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Hybrid Seed Production in Mustard (*Brassica Spp*.)

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Abstract
One of the earliest crop plants that man historically cultivated was the brassica. It may have been cultivated as early as 5000 BC and is mentioned in numerous ancient scriptures and works of literature. Brassica plants are used to make oil and condiments. As a source of vegetable and oil, mustard came to play a significant role in the diets of Indians. This discovery is supported by biochemical and biological research, which also lends credence to the notion that there are two geographical races Chinese and Indian that exist. One of the ten most important plant families in terms of economic importance is the Brassicaceae, which has roughly 3500 species and 350 genera. Crop Brassicas include a wide range of different plant kinds that are raised for use as vegetables, fodder, or sources of oils and condiments the species of oleiferous Brassica, Frequently known as mustard, are one of the economically important agricultural commodities. Mustard comprising eight different species viz. Indian mustard, toria, yellow sarson, brown sarson, gobhi sarson, karan rai, black mustard and taramira, are being cultivated in 53 countries spreading all over the globe .

Introduction
In the family cruciferae , the genus *Brassica*, is the largest important group, which includes number of economic plants, grown for oilseeds ,edible roots, stems, leaves, buds, or seeds etc. The tribe Brassiceae is important as many of its wild relative have a potential value as source of oil, condiments and other products. They also known by the trade name of rapeseed, mustard, Hindi Rai –Sarso . Species are *Brassica napus, B. juncea, B. carinata*. It had arisen more than once with different progenitors and in different localities i.e. China, Eastern India and the Caucasus the present day two centers of diversity.

Botanical Description
Rape and mustard belong to Cruciferae and genus Brassica. Brassica includes the following important oilseed species:

Rapeseed (*Brassica rapa* var. *sarson and toria*): It is a herbaceous annual plant. The plant is shorter than mustard (rai). Plant height ranges between 45 and 150 cm. The roots are more or less surface feeder and the root system has limited depth with an extensive lateral spread. The stems are usually covered with a waxy deposit. In rape, leaves are borne sessile and are glabrous and hairy. Fruits arethicker than those of mustard (rai) and are laterally compressed, with a beak,one-third to half their length. Seeds are either yellow or brown with a smooth seedcoat. Rape is self-pollinated but cross pollination also takes place to some extent

Mustard (*Brassica juncea*): It is known as *rai*, *raya* or *laha*. The plants are tall (90-200 cm), erect and much branched. The plant bears normally long and tapering roots. The leaves are not dilated at the base and clasping as in the case of rape but are stalked, broad and

pinnatified. The fruits (pods) are slender and only 2.0-6.5 cm long strongly ascending or erect with short and stout beaks. The colour of seed is brown or dark brown. Seed coat is rough, mustard is self-pollinated but cross-pollination also takes place to some extent.

B. nigra.: This species was cultivated as a spice as early as 3000 BC. Although it may originate in Asia Minor-Iran, it is now widespread through out Europe, Africa, Asia, India and the Far East

B. juncea.: Central Asia-Himalayas are a primary center of diversity for this species, with migration to China, India and the Caucasus .Perhaps it is the oldest of the cultivated amphidiploids, it is mentioned since ancient times. B. juncea is grown for oil-seed usage in India and presently gaining importance in Canada and USA as an alternative to rapeseed i.e.*B.napus*

Indian group	International name	species	Common name	Local name	Chromosome number(2n=)
Sarson	Indian colza	1.Brassica rapa var.yellow sarson	Turnip rape	Yellow sarson	20
		2.B. rapa var. brown sarson		Brown sarson	20
Toria	Indian rape	1.B.rapa var.yellow toria.	Indian rape	Yellow toria	20
		2.B.rapa var.black toria	Indian rape	Black toria	20
Rai	Mustard	1.B.juncea	Indian mustard	Rai ,Raya,Laha	36
		2.B.juncea var.rugosa	rugosa	Pahari rai	36
		3.B.nigra	Black mustard	Banarasi rai	16

Land Requirements

Land to be used for seed production of rape seed and mustard shall be free of volunteer plants. The selected field should be well-levelled and the soil suitable for cultivation of the crop.

