicals and/or biofertilizers for pest management and nutrient supplement, resulted in 10% seed yield increase both under rainfed and irrigated conditions in sunflower, 12% increase in safflower, 24% in rapeseed-mustard, 44% pod yield increase in groundnut.

Adoption of thinning: Thinning excess plant population to maintain the recommended plant stand, resulted in seed yield increase to the tune of 26 and 32% in sunflower and safflower, 16% in rapeseed-mustard.

Use of biofertilizers: Application of biofertilizers, as a nutrient supplement, resulted in 9, 24 and 40% seed yield increase in sunflower, safflower and niger. Under irrigated conditions, this technology gave seed/pod yield increase to the tune of 44% for groundnut and 6% for rapeseed-mustard.

Application of gypsum: Application of gypsum in groundnut to increase pod yield and oil content of the crop and physio-chemical properties of the soil, resulted in 25% pod yield increase under rainfed conditions.

Application of sulphur: Application of sulphur to increase oil content in rapeseed-mustard resulted in 11% seed yield increase under rainfed conditions. Sulphur+boron application increased the oil content in sunflower to the tune of 34%.

Spraying of cycocel: Spraying cycocel as a growth regulator for safflower resulted in seed yield increase to the tune of 33% under irrigated conditions.

Integrated nutrient management (INM): Adoption of INM practices to improve the productivity of the crop as well as soil fertility in a sustained manner resulted in seed/ pod yield increase to the tune of 22 and 19% in groundnut and rapeseed-mustard under irrigated conditions.

Integrated weed management (IWM): IWM practices to manage the weeds in a sustained and cost-effective manner resulted in pod yield increase of 10% in groundnut under irrigated conditions.

Integrated water management: Integrated water management practices to meet the minimal water requirement of the crop with higher use efficiency and ensuring the sustained availability of water to the crop eco-system gave 9% pod yield increase.

Integrated pest management (IPM): IPM practices to ensure the arrest of resilience of insect pests of crops through integrated management practices and ecological balance in

pest management in groundnut gave pod yield increase to the tune of 18% under rainfed conditions, whereas, 19% seed yield increase for rapeseed-mustard under irrigated conditions.

Future Direction

The vegetable oils are indispensable in the human food as also in several industrial uses. The oilseed sector constitutes an important determinant of agricultural economy in India. The country may have to almost double the vegetable oils production by 2020 if it has to achieve near self-sufficiency. This is indeed a tall order requiring a growth rate in excess of 6% per annum. There is also a high degree of variation in production of annual oilseeds due to their cultivation predominantly under low and uncertain rainfall conditions in soils which are hungry coupled with poor input supply and crop management. Sustainability of the enhanced oilseeds production is as important as enhancing production. Favourable policy framework for the oilseed sector with respect to processing, marketing and trade is the basic and overarching requirement to achieve self-reliance in vegetable oils. Given a desired policy frame work in place, oilseeds production can be increased to a limited extent by area expansion through replacement of non-remunerative crops, extension in rice fallows and problem areas, intercropping in widely spaced crops, as options in contingency planning, introduction in water scarce areas, diversification of rice-rice and rice-wheat systems and by increasing competitiveness of oilseeds through value addition. There is limited scope to bring additional area under oilseeds and bulk of the future increases in oilseed production has to come primarily from land saving technologies. This calls for giving new thrust for improving the productivity of oilseed crops by use of quality seed, providing protective irrigation, resorting to efficient crop zoning, enhanced and integrated nutrient use, farm mechanization, efficient crop management, overcoming biotic and abiotic stresses through novel approaches and effective technology transfer to bridge yield gap to harness the exploitable yield reservoir. This calls for effective contribution by all those concerned with oilseed sector to the best advantage of oilseed farmers to achieve self-reliance in vegetable oils.

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