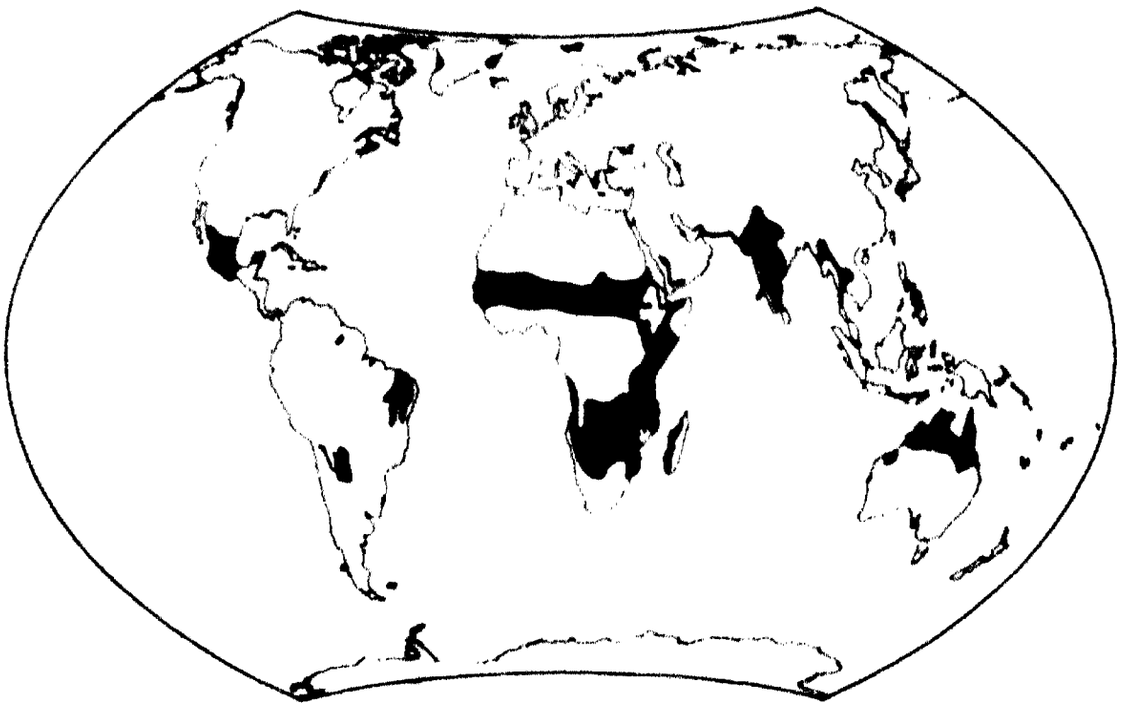
# INTERNATIONAL SORGHUM DISEASE RESISTANCE TESTING PROGRAM (ISDRTP)

Progress Report: SPGM 7901



# REPORT OF THE 1978 INTERNATIONAL SORGHUM GRAIN MOULD NURSERY (ISGMN)

ICRISAT

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## INTRODUCTION

The International Sorghum Grain Mold Nursery (ISGMN) was initiated in 1976 with the following objectives:

- to identify sources of stable grain mold resistance
- to obtain information on the variability of the grain mold pathogens
- to distribute grain mold resistant genotypes to scientists in national programs
- to promote the development of a communicating cooperating international network of scientists working on sorghum grain molds.

There has been an excellent response to the 1976 and 1977 ISGMN and a cooperative network has become well established. In this report we present the results of the 1978 ISGMN.

## COOPERATORS AND LOCATIONS

The basic requirement of cooperators is that they should be able to expose the ISGMN test entries to sufficient grain mold pressure to adequately test the reactions of the entries to grain molds. Sets of the 1978 ISGMN, consisting of 28 test entries and two known high-susceptible checks, were sent to 19 cooperators in 11 countries. Cooperators and test locations in the 1978 ISGMN from whom data had been received on February 15, 1979 are listed in Table 1.

## SELECTION OF ISGMN TEST ENTRIES

The test entries included in the 1976 and 1977 ISGMN trials were those identified as relatively less susceptible (RLS) to grain molds in the ICRISAT field screening program. A significant feature of 1978 test entries was the inclusion of promising progeny of crosses among the RLS lines and between them and elite grain quality lines. Two known high susceptible-checks, $PP_2Bx$ and IS 9991x were included to act as indicators of grain mold pressure.

## OPERATION OF THE 1978 ISGMN PROGRAM

The seeds of test entries were assembled and multiplied at ICRISAT Center, Hyderabad. All cooperators received seed from the same seed lot for each entry. This is important if erroneous information on pathogen variability is to be avoided.

Cooperators received a set of seed material and a book which included information on the objectives of the trial, suggestions on planting, fertilization, inoculum provision, time and method of scoring, and triplicate data record sheets for climatic data and plant reaction data. Cooperators were requested to return one copy of the data sheets to ICRISAT as soon as possible after completion of the trial. At the time of writing this report, cooperators have returned the data sheets from 12 locations.

## PERFORMANCE OF THE TEST ENTRIES

The field mold ratings (on a 1 to 5 scale), the laboratory

ranking of threshed grain, and estimates of percent molded surface of threshed grain, are presented in Tables 3 to 8. The entry performance is discussed below for individual locations.

Khon-Kaen, Thailand

Grain mold pressure was greatest at this location. Most entries received a field rating of 5 (trial mean 4.7). Notable exceptions were IS 9225 (2 and 1), IS 2261 (4 and 3), IS 2327 (3 and 4) and E 35-1 (1 in Rep. 1 but strangely 5 in Rep.2) (Table 3).

The best five entries based on the lab ranking (Table 5) were IS 9225, IS 2327, IS 2328, IS 2261 and E 35-1.

On the basis of percent molded surface (Table 7) IS 2327 (10%), IS 9225 (10%), IS 2261 (23%), IS 2328 (23%) and E 35-1 (35%) were far superior to the other entries.

Samaru, Nigeria

At Samaru, field ratings averaged 4.6. IS 14332 and E 35-1 had field ratings of $\leq$ 2 in both replications (Table 3). Some entries (IS 2327, IS 2435, IS 2328) had major differences in field ratings between replications.

