Cold Tolerance Evaluation in Rice under Controlled Conditions

M. Cruz, E. Corredor, P. Jennings and G. Zorrilla

High productivity of tropical germplasm combined with cold tolerance could increase rice yield in the Latin-American Southern Cone. FLAR has studied different methodologies of evaluation for screening the germplasm produced for the temperate zone at its headquarters in CIAT-Cali, Colombia.

The methodologies of evaluation under controlled conditions permit a fast generational advance with germplasm selected for cold tolerance. This type of stress is difficult to predict under natural conditions because of the timing, duration or intensity with which it occurs. Therefore it would prove advantageous to use controlled conditions and subsequently verify reactions in the field. This process greatly reduces populations that go to the field increasing efficiency of the whole program.

Each year FLAR's breeding program for temperate region evaluates thousands of lines in germination and seedling stages and makes nurseries with F_3 population to be sent to our partners in the Southern Cone.

Germination stage

Low temperatures cause poor and delayed germination. Germplasm tolerant in germination stage allows seeds to growth faster and scape from soil pathogens. Thus the crop could have better and more uniform plant population and so better competition against weeds. Fast seedling emergence is also important to short crop cycle.

Methodology of evaluation

Dry seeds are disinfected, planted on paper towel moistened with a fungicide solution, and then placed to germinate in a cold room at 12°C.The scoring is doing when the tolerant check (Quilla 66304) has 80% of its coleoptiles with a length equal to or greater than five millimeters. Those lines scoring above 60% are considered tolerant and transplanted to the field for subsequent selection.

Tolerant check Quilla 66304

Susceptible Check Oryzica 1

Seedling stage

Low temperatures cause retarded seedling growth, yellowish, delayed panicle initiation and even death of plants, in early vegetative stages of sensitive rice to cold. Tolerant material at this stage helps to reduce crop cycle.

Methodology of evaluation

Plants 21 day-old (3-4 leaves) are treated with temperature of 5°C for 32 hours. Then the plants are placed under normal conditions (24°C). Damage is visually assessed seven days later using a scale from 1 to 9, where 1 and 3 are considered tolerant, 5 intermediate, and 7 and 9 susceptible. Tolerant plants are transplanted to the field to conform the nurseries.

Susceptible and tolerant germplasm

Reproductive stage

One of the most important damage from cold stress is the sterility caused during reproductive stage because it directly affects grain yield.

Methodology of evaluation

Genotypes under evaluation are divided into two groups; one of them is treated with a temperature of 5°C for 32 hours and the other is left under normal conditions (24°C) to allow the same line to be compared under both conditions as well as with the check genotypes. After the cold stress, plants are left under normal conditions and two panicles per plant are harvested. Cold tolerance is measured using a Tolerance Index that takes in consideration weight of filled grains under cold stress, weight of filled grains under normal conditions and their relation with checks.

Susceptible check Oryzica 1 — Tolerant check L2825-CA

After cold treatment

Latin American Fund for Irrigated Rice, FLAR

E-mail: flar@cgiar.org

www.flar.org