# An ICRISAT Success Story

## Greenhouse Screening to Combat Downy Mildew in Pearl Millet

### The problem

Downy mildew, caused by the fungus *Sclerospora graminicola*, is the most devastating disease of pearl millet in Asia and Africa. The disease is more severe in single-cross hybrids than in open-pollinated varieties.

In India, hybrids occupy 60% of the 10 million hectares under pearl millet cultivation. Annual losses to downy mildew total about $45 million. Although the disease can be partially controlled with a systemic fungicide, the treatment is expensive and only protects the crop for about 40 days. Host plant resistance is therefore the most cost-effective management option.

The effective commercial life of hybrids is 3-5 years. Over the past 20 years, several hybrids succumbed to downy mildew and were withdrawn from cultivation.

*Downy mildew in pearl millet. Above: the foliar phase. Right: the green ear phase.*

### Greenhouse screening

Both field and greenhouse screening techniques are essential in an effective breeding program. Because pathogen populations are constantly evolving, and also because of increasing diversity of hybrid cultivars in farmers' fields, a rapid and precise evaluation of breeding lines is crucial. Field screening is limited to two seasons (rainy and postrainy) and is effective only against a single pathotype.

Our greenhouse screening technique, on the other hand, is independent of seasonal climatic changes and is operational for most of the year with a screening cycle of 30 days. Moreover, screening can be done against various pathotypes.

### The process

1. Maintain the pure isolate of the pathogen in the isolation chamber.
2. Multiply inoculum under optimal conditions of light, humidity and temperature.
3. Spray inoculate pot-grown young seedlings with sporangial suspension.
4. Incubate inoculated seedlings at 20ºC in the dark for 16 hours.
5. Transfer pots to the greenhouse at 25ºC under high relative humidity (>95%).
6. Record data two weeks after inoculation.

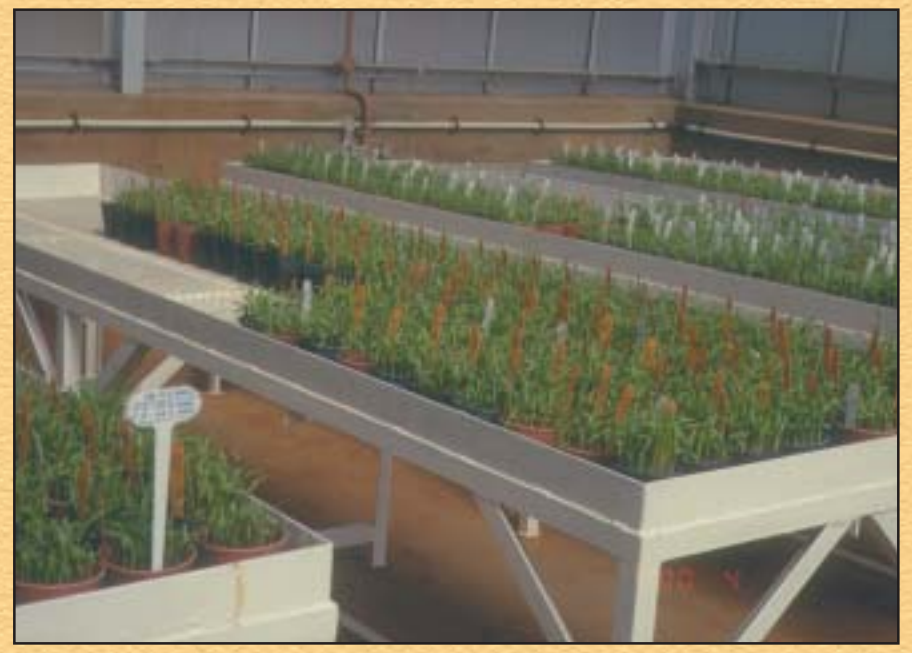
The entire process takes about 30 days. Although the ICRISAT-developed field screening technique has been widely adopted in India and Africa, the greenhouse screening technique is limited to only two places in the world (ICRISAT-Patancheru and the University of Wales at Bangor).

## Advantages of greenhouse over field screening

- Faster
- Cheaper
- More precise indications of disease incidence

## Impact

- More than 9000 ICRISAT pearl millet breeding lines have been screened.
- Over 70 pearl millet lines with resistance to multiple pathotypes have been identified.
- Several hybrids based on resistant lines developed at ICRISAT have been released by private and public organizations and some are under commercial cultivation.
- This research contributes significantly towards economic savings on fungicide and prolonging the commercial life of hybrids.



*Above: Greenhouse screening of pearl millet. Below: Field screening.*

### Greenhouse screening vs field screening

**As shown by downy mildew incidence (%) of selected lines across various experiments.**

| | Field screening | | | | Greenhouse screening | | | |
|---|---|---|---|---|---|---|---|---|
| Line | 2000 | 2001 | 2002 | 2003 | 2000 | 2001 | 2002 | 2003 |
| P 7-4 | 1 | 0 | 11 | 6 | 12 | 14 | 17 | 13 |
| 700651 | 3 | 4 | 19 | 4 | 27 | 24 | 31 | 29 |
| 843B | 26 | 32 | 93 | 39 | 86 | 73 | 89 | 91 |
| ICMP 451 | 30 | 10 | 76 | 3 | 81 | 91 | 90 | 93 |
| 7042S | 98 | 98 | 94 | 88 | 97 | 99 | 97 | 98 |

## Partners

- All India Coordinated Pearl Millet Improvement Project (AICPMIP) of Indian Council of Agricultural Research (ICAR)
- Private seed companies

## Donors

- USAID
- Sehgal Family Foundation, India
- DFID

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