On the basis of the lab ranking, IS 14332, IS 2327 and IS 9225 were the best entries (Table 5). There are discrepancies between field ratings and lab ranking, e.g. IS 9225 was given field ratings of 5 and 4 (on the 1 to 5 scale) and yet was ranked third best in both replications; IS 2327 was given field ratings of 5 and 2 and yet in the lab

ranking was 2nd in replication 1 and best in replication 2. As the lab ranking is made on the threshed grain, it probably gives a more accurate assessment of the *grain mold* as opposed to *head mold*. The head can look quite molded if glumes and rachis branches etc. are moldy, while the grain may or may not be molded.

Farakoba, Upper Volta

Nine entries have field ratings of ≤ 2 and IS 9225 had field ratings of 1 in both replications. Ten entries had field ratings > 4 and the location mean was 3.2 (Table 3).

There appears to have been some mix-up in seed prior to lab ranking and lab mold assessment. Some entries with low field ratings have high rank values, and there are some major discrepancies between replications e.g. IS 2328 ranked 24th in replication 1 was ranked 1 in replication 2 (with field ratings of 1 and 2 in replications 1 and 2 respectively (Table 5).

Replication discrepancies also occur in the percent molded surface ratings, e.g. IS 2328 has a score of 60 percent in replication 1 and 5 percent in replication 2, M 36619 has no mold in replication 1 and 58 percent molded surface in replication 2 (Table 7).

Sotuba, Mali

Three entries -- IS 14332, IS 9225 and IS 2261 -- had field ratings of 1 in both replications, and 7 other entries (E 35-1, IS 2327 M36046, IS 2328, IS 2435, M 36284 and M 36285) had maximum field ratings of 2 (Table 3).

Based on lab ranking, IS 14332, IS 2261, IS 2435, E 35-1 and IS 2327 were the best five entries (Table 5).

Seven entries averaged < 10 percent molded surface and of these IS 2327, IS 2328 and E 35-1 had < 5 percent in both replications (Table 7).

Arsinegele, Ethiopia

Grain mold pressure was generally lower at this location (location mean of 2.7) and only 2 entries had scores of 5 (Table 3). Seven entries had field ratings of no more than 2. The best two lines were M 36284 and M 36471.

No data were provided on lab ranking or percent molded surface of threshed grain.

Tarna, Niger

Only field rating data were provided, and from only one replication. Five entries IS 14332, IS 9225, M 36284, IS 2435 and CS 3541 had field ratings of 2. Location mean was 3.3 and only one entry had a field rating of 5 (Table 3).

ICRISAT Center, India

The trial was planted towards the end of June and sprinkler irrigation was provided on rain-free days during the flowering and grain-filling periods. Entries were inoculated with mixtures of *Curvularia lunata*, *Fusarium moniliforme* and *F. semitectum*, and heads were covered with brown paper bags for two weeks following inoculation.

Known high susceptibles developed severe mold. Eight entries combined field ratings of 2 or less, with laboratory rankings < 10, and ≤ 15 percent molded surface (IS 14332, E 35-1, IS 9225, IS 2261, IS 2327, IS 2328, M 36285 and M 36113) (Tables 4, 6, and 8).

Warangal, India

Grain mold pressure appears to have been low at this location Sixteen entries had field ratings of≤2 in both replications, and the trial mean was 2.4 (Table 4).

Is 14332 ranked 1 in both replications and was followed by IS 472 (ranked 2 in both reps) and JP 2579 (ranked 3 in both reps) (Table 7). Threshed grains of IS 14332, IS 472, JP 2579 and M 36368 were reported mold free. E 35-1, M 36285, M 36284, IS 2435, CS 3541 averaged < 10 percent molded surface (Table 8).

Bhavanisagar, India

Five entries -- IS 14332, IS 2327, IS 472, M 36423 and M 36049 -- had field ratings of 2 or less in both replications. The trial mean rating was 2.7 (Table 4).

In the ranking of threshed grain M 36619 was ranked 1 in both replications and was followed by IS 14332 (2 and 6), M 36285 (3 and 5) and M 36284 (6 and 3) (Table 6).

On the basis of percent molded surface of threshed grain IS 14332, M 36285, M36619 and M 36284 were the best lines with average molded surface of < 10 percent (Table 8).

Adilabad, India

Grain mold pressure was least at this location (mean 1.8). Twenty-six entries had field ratings of no more than 2.

Parbhani, India

Most entries, and the two known high susceptibles, had field ratings of 2 or 3, and thus there is no basis of differentiating the entries (Table 4).

Coimbatore, India

The trial was planted in early August and did not encounter rains during the period from flowering to grain maturity. Most entries received field ratings of 2 and 3 (Table 4).

DISCUSSION

Overall performance

Although no entry was highly resistant to grain mold at all locations there are a group of about eight lines which are consistently better than others at most locations. Three entries -- IS 14332, IS 9225, and E 35-1 -- combined mean field mold ratings of $\leq 2$ with mean ranking < 10, and mean percent molded surface < 20 (Table 9). IS 14332 and IS 9225 were among the best four entries for all mold assessment parameters, and six other lines (E 35-1, IS 2327, M 36284, IS 2328, M 36285 and JP 2579) were among the best ten entries for all three mold assessment parameters (Table 10). The two M-lines among

these better entries are derivatives from crosses between E 35-1 and SC 108-3. Other progenies in the trial were generally not as good as the original source lines.

Several entries have performed well in the ISGMN in two or three years of testing (Table II). Of the best lines across locations and years, E 35-1 has been the line most accepted by breeders for use in crossing programs, and in some countries, for direct use in yield trials in farmers' fields. It is important however that the full range of source material is utilized if the problem of narrow genetic basis is to be avoided. It will take longer to get commercially acceptable products from some of the other good source lines but this is no reason to avoid using them.