Climatic Requirements: The rapeseed and mustard crops grow well in areas having 25 to 40 cm of rainfall. 18-20 C low humidity. Mustard is a long day in photoperiodic response. Proper drainage must be their in field.

Sowing time: October 3rd week to November 1st week.

Seed Rate and sources of seed: Main crop- 4 to 6 kg/ha. It should be from the certified agency.

Soil type: The rapeseed and mustard grow best on well-drained, light-to-medium textured soils loamy and loamy-sand soils.

Isolation Requirements: Indian minimum seed certification standards prescribe a minimum isolation distance of 100m and 50m for foundation seed class and 50m and 25m for certified seed class, for self incompatible and self compatible types respectively, from fields of other varieties of the same species, and fields of the same variety not conforming to varietal purity requirements of certification; Eruca sativa (taramira) and any of the following species of genus Brassica.

Brief Cultural Practices

Preparation of land: Usually one ploughing three to four harrowings, followed by levelling, are sufficient to prepare land to desired tilth. Toria in particular requires a fairly moist seed bed for good germination.

Time of sowing: Sowing at the following times are recommended for best results.

Source of seed: Obtain nucleus/ breeder's /foundation seed from the source approved by a seed certification agency.

Method of sowing: Seed should be sown in the rows. The depth of seedling should not be more than 3 cm.

Fertilization: Recommended doses of nitrogenous fertilizers In different states are as follows: In addition to nitrogen, apply 40 kg each of phosphorous and potash, per hectare. This crop gives excellent response to organic fertilisers; therefore, nutrient requirements may be partially or wholly met with organic manures. Organic manures, if used, should be well mixed in the field at the time of land preparation. If fertilisers are used, all the phosphate, and two-third of the nitrogen should be applied as basal dose. The remaining nitrogen should be applied at the time of the first irrigation. Apply 25 kg zinc sulphate perhactare in deficient soils.

Irrigation. One Presowing irrigation and one at flowering and pod formation is recommended for obtaining higher seed yields.

Interculture. One hand weeding when the plants are 15 to 20 cm high is required.

Plant protection. For control of mustard sawfly, dust 5 per cent BHC dust (25 kg per hectare), for aphids spray one litre metasystox 25 E.C. or 250 to 300 ml dimecron 100 E.C. dis solved in 1000 litres of water per hectare and for control of cut worms drill into the soil 5 per cent dust of aldrin or heptachlor at 25 kg per hactare. For control of Alternaria blight, spray 2 kg dithane Z-78 or dithane M-45 dissolved in 1000 litres of water per hectare.

Supplementary pollination: Placing of bee-hives during the flowering season boost the seed yield of cross-pollinated spp.

Roguing: All the off-type plants, easily distinguishable on the basis of plant characteristics, and other species plants must be removed before flowering to ensure pure seed production. Remaining off types, if any, distinguishable on the basis of siliqua characteristics should be removed before maturity. Satyanashi (*Argemone mexicana*) is the most objectionable weed in rape and mustard seed production.

Harvesting and Threshing: It is important to harvest seed crop soon after plants start turning a light yellow. At this stage most of the siliqua are light yellow and the seed inside the siliqua light brown. After harvesting, the crop should be left in the field in small bundles for two to days to dry in the field, or the bundles may be brought to threshing floor and completely dried there. After plants have been well dried, threshing can be done by bullocks, tractor or with sticks. Before storage, dry seeds to reduce moisture content to 8%.

Seed Yield: With good management crop yields up to 20 to 25 qtl per hectare may be obtained.

Weeding: First hoeing should be done 3-4 weeks after sowing and second, if required 3 weeks after first Hoeing.

Irrigation: 2 irrigations, 20-30 cm water requirement.

Critical stages: 1. Rosette stage (20-30 DAS)
2. Siliqua formation stage.

Nutrient Management: N: P: K: S: Zn @ 60:30:30:20:10 kg/ha.

Varieties: Mustard/Rai/Indian Mustard (*Brassica juncea*): Kranti, Varuna, Krishna.

Varieties released by NDUAT: – Narendra Rai-1, Narendra Sarson-2, Narendra Ageti Rai-4, Narendra Rai-8 (NDYR-8), NDYS-2018 (Jagrati), NDRE-07