

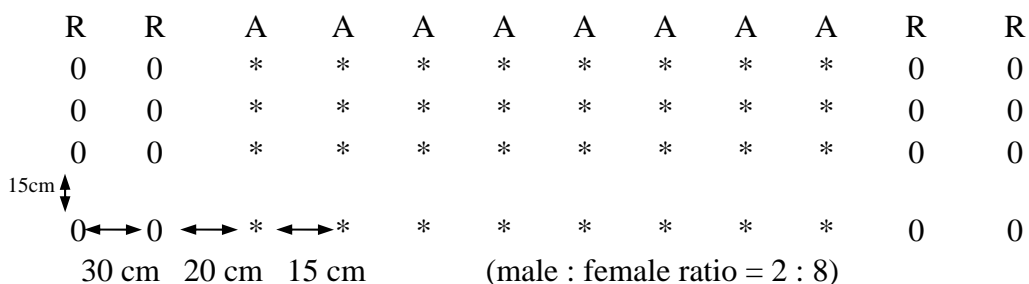
### Hybrid Rice Seed Production

Hybrid vigour in rice has been first reported by Jones (1926). This has led to speculation regarding the production of hybrid rice by utilising cytoplasmic male sterility. Most japonica rice has normal cytoplasm, but indica varieties with sterile cytoplasm and fertility restoring system have been identified. But difficulties have been encountered in obtaining sufficient seed set by cross pollination to make hybrid rice seed production economically feasible. After the implementation of UNDP/FAO project entitled "Development and use of hybrid rice technology in India" - the hybrid rice production in India has become a success story.

Hybrid rice seeds were produced using (cytoplasmic genic male sterility) three line system. The two genes Rf<sub>1</sub> and Rf<sub>2</sub> are the genes for fertility restoration.

The process of hybrid rice production involves continuous supply of agronomically improved cytoplasmic male sterile line (A), maintainer line (B) and fertility restorer (R) line in system. Maintainer and restorer lines are maintained by selfing, while CMS line and F<sub>1</sub> seeds are produced with efforts to enhance cross pollination in field. F and S refer to fertile and sterile cytoplasm. Rf and rf are fertility restoring and non restoring gene respectively.

#### *Row ratio and spacing of A and R lines in the main field*



### Technique of hybrid rice seed production

The following points are to be taken in to account for a successful hybrid rice production.

- 1) **Choice of field** : Fertile soil, protected irrigation and drainage system, sufficient sunshine. No serious disease and insect problem.
- 2) **Isolation** : To ensure purity of hybrid seed and avoid pollination by unwanted pollen isolation is a must.
  - a) Space isolation : No other rice varieties should be grown except pollen parent with a range of 100m distance.
  - b) Time isolation : a time of over 20 days is practiced (The heading stage of other variety over a 100m range should be 20 days earlier or later over the MS line).
  - c) Barrier isolators : Topographic features like wood lot, tall crops to a distance of 30m/artificial obstacles of (plastic sheet) above 2m height.

### 3) Optimum time for heading and flowering

Favourable climatic condition for normal flowering are

- (i) Mean temperature 24-28°C
- (ii) Relative humidity 70-80%
- (iii) Day and night temperature difference 8-10°C.
- (iv) Sufficient sunshine
- (v) Sufficient breeze.

### 4) Synchronization of flowering

As the seed set on MS line depends on cross pollination it is most important to synchronize the heading date of the male and female parents. In addition, in order to extend the pollen supply time, the male parent is usually seeded twice or thrice at an interval of 5-7 days.

### 5) Row ratio, row direction and planting pattern

Row ratio refers to the ratio of number of rows of the male parent to that of the female parent in the hybrid seed production field. The layout of row ratio depends on

- (i) The growth duration of the R line
- (ii) Growth vigor of the R line
- (iii) Amount of pollen shed and
- (iv) Plant height of the R line.

The principles include

- \* R line should have enough pollen to provide
- \* the row direction should be nearly perpendicular to the direction of winds prevailing at heading stage to facilitate cross pollination.

Practically, a row ratio of 2:8 is currently widely used in indica hybrid seed production.

Generally, the R line is transplanted with two to three seedlings per hill and separated by a spacing of 15cm from plant to plant, 30cm from one row of restorer to another and 20cm from CMS line. The MS line is transplanted with one to two seedlings per hill with a spacing of 15x15 cm.

A good population structure to get more seed yield is given below :

a) Seedling/hill          b) Hills/sq.m          c) effective tillers/sq.m

A line = 1-2      A line = 30      A line = 300

R line = 2-3      R line = 5      R line = 120

### 6) Prediction and adjustment of heading date

Even if the seeding interval between both parents is accurately determined, the synchronization of their flowering might not still be attained because of variation in temperature and difference in field management. Hence it is necessary to predict their heading date in order to take measures as early as possible to make necessary adjustments by examining the primordial initiation of panicle.

