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Hybrid seed Production Technology in Indian Mustard (Brassica juncea)

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INTRODUCTION

Rapeseed mustard is a group of crops grown worldwide as an important source of edible oil. Seven annual oilseed crops viz., Indian mustard (B. Juncea), Ethopian mustard (B. carinata), Oilseed rape (B. napus), rocket salad (Eruca sativa), brown sarson (B. rapa var brown sarson), toria (B. rapa var toria) and yellow sarson (B. rapa var yellow sarson) of family Brassicacaceae are grown in India commonly called as rapeseed and mustard together with black mustard (B. nigra), which is mainly used as condiment. Indian mustard (Brassica juncea) alone occupies about 85% of total area under these crops. Hybrids have been commercialized in Indian mustard in India. In Indian mustard many cytopasmic male sterility system have been developed but most off the hybrids developed so far are based upon either moricandia or ogura cms fertility restorer system. The 1sthybrid NRCHB 506 was developed by Directorate of Rapeseed and Mustard Research, Bharatpur and released for commercial cultivation in 2009. The potential of the conventionally bred open pollinated varieties has been exploited to its maximum level resulting in a platue in the productivity level, which breeder often calls as yielding depressed. Here we need exploit heterosis *i.e.* hybrid vigour to break the yield platue.

Development of a successful hybrid seed production technology in a crop is essential for the extension of hybrid technology to farmers. Standardization of sowing time and planting ratio is an important for economic hybrid seed production and it is more valid for a species, which is predominantly self-pollinated. A higher frequency of male rows in a planting ratio sown at optimum time gives higher hybrid seed set in Indian mustard.



Hybrid seeds production technology requirements:

Parental Lines: A line: It is the male sterile parent line.

B line: The fertile counterpart of A line, doesn't have fertility restoring genes and used to maintain A line.

R line: Themale fertile line carries genes for fertility restoration.

Hybrid seed production requires multiplication of three parental lines; A (CMS), B (Maintainer) and R (Restorer) lines, separately in addition to hybrid (F_1) seed production.

Hybrid seed production program requires four isolated plots, simultaneously, one each for three (A, B, & R) lines and forth one hybrid seed production. Methods of maintainer and restorer lines multiplication are similar to that of a pureline method; hence, planting methods for CMS (A) line multiplication and hybrid seed production are being presented here. Hybrid seed production requires panting CMS (A) and R (restorer) lines in such a manner so that "A" line pants obtain abundant pollen for fertilizer from R lines, however increasing number of R line shall increase the cost off seed production.12:2 planting ratio of A and R lines for hybrid seed production as well as for multiplication of A

lines were found appropriate, on the bases of prescribed 45 cm row to row distance.

Parental lines are multiplied / maintained separately in isolated plots by plants to progeny row methods. Nucleus seed of CMS line (A) is maintained by raising 2 rows of maintainer (B) lines adjacent to 12 rows of A (CMS) line.

The off -type progenies of A and B lines are removed. Similarly the parent stocks off R line are maintained in isolation. Breeder in nucleus / breeder involved seed multiplication should know breeding behavior and the impact of environmental conditions on particularly, the crop the diagnostic characteristics of the variety parental lines. At the harvest the maintainer rows (B) lines are harvest first. Later on the remaining rows off seed (A line) parent are harvested and bulked. Strict rogueing is advised during flowering to rogue out the fertile plants from seed parent. The commercial F1 hybrid seed is produced by growing seed parent (A line) and restorer (R line) in 12:2 row ratiosas followed in case of maintenance of seed parent. The row of restorer parent (R line) are harvested first and bulked followed by harvesting of seed parent. The seed from the parent is processed and packed as hybrid seed.



Fig. Planting Method of A and R lines for Hybrid Seed Production in Indian Mustard



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Maintenance of nucleus seed

CMS is sown in seed multiplication plot with its maintainer line (B line) in 4:2 ratios for hybrid seed production. In order to have high pollen pressure, planting may be 3:2 or 1:1 if pollen parent is poor pollen production. The B line is male fertile line and it is isogenic line of A line except its cytoplasm is fertile. The seed harvested separate of both line and threshed also separately A and B line. Harvested A line seed used as hybrid seed production as female parent line. Proper isolation distance is 200 meter. Off type plant should be remove before flowering for insure genetic purity. Restorer line (R-line) is male fertile. It is maintained just like by open pollination in isolation of 200 meter.