Performance and flowering time

Grain molds are greatly influenced by rainfall and humidity during the period from flowering to grain maturity. The wetter the weather during this period the greater the mold problem. A general feature of crops in the semi-arid tropics is that the later the flowering period the less wet weather encountered during the flowering and grain filling period. So late flowering sorghum lines can, and often do, escape grain molds. In view of this, it is essential to examine the relationship between grain mold reactions and time of flowering for the ISGMN entries. The mean number of days to flowering of the best 10 1978 entries was 76 (range 60 to 81), and the mean for the worst 10 entries was 65 (range 58 to 72). There is a significant negative cor-

relation (r = -0.67) between mean days to 50 percent flowering and mean field mold rating based on the data from all 30 entries (Table 9). Thus it is likely that the better performance of some of the entries is at least in part due to later flowering. However, several entries performed considerably better than the susceptible check IS 9991 even though they flowered earlier or at about the same time, and IS 14332, the best entry in the trial in 2 years of tests is relatively early (mean days to flowering 70 days, compared with 72 for IS 9991).

A detailed by-location analysis is needed, using the daily rainfall data supplied by the cooperators, to separate flowering time effects from resistance.

## THE 1979 ISGMN

The 1979 ISGMN will consist mainly of breeding progenies in which the emphasis will be on increasing the mold resistance and combining it with earliness and good grain quality. The nursery will consist of 30 entries, with two replications of two row plots each. We welcome participation of more cooperators from other areas where grain molds are a serious problem. Comments and suggestions to improve trial composition and management will be appreciated.

Entries are welcome from scientists in national and regional programs, provided the entries have shown at least a moderate degree of resistance under high grain mold pressure at the home location. Because of plant quarantine requirements in India, seed sent from abroad will take about one year before it can be included in the trial.

SEEDS SUPPLY

Any scientist who would like to receive seed of any entry listed in the report should send a request to the Cereals Pathologist at ICRISAT (address is given on the cover of this report) indicating that the seed requested is from the 1978 ISGMN entries.

Table 1. Cooperators and locations in the 1978 International Sorghum Grain Mold Nursery (ISGMN)[a/]

| Cooperator(s) | Location |
|---|---|
| J.A. Frowd | Sotuba, Mali |
| J.A. Frowd | Farakoba, Upper Volta |
| N.V. Sundaram | Samaru, Nigeria |
| O. Sidibe | Seha, Tarna, Niger |
| Brhane Gebrekidan and Yilma Kebede | Arsinegele, Ethiopia |
| Soontree Patanothai | Khon-Kaen, Thailand |
| T.B. Garud | Parbhani, India |
| K.N. Rao | ICRISAT Center, India |
| K. Ramaiah, S. Ranga Reddy and V. Muralidhar | Warangal, India |
| G. Koteswar Rao | Adilabad, India |
| K.N. Rao and D.S. Murthy | Bhavanisagar, India |
| Kausalya Gangadharan and B. Ramaraj | Coimbatore, India |

[a/] From whom data were received by February 15, 1979.

Table 2. Location means of two grain mold assessment parameters of 30 sorghum entries in two replications at each location in the 1978 ISGMN.

| Location | Field mold rating[a/] | Percent molded surface of threshed grain[b/] |
|---|---|---|
| Khon Kaen | 4.7 | 79.8 |
| Samaru | 3.6 | - [c/] |
| Tarna | 3.3 | - |
| Farakoba | 3.2 | 40.7 |
| Sotuba | 2.9 | 21.0 |
| Bhavanisagar | 2.7 | 25.8 |
| Arsinegele | 2.7 | - |
| Coimbatore | 2.5 | 30.2 |
| ICRISAT | 2.4 | 21.8 |
| Warangal | 2.4 | 28.9 |
| Parbhani | 2.4 | - |
| Adilabad | 1.8 | 7.9 |

[a/] Rated on a 1-5 scale where 1 is mold free and 5 is severely molded.

[b/] Approximate percent molded surface of the grain.

[c/] Data not received.

Table 3. Field mold ratings[a/] of 30 sorghum entries in two replications at six locations in the 1978 ISGMN.

| Entry | Mean days to 50% flowering | Sotuba | | Farakobe | | Samaru | | Tarna | | Arsinegele | | Khon Kaen | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R.1 | R.2 | R.1 | R.2 | R.1 | R.2 | R.1 | R.2 | R.1 | R.2 | R.1 | R.2 |
| IS 14332 | 70.3 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | -[c/] | 2 | 3 | 5 | 5 |
| IS 9225 | 80.8 | 1 | 1 | 1 | 1 | 5 | 4 | 2 | - | 2 | 3 | 1 | 2 |
| E 35-1 | 81.0 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | - | 2 | 2 | 1 | 5 |
| IS 2261 | 79.1 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | - | 2 | 2 | 4 | 3 |
| IS 2327 | 78.1 | 1 | 2 | 2 | 2 | 5 | 2 | 3 | - | 2 | 2 | 3 | 4 |
| M 36284 | 75.9 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | - | 1 | 2 | 5 | 5 |
| IS 2435 | 80.5 | 2 | 2 | 2 | 2 | 4 | 2 | 2 | - | 2 | 2 | 5 | 5 |
| IS 2328 | 79.1 | 1 | 2 | 1 | 2 | 4 | 2 | 3 | - | 3 | 2 | 5 | 5 |
| JP 2579 | 59.8 | 2 | 4 | 4 | 5 | 3 | - | 3 | - | 2 | 2 | 5 | 5 |
| M 36285 | 72.9 | 2 | 2 | 2 | 2 | 4 | 3 | 3 | - | 3 | 3 | 5 | 5 |
| M 36368 | 71.2 | 2 | 3 | 3 | 3 | 4 | 4 | 3 | - | 2 | 3 | 5 | 5 |
| M 36471 | 74.8 | 3 | 2 | 3 | 3 | 3 | 4 | 3 | - | 1 | 2 | 5 | 5 |
| IS 472 | 61.7 | 5 | 5 | 4 | 5 | - | 4 | 4 | - | 1 | 3 | 5 | 5 |
| M 36423 | 69.1 | 3 | 2 | 2 | 3 | 3 | 5 | 4 | - | 2 | 4 | 5 | 5 |
| M 36533 | 68.5 | 3 | 2 | 3 | 2 | 4 | 5 | 4 | - | 3 | 5 | 5 | 5 |
| M 36348 | 67.7 | 3 | 3 | 4 | 5 | - | 4 | 3 | - | 3 | 3 | 5 | 5 |
| M 36049 | 75.2 | 5 | 5 | 2 | 3 | 3 | 2 | 4 | - | 2 | 3 | 5 | 5 |
| M 36046 | 68.9 | 2 | 2 | 4 | 2 | 5 | 4 | 3 | - | 3 | 3 | 5 | 5 |
| M 36619 | 68.4 | 3 | 3 | 4 | 2 | 5 | 3 | 3 | - | 2 | 3 | 5 | 5 |
| CS 3541 | 70.5 | 3 | 3 | 3 | 4 | 5 | 4 | 2 | - | 3 | 3 | 5 | 5 |
| M 35052 | 66.8 | 3 | 3 | 4 | 5 | 3 | 5 | 4 | - | 3 | 3 | 5 | 5 |
| M 36109 | 68.2 | 5 | 5 | 2 | 4 | 4 | 5 | 4 | - | 2 | 3 | 5 | 5 |
| M 36113 | 67.1 | 4 | 2 | 5 | 3 | 4 | 4 | 4 | - | 3 | 2 | 5 | 5 |
| M 407-15 | 65.2 | 4 | 2 | 3 | 5 | 5 | 5 | 4 | - | 3 | 3 | 5 | 5 |
| M 35175 | 63.9 | 2 | 4 | 5 | 4 | 4 | 5 | 4 | - | 3 | 4 | 5 | 5 |
| M 36333 | 65.7 | 5 | 5 | 4 | 5 | 4 | 4 | 4 | - | 3 | 3 | 5 | 5 |
| M 4337-2 | 64.9 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | - | 3 | 4 | 5 | 5 |
| M 4397-1 | 62.1 | 3 | 3 | 5 | 4 | 4 | 4 | 4 | - | 5 | 4 | 5 | 5 |
| IS 9991x[b/] | 71.8 | 5 | 5 | 5 | 5 | 4 | 4 | 4 | - | 4 | 4 | 5 | 5 |
| PP28x[b/] | 57.7 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | - | 2 | 3 | 5 | 5 |

