Challenges and Future Priorities of Researches on Rapeseed - Mustard in India

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Introduction

India is the second largest rapeseed-mustard growing country of the world with 5.07 m.ha area and 5.06 m. tones of production (Table 1). The oil is an important component of Indian diet. These crops have diversified domestic and industrial uses. The requirements for vegetable oilseed has been projected to be around 34 million tones by 2020 AD, of which 14 million tones is to be contributed by rapeseed-mustard to meet the annual domestic demand based on present level of consumption of fats and oils (12 kg/capita / yr) and the subsequent growth rate.

Challenges

- Instability in yield and production because of absence of appropriate donor sources for major biotic stresses like alternaria blight, white rust, sclerotinia disease and aphid pest; and abiotic stresses like drought, frost and salinity. Identified sources possess low level of tolerance / resistance. Knowledge about their mechanism of resistance is limited
- Species, in general, are having low productivity because of their inherent physiological nature (C3) and diverse mating behaviour. Further, sizeable area is under poor yielding cultivars of rapeseed-mustard, cultivated in marginal and sub-marginal lands
- Non-availability of varieties for specific cropping system, and non traditional areas, viz., after cotton and pearl millet, harvest in northern India and rice-fallow including *paira* cropping in eastern and central India, after sugarcane in Maharashtra and for different cropping situations
- In *B.juncea* hybrid development programme, a perfect three-line breeding system is lacking though one of the cytoplasmic male sterility-restorer systems, *mori* has been perfected. The other available CMS systems are behaving as cytoplasmic male sterility system and not as cytoplasmic genetic MS system
- Non-availability of short duration high yielding *toria, B.rapa* (less than 85 days) varieties because of undesirable linkage between maturity and seed yield
- Indigenous sources with rich quality of oil and seed meal are available but are poor yielders. Exotic quality materials are late maturing and poor yielders. They are susceptible to pests and diseases

Researchable Issues

Researchable issues, which need immediate attention are to stabilize and increase the productivity. This is to be done through utilization of modern techniques of breeding to transfer novel genes for evolving superior genotypes with in-built resistance to major biotic and abiotic stresses and integrated approach to plant-water-nutrient and pest management. With increasing consumers awareness and the establishment of World Trade Organization, greater emphasis need to be laid on developing rapeseed-mustard cultivars satisfying internationally accepted norms for oil and meal quality. Low glucosinolate rapeseed-mustard meals with enhanced levels of amino-acids, particularly increased levels of lysine and methionine, and oils with high erucic, oleic, palmitic, stearic, lauric and myristic acids would be the future rapeseed-mustard by 2020 AD. The development and diversification of the value added products and by – product utilization, besides enabling the country to earn a substantial foreign exchange, would go a long way in furthering the cause of resource poor farmers of India.

Table 1. Area, Production and Yield of Major Rapeseed-Mustard-Canola Growing Countries during 2001-2002

Country	*Area*		*Production*		Yield
	m. ha	% contribution	m. t	% contribution	(kg/ha)
China	7.83	32.21	11.32	30.98	1446
India	5.05	20.77	5.04	13.79	999
Canada	3.78	15.55	5.06	13.84	1338
Australia	1.18	4.85	1.63	4.46	1380
Germany	1.14	4.69	4.16	11.38	3660
France	1.09	4.48	2.91	7.96	2660
Others	4.24	17.44	6.42	17.57	1514
World	**24.31**		**36.54**		**1503**

(Source: Oil World Annual 2002)

Future Priorities

The following areas of research are identified

- Collection of germplasm from newer areas and their management
- Development of gene pool for various traits
- Breeding for increased level of resistance or tolerance either through the use of biotechnological tools or conventional breeding
- Development of plants with high harvest index, responsive to low inputs like fertilizer and water
- Development of plant types for specific situations
- With the availability of *mori* CMS and restoration system, it is now necessary to diversify the nuclear background of *mori* CMS and restorer for use in commercial mustard hybrids production. In other CMS system, improvement to get stable CMS-restorer, system can be achieved either through protoplast fusion or through genetic manipulation. In *B.rapa* ssp *yellow sarson*, identification of genetic markers like long siliqua, narrow serrated leaves, spreading bud bunch (pendent type) at early stage of growth and development of 3-line breeding system may be pursued
- Very early maturing lines (<80 days) of *toria* are available in Bastar region of Chhattisgarh State, but are very poor yielders. Use of such germplasm and population improvement to enhance the productivity per day is required
- Development of short stature, early maturing cultivars with prolong reproductive phase for late sown conditions of different ecologies of the country
- To develop cultivars possessing nutritionally superior oil and seed meal quality in the indigenous material. Conventional breeding methods would overcome the problem of poor yield. For development of very high oleic and erucic acid and low saturated fatty acids (below 3 per cent), available germplasm is to be looked into. In the absence of such trait in the gene-bank, biotechnological tools may be used to transfer alien gene
- Development of production technologies for different agro-ecological cropping systems; crop growing situations like intercropping, salinity, rainfed, etc., under utilized farm situations like rice-fallows, mustard to be followed after cotton, sugarcane, soybean, etc., and mustard as *paira* crop in paddy with lathyrus, lentil or any other *rabi* crop in traditional and non traditional areas

- Use of tracer technique to work out the efficiency of fertilizers and to study the uptake and translocation mechanism of major macro-and micro-nutrients
- Yield targeting for low and high input situations
- Integrated nutrient, insect-pest and disease management with special emphasis to botanicals
- Development of weather models to predict the occurrence of insect-pests, diseases and frost
- Studies on bio-ecological and plant resistance to insect-pests
- Biological control of insect-pests and diseases
- Studies on change in biosysnthesis of oil and various metabolic pathways at cellular level under biotic and abiotic stresses
- Studies on activities of enzymes to have the desired levels of saturated and unsaturated fatty acids
- Studies on crop management practices on plant nutrition, oil and seed meal
- Studies on residual effects of pesticides and herbicides in the oil and seed meal
- Identification of socio-economic, operational and institutional constraints in the transfer of technology and yield gap analysis
- Analysis of impact of price policy, marketing behaviour and other development programmes on area and production of rapeseed-mustard
- Exploiting yield potential of rapeseed-mustard by effective transfer of technology with NGOs, CBOs with missionaries
- On-Farm technology demonstration and farmers training involving CBOs and NGOs
- Using data-base, development of “Expert System”, a type of artificial intelligence, to offer technical expertise at any remote corner where Subject Matter Specialists may not be available