Breeder and foundation seed production of mustard:

Breeder seed is the progeny of nucleus seed. In breeder seed production three different lines, CMS line (A Line), Maintainer Line (B line) and restorer line (R line) should have to multiply in different isolated fields (200 m).

CMS line:

The seed parent (A line) is grown with its maintainer line in 4:2 ratios. For high pollen pressure two-four rows of B-line around the field may be grown.

B line: B and R line self fertile and may be multiply by open pollination in an isolation field with 200 m. in production of breeder seed 3 linegap should be kept after 5-6 line to facilitate inspection of the field by breeder and monitoring team. Rouging should be carefully and perfect stages. Of type plants distinguish on the basis of morphological characters should be removed before flowering. Crop should be planted in spaced 45 cm to easy rouging.

- 1. **Climate:** cool and moist climate, for seed germination require 25°c temperature.
- 2. Sowing time: 15, October to 15, November

- 3. **Land requirement:** at least previous 3 years mustard not to grown in same field. Land should be free from volunteer plants. It should be deep, fertile well drained.
- 4. **Isolation distance:** 200 meter from other field of same crop.
- 5. **Seed treatment:**Thiram 3g/kg seed or Bavistin 2g/kg seed.
- 6. Seed rate:Seed parent : 1875 g/ha and R line 875 g/ha
- 7. Planting ratio: 4:2 or 8:2 Female: Male
- 8. Spacing: row to 45 cm and plant to plant 15-20 cm
- 9. Irrigation: Two irrigations required at one pre boom flowering stage another is pod filling stage.
- 10. Manure & fertilizer:
- FYM : 20-25 tonnes/ha,
- N:P:K 100 : 60 : 40 (N apply in split dose).
- 11. Rouging:
- Remove off type at pre flowering stage and diseased plant.
- Remove objectionable weed plants
- At least three fields inspection at pre flowering, flowering and pre harvest stage
- 12. Keep honey bee hives: 5-10 beehives per hectare.
- 13. Supplementary pollination: rope pulling is more effective
- 14. Harvesting: male lines are harvested first followed by female line when siliqua are mature.
- 15. Seed yield: 2.5 -2.5 t/ha

Field standard for hybrid seed production:

Indian minimum seed certification standards (IMSCS) prescribed standard for seed quality control, certain field and seed standard are essential, which should be followed during seed production and subsequent seed processing.



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A. General requirement

I. Isolation

Contaminants	Minimum distance (meters)				
	Foundation	Certified			
	Self	Self	Self	Self	
	compatible	incompatible	incompatible	incompatible	
1	2	3	4	5	
Field of the other varieties of the same	200	100	50	50	
spp.					
Field of the same variety not confirming	200	100	50	50	
to varietal purity requirement for					
certification					
Field of rocket salad and any of the other	50	100	25	50	
species of the genus Brassica					

B. Specific requirement

Factor	Maximum permitted (%)*			
	Foundation	Certified		
Off types	0.10	0.50		
Objectionable weed plants	0.050	0.10		

C. Seed standards

Factors	Maximum permitted (%)*		
Factors	Foundation	Certified	
Pure seed (minimum)	97.0%	97.0%	
Inert matter (minimum)	3.0%	3.0%	
Other crop seed (maximum)	10/kg	20/kg	
Other distinguishable variety (maximum)	0.10%	0.50%	
Total weed seed (maximum)	10/kg	20/kg	
*Objectionable weed seed (maximum)	5/kg	10/kg	
Germination (minimum)	85%	85%	
Moisture (minimum)	8.0%	8.0%	
For vapour proof containers (maximum)	5%	5%	
Mustard Rapeseed	7%	7%	

*Objectionable weed is the same as given at B above.

Seed storage:

Mustard having good storability in seed under ambient condition of mind climate maintaining germination (85%) for at least two planting season recommended in IMSCS. However, hybrid seed being high value commodity, germination and vigour of the seed need to be maintained as high as possible. For this reason hybrid mustard seeds are dried below 6-8 % moisture and storage in sufficiently cool, dry, and hygienic ambience.