[a/] Based on a 1-5 scale, where 1 is mold free and 5 is severely molded.

[b/] Known high susceptibles.

[c/] No data provided.

Table 4. Field mold ratings[a/] of 30 sorghum entries in two replications at six Indian locations in the 1978 ISGMN.

| Entry | Mean days to 50% flowering | ICRISAT[b/] | | Warangal | | B'Sagar | | Adilabad | | Parbhani | | Coimbatore | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R.1 | R.2 | R.1 | R.2 | R.1 | R.2 | R.1 | R.2 | R.1 | R.2 | R.1 | R.2 |
| IS 14332 | 70.3 | 1.5 | 1 | 1 | 1 | 1.5 | 1.5 | 1 | 1 | 3 | 2 | 1 | 2 |
| IS 9225 | 80.8 | 1.5 | 1.5 | 2 | 2 | 2 | 2.5 | 1 | 1 | 2 | 2 | 3 | 2 |
| E 35-1 | 81.0 | 2 | 1.5 | 1 | 1 | 2 | 2.5 | 1 | 1 | 3 | 2 | 3 | 3 |
| IS 2261 | 79.1 | 2 | 1 | 1 | 2 | 4 | 3.5 | 1 | 1 | 3 | 3 | 2 | 2 |
| IS 2327 | 78.1 | 1.5 | 1.5 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 3 |
| M 36284 | 75.9 | 2.5 | 1.5 | 1 | 2 | 2 | 2.5 | 1.5 | 1.5 | 3 | 2 | 2 | 3 |
| IS 2435 | 80.5 | 2.5 | 1.5 | 1 | 1 | 3 | 3.5 | 1.5 | 1.5 | 2 | 2 | 2 | 2 |
| IS 2328 | 79.1 | 1.5 | 1.5 | 3 | 3 | 3 | 2 | 1 | 1 | 2 | 2 | 2 | 3 |
| JP 2579 | 59.8 | 3 | 2 | 1 | 1 | 2.5 | 2 | 1.5 | 1.5 | 2 | 2 | 2 | 2 |
| M 36285 | 72.9 | 2 | 2 | 2 | 1 | 2 | 2.5 | 1.5 | 1.5 | 3 | 2 | 3 | 3 |
| M 36368 | 71.2 | 2.5 | 2 | 2 | 2 | 2.5 | 2 | 1.5 | 1.5 | 2 | 2 | 2 | 2 |
| M 36471 | 74.8 | 3 | 2.5 | 3 | 3 | 4 | 2.5 | 1.5 | 1.5 | 2 | 2 | 2 | 2 |
| IS 472 | 61.7 | 3 | 2.5 | 1 | 1 | 1.5 | 2 | 1.5 | 1.5 | 3 | 3 | 2 | 2 |
| M 36423 | 69.1 | 3 | 3 | 3 | 2 | 2 | 2 | 1.5 | 1.5 | 2 | 2 | 2 | 3 |
| M 36533 | 68.5 | 3 | 2.5 | 1 | 1 | 3 | 2.5 | 1.5 | 1.5 | 2 | 2 | 2 | 2 |
| M 36348 | 67.7 | 2.5 | 1.5 | 2 | 1 | 3 | 2.5 | 2 | 2 | 2 | 3 | 3 | 3 |
| M 36049 | 75.2 | 3 | 2.5 | 3 | 3 | 1 | 2 | 1.5 | 1.5 | 3 | 3 | 2 | 2 |
| M 36046 | 68.9 | 2.5 | 2.5 | 3 | 2 | 2 | 2.5 | 2 | 2 | 3 | 2 | 3 | 2 |
| M 36619 | 68.4 | 2.5 | 3 | 2 | 3 | 1.5 | 2.5 | 2 | 2 | 3 | 2 | 3 | 3 |
| CS 3541 | 70.5 | 3 | 2.5 | 2 | 2 | 2.5 | 2.5 | 2 | 2 | 2 | 3 | 3 | 3 |
| M 35052 | 66.8 | 2.5 | 2.5 | 2 | 1 | 3 | 3 | 1.5 | 1.5 | 2 | 2 | 3 | 3 |
| M 36109 | 68.2 | 2.5 | 2 | 3 | 2 | 4 | 3 | 1.5 | 1.5 | 2 | 2 | 2 | 2 |
| M 36113 | 67.1 | 2 | 2 | 4 | 3 | 3.5 | 3.5 | 1.5 | 1.5 | 2 | 2 | 3 | 3 |
| M 407-15 | 65.2 | 2.5 | 2.5 | 3 | 3 | 3 | 3 | 2 | 2.5 | 2 | 3 | 3 | 3 |
| M 35175 | 63.9 | 3.5 | 2.5 | 4 | 4 | 3 | 2.5 | 2 | 2 | 2 | 3 | 2 | 3 |
| M 36333 | 65.7 | 3.5 | 2.5 | 2 | 2 | 3.5 | 3 | 2.5 | 3 | 2 | 4 | 3 | 3 |
| M 4337-2 | 64.9 | 3 | 3 | 4 | 4 | 4 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| M 4397-1 | 64.9 | 3.5 | 3.5 | 4 | 4 | 2.5 | 3.5 | 2 | 2 | 3 | 3 | 3 | 3 |
| IS 9991x[b/] | 71.8 | 5 | 5 | 5 | 5 | 3.5 | 4 | 5 | 5 | 2 | 3 | 4 | 3 |
| PP2Bx[c/] | 57.7 | 5 | 5 | 5 | 5 | 4 | 5 | 5 | 5 | 2 | 3 | 3 | 3 |