Adjustment of flowering date can be made by applying quick releasing nitrogen fertilizer on the earlier developing parent and the later developing parent should be sprayed with 2% solution DAP. By this measure a difference of 4 to 5 days may be adjusted.

## 7) Leaf clipping, gibberellin application and supplementary pollination

These techniques are very effective for increasing the outcrossing rate.

a) Leaf clipping : The leaves taller than the panicles are the main obstacles to cross pollination and, therefore, should be cut back. Generally leaf clipping is undertaken 1-2 days before the initial heading stage, and more than 2/3 rd of the blades of flag leaves are cut back from the top.

b) Application of gibberellin (GA<sub>3</sub>) GA<sub>3</sub> can adjust physiological and biochemical metabolism of rice plant and helps in hybrid seed production by stimulating the elongation of young cells. In most of the CMS lines, about 20-30% of spikelets of a panicle are inside the flag leaf sheath (exertion is only 70%). GA<sub>3</sub> affects exertion of panicle completely out of flag leaf sheath. In India recommended dose of GA<sub>3</sub> is 50g/ha using knapsack sprayer and 25g/ha with ultra low volume sprayer.

Advantage of GA<sub>3</sub> application

- \* enhances panicle and stigma exertion
- \* speed up growth of late tillers and increase effective tillers
- \* flag leaf angle is increased
- \* reduces unfilled grains
- \* enhances seed setting and seed yield

Spraying stage : 5% of panicle emergence

Spraying time : 8-10AM is the best time.

c) Supplementary pollination : Shaking the R lines panicles by rope-pulling or rod driving during anthesis can enhance the crossing rate. This is carried out during peak anthesis (10-12 AM).

## 8) Rogueing

To get 98% purity of CMS lines and R lines, in addition to strict isolation, a thorough rogueing is also necessary.

## 9) Harvesting and processing

- the male parent harvested first
- care should be taken to avoid admixture of male and female lines.
- female line should be threshed separately in a well cleaned threshing floor
- seed field dried in shade to 12% moisture content
- packed in suitable, cleaned gunny bags after grading

**Hybrid Rice CORH - 1 (MGR Rice) : Released in 1994**

Short duration, medium fine grain (Parentage : IR 62829A x IR10198-66-2R)

Breeding method : Three line Breeding  
Season : May-June (Kar-Kuruvai)  
Duration : 110-115 days  
Yield : 6380 kg/ha  
Area of adaptation : Coimbatore, Madurai, Chengalput, Salem, Nagapattinam, Periyar Districts.

## SEED PRODUCTION TECHNIQUES FOR CORH 2 HYBRID RICE

**Parentage :** IR 58025 A x C 20 R

**Selection of Field :**

Previous crop should not be of rice. If previous crop is rice, irrigate the field and there by the dropped seeds will germinate which can be puddled in. If the pervious crop is having dormancy means, we must be careful to see that the dropped seeds are all germinated and puddled in.

**Isolation distance :**

100 meters. If time isolation is to be followed, there should not be any rice crop near by within 100 meters, in the process of flowering while the crop in seed production plot is in flowering. There must be a difference of 30 days in flowering for the near by crop.

**Season :** April - May and Dec - January month of sowing.

**Seed rate :** A line : 20 kg / ha  
R line : 10 kg / ha.

**Nursery :**

Apply 2kg DAP to the nursery. Adopt 1kg / cent of nursery for both A line and R line while raising the R line 5 kg seeds can be raised on the same date when A line is raised. The rest 5 kg can be sown five days after first sowing.

**Manuring of main field :** 10 tonne FYM / ha

	N	P	K
Basal dressing	50 kg/ha	60kg/ha	20kg/ha
Tillering stage	50kg/ha	-	20kg/ha
Boot leaf stage	50kg/ha	-	20kg/ha

**Planting date :** A line - 25 - 30 days after sowing  
R line - 20-25 days after sowing

**Planting Ratio :** 8 rows of A line  
2 rows of R line

**Spacing :** A line : 10cm between rows  
15 cm within rows  
Single seedling / hill  
B line : 30 cm between rows  
15 cm within rows.  
Two seedlings / hill.

The space between A line and R line is 20 cm

**Plant protection :**

Follow the plant protection measures advised for rice. Avoid spraying or dusting during anthesis and pollination i.e. early morning period.

**Rogueing and removal of pollen shedders :**

From the beginning rogueing is to be done in both A line and R line. Pollen shedders are to be removed along with tillers. In A line seed set may not exceed 40%. If plants having a setting of 70 to 80% means they are rogues and they have to be removed before harvest.

**Special techniques :**

- i. Pulling of ropes across the plot
- ii. Shaking the R lines with bamboo poles.

**Harvest :**

Harvest the R line first. Then harvest the hybrid. Thresh it properly dry it with 12% moisture and bag it.