A seed production system for backstopping a hybrid rice breeding program

R. S. Toledo, C. L. Casal, and S. S. Virmani, IRRI

For a hybrid rice breeding program to succeed, it should have a system for mass producing parental lines and developed hybrids. The parental lines should be multiplied efficiently without compromising purity. Sufficient hybrid seeds of acceptable purity should be made available for the various stages of evaluation. At IRRI, we employ a system for mass producing parental lines and hybrids for in-house use and sharing with collaborators.

The scheme for increasing seed of promising parental lines starts with nucleus seed production and is followed by breeder seed production. These stages of seed multiplication are carried out under strict isolation conditions. Experimental hybrids are produced in quantities depending on their current stage of yield evaluation. In producing seeds for trials requiring a few thousand seeds, we use the "isolation-free" system. This allows us to produce seeds of several hybrids in small adjacent plots. To produce a few kilograms of hybrids for multilocational testing and sharing with collaborators, we use 100-500-m^2 partially isolated plots. Within this seed production system, we assess the outcrossing potential of the seed parent and determine the ease of production of particular hybrid combinations. We determined the quality of output of the various seed production steps through grow-outs conducted after each season. ■

Standardizing hybrid rice seed production practices

S. Singh, B. C. Viraktamath, C. H. M. Vijayakumar, M. S. Ramesha, and M. I. Ahmed, Directorate of Rice Research, Rajendranagar, Hyderabad 500030, India

Seed yield in hybrid rice seed production plots depends, among other things, on the area under the female parent and the extent of seed set. Factors influencing seed set percentage on the female parent include row ratio, row direction, height of the pollen parent, weather conditions, particularly at the time of flowering such as wind velocity, pollen load, nature of the hybrid combination, and the adoption of practices that promote outpollination such as proper application of GA_3 and supplementary pollination.

We conducted an experiment to find out the optimum row ratio of the pollen parent to the seed parent and the appropriate season for maximizing seed yields in male sterile lines and hybrid rice. The material for the study consisted of IR58025A, with its maintainer line in cytoplasmic male sterile (CMS) line multiplication, and IR58025A, with restorer line IR40750. Only in the 1993 wet season (WS) was IR46 used as a restorer in hybrid rice seed production. Using these experimental materials, a trial involving both CMS multiplication and hybrid seed production was conducted in a fixed row ratio of 2 male:16 female parents during 1993-95 WS and dry season (DS) with six replications. The spacing adopted was 30 cm between two male rows, 20 cm from male to female row, and 15 cm each for female to female row and plant to plant. Seeding of the female parent was done only once, whereas the male parent was sown twice at an interval of 3-5 d except in the 1995 WS, when only one seeding was done. Seedlings of appropriate age were transplanted at the rate of a single seedling $hill^{-1}$ for the male and female in the 1993 WS and 2-3 seedlings for the male and 2 seedlings for the female during the remaining seasons. Seed production practices such as GA_3 application at 50 g ha^{-1} and supplementary pollination were commonly adopted. Leaf clipping, however, was practiced only during the 1993 WS.

Besides days to flowering and extent of synchronization, observations were recorded on percentage seed set and seed yield of individual female parent rows in each plot and in all replications. By using the yield of individual rows, the seed yield for different row ratios such as 2:2, 2:4, ..., and 2:16 were computed by adding the yield of the 2nd, 3rd, ..., and 8th row from both sides at a time. The results showed a constant decline in seed set in CMS multiplication and hybrid seed production, with a gradual increase in row ratio from 2:2 to 2:16.

The optimum row ratio in hybrid seed production varied from 2:8 (1993 and 1994) to 2:12 (1995) in the WS, whereas in the 1995 DS it was 2:10. Seed yield obtained at optimum row ratios was the highest in the 1995 WS (1,636 kg ha^{-1}) and the lowest in the 1993 WS (720 kg ha^{-1}). The low mean yields in 1993 and 1994 in the WS were mainly due to nonsynchrony in flowering between the male and female parents. The mean seed yield was also maximum in the 1995 WS (1,427 kg ha^{-1}), which was attributed to higher pollen load by virtue of perfect synchrony resulting from one-time sowing and planting of the male parent seedlings. Similarly, in CMS multiplication of IR58025A, seed yield was the highest with the ratio of 2:6 (1994 and 1995 WS) and 2:8 (1993 WS and 1995 DS). The main reason for the very low yield (515 kg ha^{-1}) in the 1995 WS was incessant rain during flowering. The mean seed yield obtained in different seasons indicated DS was more favorable for successful commercial seed production. ■