[a/] Based on a 1-5 scale, where 1 is mold free and 5 is severely molded.

[b/] Each replicate score a maximum of 2 adjacent rows.

[c/] Known high susceptibles.

Table 5. Laboratory ranking of 30 sorghum entries in two replications at four locations in the 1978 ISGMN.

| Entry | Mean days to 50% flowering | Sotuba R.1 | Sotuba R.2 | Farakoba R.1 | Farakoba R.2 | Samaru R.1 | Samaru R.2 | Khon Kaen R.1 | Khon Kaen R.2 |
|---|---|---|---|---|---|---|---|---|---|
| IS 14332 | 70.3 | 1 | 1 | 4 | 3 | 1 | 1 | 13 | 10 |
| M 36285 | 72.9 | - | 13 | 2 | 5 | 5 | 7 | 9 | 7 |
| IS 2327 | 78.1 | 7 | 2 | 3 | 8 | 2 | 1 | 3 | 1 |
| IS 9225 | 80.8 | 11 | 7 | 1 | 6 | 3 | 3 | 1 | 2 |
| E 35-1 | 81.0 | 4 | 5 | - | 24 | 8 | 11 | 5 | 6 |
| IS 2435 | 80.5 | 3 | 2 | 7 | 2 | 9 | 9 | 13 | 10 |
| M 36284 | 75.9 | 5 | 10 | 21 | 9 | 6 | 5 | 8 | 9 |
| IS 2328 | 79.1 | 10 | 9 | 24 | 1 | 12 | 12 | 2 | 5 |
| JP 2579 | 59.8 | 13 | 11 | 22 | 7 | 5 | - | 13 | 10 |
| M 36619 | 68.4 | 8 | 15 | - | 10 | 10 | 8 | 13 | 10 |
| M 36348 | 67.7 | 9 | 14 | 13 | 4 | - | 7 | 13 | 10 |
| IS 2261 | 79.1 | 2 | 3 | 17 | 23 | 3 | 6 | 4 | 4 |
| M 35052 | 66.8 | 18 | 12 | 10 | 26 | 12 | 11 | 13 | 10 |
| IS 472 | 61.7 | 14 | 20 | 23 | 19 | - | 2 | 13 | 10 |
| M 36471 | 74.8 | 6 | 17 | 15 | 14 | 6 | 7 | 10 | 10 |
| M 36368 | 71.2 | 12 | 6 | 5 | 20 | 11 | 10 | 13 | 10 |
| M 36423 | 69.1 | 19 | 16 | 6 | 15 | 10 | 7 | 12 | 3 |
| M 36049 | 75.2 | 25 | 23 | 8 | 12 | 12 | 11 | 6 | 8 |
| M 36113 | 67.1 | 17 | 4 | 20 | 21 | 4 | 11 | 13 | 10 |
| M 36533 | 68.5 | 26 | 19 | 14 | 18 | 9 | 11 | 7 | 10 |
| M 4397-1 | 62.1 | 15 | 28 | - | 13 | 12 | 9 | 13 | 10 |
| M 36046 | 68.9 | 16 | 24 | 9 | 11 | 6 | 4 | 13 | 10 |
| M 407-15 | 65.2 | 23 | 18 | 19 | 28 | 10 | 10 | 11 | 10 |
| CS 3541 | 70.5 | 24 | 22 | 11 | 17 | 10 | 11 | 13 | 10 |
| M 36109 | 68.2 | 21 | 25 | 18 | 16 | 8 | 13 | 13 | 10 |
| M 36333 | 65.7 | 22 | 26 | 16 | 25 | 7 | 14 | 13 | 10 |
| M 4337-2 | 64.9 | 27 | 29 | 12 | 22 | 12 | 10 | 13 | 10 |
| M 35175 | 63.9 | 20 | 21 | 25 | 27 | 3 | 12 | 13 | 10 |
| PP28x[b/] | 57.7 | - | 30 | 26 | 30 | 12 | 11 | 13 | 10 |
| IS 9991x[b/] | 71.8 | 29 | 30 | 27 | 29 | 4 | 11 | 13 | 10 |

a/ Entries ranked 1 to 30 based on grain appearance, where 1 = least moldy and 30 = most moldy.

b/ Known high susceptibles.

Table 6. Laboratory rankings[a/] of 30 sorghum entries in two replications at five Indian locations in the 1978 ISGMN.

| Entry | Mean days to 50% flowering | ICRISAT R.1 | ICRISAT R.2 | Warangal R.1 | Warangal R.2 | B'Sagar R.1 | B'Sagar R.2 | Adilabad R.1 | Adilabad R.2 | Coimbatore R.1 | Coimbatore R.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| IS 14332 | 70.3 | 6 | 8 | 1 | 1 | 2 | 6 | 1 | 1 | 3 | 3 |
| M 36285 | 72.9 | 8 | 6 | 5 | 5 | 3 | 5 | 11 | 11 | 13 | 13 |
| IS 2327 | 78.1 | 2 | 2 | 16 | 15 | 18 | 14 | 2 | 2 | 11 | 10 |
| IS 9225 | 80.8 | 3 | 1 | 19 | 19 | 17 | 22 | 3 | 3 | 12 | 12 |
| E 35-1 | 81.0 | 5 | 7 | 8 | 9 | 12 | 13 | 5 | 5 | 16 | 15 |
| IS 2435 | 80.5 | 4 | 4 | 6 | 6 | 22 | 29 | 8 | 8 | 9 | 10 |
| M 36284 | 75.9 | 10 | 9 | 7 | 7 | 6 | 3 | 10 | 10 | 14 | 14 |
| IS 2328 | 79.1 | 1 | 3 | 24 | 25 | 27 | 15 | 4 | 4 | 5 | 5 |
| JP 2579 | 59.8 | 17 | 12 | 3 | 3 | 15 | 2 | 9 | 9 | 19 | 19 |
| M 36619 | 68.4 | 12 | 25 | 12 | 12 | 1 | 1 | 23 | 23 | 4 | 5 |
| M 36348 | 67.7 | 11 | 11 | 13 | 13 | 11 | 4 | 21 | 21 | 10 | 9 |
| IS 2261 | 79.1 | 9 | 5 | 14 | 14 | 20 | 28 | 6 | 6 | 23 | 22 |
| M 35052 | 66.8 | 14 | 10 | 18 | 18 | 5 | 12 | 13 | 13 | 4 | 4 |
| IS 472 | 61.7 | 19 | 13 | 2 | 2 | 13 | 20 | 7 | 7 | 18 | 18 |
| M 36471 | 74.8 | 15 | 16 | 25 | 27 | 7 | 8 | 12 | 12 | 7 | 7 |
| M 36368 | 71.2 | 22 | 14 | 4 | 4 | 14 | 11 | 18 | 18 | 17 | 17 |
| M 36423 | 69.1 | 20 | 22 | 20 | 20 | 4 | 10 | 15 | 15 | 11 | 11 |
| M 36049 | 75.2 | 24 | 26 | 17 | 17 | 8 | 17 | 14 | 14 | 1 | 1 |
| M 36113 | 67.1 | 7 | 15 | 27 | 26 | 21 | 23 | 16 | 16 | 8 | 8 |
| M 36533 | 68.5 | 21 | 18 | 11 | 11 | 24 | 18 | 17 | 17 | 8 | 8 |
| M 4397-1 | 62.1 | 16 | 28 | 26 | 24 | 16 | 19 | 20 | 20 | 5 | 6 |
| M 36046 | 68.9 | 25 | 7 | 15 | 16 | 10 | 7 | 27 | 27 | 20 | 21 |
| M 407-15 | 65.2 | 18 | 19 | 21 | 21 | 19 | 21 | 26 | 26 | 2 | 2 |
| CS 3541 | 70.5 | 23 | 24 | 9 | 8 | 25 | 9 | 22 | 22 | 21 | 24 |
| M 36109 | 68.2 | 13 | 17 | 22 | 22 | 29 | 24 | 19 | 19 | 15 | 16 |
| M 36333 | 65.7 | 26 | 23 | 10 | 10 | 23 | 27 | 28 | 28 | 6 | 6 |
| M 4337-2 | 64.9 | 27 | 20 | 23 | 23 | 9 | 26 | 24 | 24 | 23 | 23 |
| M 35175 | 63.9 | 28 | 21 | 28 | 28 | 28 | 25 | 25 | 25 | 20 | 20 |
| PP2B x [b/] | 57.7 | 30 | 30 | 29 | 29 | 26 | 16 | 30 | 30 | 24 | 25 |
| IS 9991 x [b/] | 71.8 | 29 | 29 | 30 | 30 | 30 | 30 | 29 | 29 | 25 | 26 |

a/ Entries ranked 1-30 based on grain appearance, where 1 is least moldy and 30 is most moldy.

b/ Known high susceptibles.

Table 7. Percent molded surface[a/] of 30 sorghum entries in two replications at three locations in the 1978 ISGMN.

| Entry | Mean days to 50% flowering | Sotuba R.1 | Sotuba R.2 | Farako-ba R.1 | Farako-ba R.2 | Khon Kaen R.1 | Khon Kaen R.2 |
|---|---|---|---|---|---|---|---|
| IS 2327 | 78.1 | 2 | 2 | 2 | 20 | 10 | 10 |
| IS 14332 | 70.3 | 2 | 10 | 15 | 10 | 100 | 100 |
| IS 9225 | 80.8 | 10 | 2 | 2 | 5 | 5 | 15 |
| E 35-1 | 81.0 | 5 | 5 | - | 60 | 20 | 50 |
| M 36285 | 72.9 | - | 5 | 10 | 60 | 60 | 75 |
| IS 2328 | 79.1 | 2 | 2 | 60 | 5 | 5 | 40 |
| M 36284 | 75.9 | 10 | 20 | 60 | 25 | 50 | 85 |
| M 36340 | 67.7 | 10 | 40 | 50 | 20 | 100 | 100 |
| JP 2579 | 59.8 | 30 | 15 | 30 | 10 | 100 | 100 |
| M 36423 | 69.1 | 10 | - | 20 | 40 | 80 | 20 |
| IS 472 | 61.7 | 10 | 20 | 50 | 50 | 100 | 100 |
| M 36619 | 68.4 | 20 | 40 | 0 | 50 | 100 | 100 |
| M 36533 | 68.5 | 20 | 30 | 35 | 30 | 50 | 100 |
| IS 2435 | 80.5 | 10 | 10 | 25 | 50 | 100 | 100 |
| IS 2261 | 79.1 | 10 | 5 | 50 | 75 | 15 | 30 |
| M 36049 | 75.2 | 50 | 5 | 30 | 65 | 25 | 80 |
| M 36471 | 74.8 | 15 | 5 | 30 | 30 | 80 | 100 |
| M 35052 | 66.8 | 25 | 5 | 25 | 65 | 100 | 100 |
| M 36368 | 71.2 | 15 | 10 | 30 | 50 | 100 | 100 |
| M 407-15 | 65.2 | 20 | 15 | 25 | 60 | 80 | 100 |
| M 4397-1 | 62.1 | - | 25 | - | 40 | 100 | 100 |
| M 36046 | 68.9 | 10 | 20 | 35 | 50 | 100 | 100 |
| M 36113 | 67.1 | 25 | 25 | 50 | 75 | 100 | 100 |
| CS 3541 | 70.5 | 25 | 25 | 40 | 55 | 100 | 100 |
| M 36333 | 65.7 | 40 | 50 | 80 | 35 | 100 | 100 |
| M 36109 | 68.2 | 20 | 65 | 75 | 75 | 100 | 100 |
| M 4337-2 | 64.9 | 65 | 50 | 40 | 60 | 100 | 100 |
| M 35175 | 63.9 | 25 | 30 | 70 | 70 | 100 | 100 |
| PP28x [b/] | 57.7 | - | 65 | 70 | 90 | 100 | 100 |
| IS 9991x[b/] | 71.8 | 95 | 80 | 50 | 80 | 100 | 100 |

a/ Approximate percent molded surface for each entry.

b/ Known high susceptibles.

Table 8. Percent molded surface[a/] of 30 sorghum entries in two replications at five Indian locations in the 1978 ISGMN.

| Entry | Mean days to 50% flowering | ICRISAT R.1 | ICRISAT R.2 | Warangal R.1 | Warangal R.2 | B'Sagar R.1 | B'Sagar R.2 | Adilabad R.1 | Adilabad R.2 | Coimbatore R.1 | Coimbatore R.2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| IS 2327 | 78.1 | 3 | 3 | 32 | 32 | 22 | 22 | 0 | 0 | 20 | 10 |
| IS 14332 | 70.3 | 8 | 10 | 0 | 0 | 8 | 10 | 0 | 0 | 6 | 6 |
| IS 9225 | 80.8 | 5 | 2 | 38 | 30 | 22 | 40 | 0 | 0 | 25 | 24 |
| E 35-1 | 81.0 | 8 | 10 | 6 | 10 | 10 | 20 | 0 | 0 | 37 | 33 |
| M 36285 | 72.9 | 10 | 8 | 5 | 5 | 8 | 8 | 3 | 3 | 28 | 26 |
| IS 2328 | 79.1 | 2 | 5 | 55 | 48 | 42 | 22 | 0 | 0 | 9 | 10 |
| M 36284 | 75.9 | 12 | 10 | 6 | 6 | 10 | 6 | 3 | 3 | 30 | 28 |
| M 36348 | 67.7 | 15 | 15 | 20 | 15 | 15 | 5 | 7 | 7 | 19 | 18 |
| JP 2579 | 59.8 | 8 | 10 | 0 | 0 | 20 | 5 | 3 | 3 | 55 | 50 |
| M 36423 | 69.1 | 25 | 35 | 44 | 35 | 10 | 12 | 3 | 3 | 20 | 22 |
| IS 472 | 61.7 | 22 | 18 | 0 | 0 | 18 | 30 | 3 | 3 | 48 | 45 |
| M 36619 | 68.4 | 15 | 40 | 17 | 12 | 5 | 3 | 7 | 7 | 7 | 10 |
| M 36533 | 68.5 | 25 | 28 | 10 | 10 | 32 | 30 | 3 | 3 | 16 | 16 |
| IS 2435 | 80.5 | 5 | 5 | 5 | 5 | 28 | 65 | 3 | 3 | 17 | 19 |
| IS 2261 | 79.1 | 12 | 8 | 28 | 20 | 25 | 60 | 0 | 0 | 86 | 70 |
| M 36049 | 75.2 | 30 | 42 | 35 | 25 | 12 | 28 | 3 | 3 | 3 | 4 |
| M 36471 | 74.8 | 18 | 25 | 60 | 60 | 12 | 10 | 3 | 3 | 13 | 15 |
| M 35052 | 66.8 | 18 | 12 | 36 | 25 | 10 | 18 | 3 | 3 | 7 | 8 |
| M 36368 | 71.2 | 25 | 20 | 0 | 0 | 20 | 15 | 3 | 3 | 38 | 43 |
| M 407-15 | 65.2 | 22 | 30 | 45 | 35 | 25 | 35 | 8 | 8 | 4 | 5 |
| M 4397-1 | 62.1 | 20 | 45 | 62 | 45 | 20 | 30 | 7 | 7 | 9 | 11 |
| M 36046 | 68.9 | 30 | 42 | 30 | 22 | 15 | 10 | 8 | 8 | 57 | 54 |
| M 36113 | 67.1 | 10 | 22 | 65 | 55 | 28 | 45 | 3 | 3 | 16 | 16 |
| CS 3541 | 70.5 | 28 | 38 | 8 | 10 | 35 | 12 | 7 | 7 | 63 | 80 |
| M 36333 | 65.7 | 32 | 38 | 10 | 10 | 30 | 55 | 14 | 19 | 11 | 11 |
| M 36109 | 68.2 | 15 | 25 | 48 | 36 | 50 | 48 | 3 | 3 | 31 | 35 |
| M 4337-2 | 64.9 | 35 | 32 | 50 | 40 | 15 | 52 | 8 | 8 | 78 | 80 |
| M 35175 | 63.9 | 30 | 35 | 68 | 60 | 45 | 50 | 8 | 8 | 57 | 53 |
| PP2Bx [b/] | 57.7 | 45 | 52 | 75 | 75 | 40 | 25 | 65 | 65 | 92 | 90 |
| IS 9991x [b/] | 71.8 | 38 | 48 | 80 | 80 | 65 | 70 | 60 | 55 | 95 | 96 |

a/ Approximate percent molded surface for each entry.

b/ Known high susceptibles.

Table 9. Mean days to 50 percent flowering (MDF), mean field mold ratings (FR), threshed grain ranking (TGR) and threshed grain percent molded surface (TGPMS) for 30 entries in the 1978 ISGMN.

| Entry | MDF | FR[a/] | TGR[b/] | TGPMS[c/] |
|---|---|---|---|---|
| IS 14332 | 70 | 1.8 | 3.6 | 18 |
| IS 9225 | 81 | 1.9 | 8.1 | 14 |
| E 35-1 | 81 | 2.0 | 9.3 | 18 |
| IS 2261 | 79 | 2.1 | 11.6 | 31 |
| IS 2327 | 78 | 2.1 | 6.6 | 12 |
| M 36284 | 76 | 2.2 | 9.1 | 23 |
| IS 2435 | 81 | 2.2 | 9.0 | 28 |
| IS 2328 | 79 | 2.3 | 10.4 | 19 |
| JP 2579 | 60 | 2.5 | 10.5 | 27 |
| M 36285 | 73 | 2.5 | 6.4 | 20 |
| M 36368 | 71 | 2.6 | 12.6 | 30 |
| M 36471 | 75 | 2.6 | 12.3 | 30 |
| M 36423 | 69 | 2.7 | 13.1 | 24 |
| M 36533 | 69 | 2.7 | 15.4 | 27 |
| IS 472 | 62 | 2.8 | 12.2 | 32 |
| M 36348 | 68 | 2.8 | 10.8 | 29 |
| M 36049 | 75 | 2.8 | 13.6 | 28 |
| M 36046 | 69 | 2.8 | 16.0 | 37 |
| M 36619 | 68 | 2.8 | 10.7 | 28 |
| CS 3541 | 71 | 2.9 | 16.9 | 40 |
| M 35052 | 67 | 2.9 | 11.7 | 29 |
| M 36109 | 68 | 3.0 | 17.8 | 40 |
| M 36113 | 67 | 3.0 | 14.8 | 40 |
| M 407-15 | 65 | 3.2 | 16.9 | 32 |
| M 35175 | 64 | 3.3 | 21.0 | 51 |
| M 36333 | 66 | 3.4 | 17.8 | 40 |
| M 4337-2 | 65 | 3.4 | 19.8 | 51 |
| M 4397-1 | 62 | 3.4 | 15.6 | 33 |
| IS 9991 x | 72 | 4.2 | 22.3 | 66 |
| $PP_2B$ x | 58 | 4.2 | 24.5 | 75 |

a/ based on data from 12 locations on a 1 to 5 rating scale

b/ based on data from 9 locations on a simple ranking

c/ based on data from 8 locations on estimated percent molded surface of threshed grains.

Table 10. The rank values of 30 1978 ISGMN entries based on across-location means for three grain mold assessment parameters.

| Entry | Field Rating[a/] | Lab Ranking[b/] | Lab Rating[c/] |
|---|---|---|---|
| IS 14332 | 1 | 1 | 4 |
| IS 9225 | 2 | 4 | 2 |
| E 35-1 | 3 | 7 | 3 |
| IS 2327 | 5 | 3 | 1 |
| M 36204 | 6 | 6 | 7 |
| IS 2328 | 8 | 8 | 5 |
| M 36285 | 10 | 2 | 6 |
| JP 2579 | 9 | 9 | 10 |
| IS 2435 | 7 | 5 | 13 |
| IS 2261 | 4 | 12 | 18 |
| M 36368 | 11 | 16 | 16 |
| M 36471 | 12 | 15 | 17 |
| M 36423 | 13 | 17 | 8 |
| M 36533 | 14 | 20 | 9 |
| IS 472 | 15 | 14 | 19 |
| M 36348 | 16 | 11 | 14 |
| M 36049 | 17 | 18 | 11 |
| M 36046 | 18 | 22 | 22 |
| M 36619 | 19 | 10 | 12 |
| CS 3541 | 20 | 24 | 23 |
| M 35052 | 21 | 13 | 15 |
| M 36109 | 22 | 25 | 26 |
| M 36113 | 23 | 19 | 25 |
| M 407-15 | 24 | 23 | 20 |
| M 35175 | 25 | 28 | 28 |
| M 36333 | 26 | 26 | 24 |
| M 4337-2 | 27 | 27 | 27 |
| M 4397-1 | 28 | 21 | 21 |
| IS 9991x | 29 | 30 | 30 |
| $PP_2$8x | 30 | 29 | 29 |

a/ based on data from 12 locations - scored on a 1 to 5 basis

b/ based on data from 9 locations - based on a simple ranking

c/ based on data from 8 locations - based on estimated percent molded surface of threshed grain.

Table 11. Across-location mean performance of selected entries from the 1976, 1977 and 1978 ISGMN trial for two grain mold assessment parameters.

| Entry | Mean field rating a/ | | | Mean rank value b/ | |
|---|---|---|---|---|---|
| | 1976 | 1977 | 1978 | 1977 | 1978 |
| IS 14332 | -c/ | 1.9 | 1.8 | 5.3 | 4.1 |
| E 35-1 | 2 | 1.9 | 1.9 | 8.4 | 8.4 |
| IS 2327 | 2.5 | 1.8 | 2.1 | 4.9 | 6.4 |
| IS 2261 | 2.6 | 1.7 | 2.0 | 7.0 | 11.4 |
| IS 9225 | 2.7 | 1.8 | 1.9 | 11.9 | 7.4 |
| IS 2320 | 2.0 | 1.8 | 2.4 | 7.5 | 11.4 |
| IS 2435 | - | 2.1 | 2.4 | 10.7 | 9.8 |
| $PP_2Bx$ (Known high susceptible) | - | 4.4 | 4.7 | 23.3 | 23.0 |

a/ Data received from 6 locations in 1976 and 12 locations in 1977 and 1978.

b. Rank values started in 1977 and based on 8 locations in 1977 and 9 locations in 1978.

c/ Not included in the trial.