

Legumes Pathology (Pigeonpea)

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TRP

Report of Work (June 1991 – May 1992)



ICRISAT

Legumes Program

International Crops Research Institute for the Semi-Arid Tropics
Patancheru P.O., Andhra Pradesh 502 324, India

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LEGUMES PATHOLOGY (PIGEONPEA)

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List of Approved Projects (1991)

No.	Title	Project Scientist(s) Cooperators	
LP-502(90)IC/IC	Management of phytophthora and alternaria blight and other stem and leaf diseases of pigeonpea	M.V. Reddy	D.H. Smith A.M. Ghanekar D.R. Butler R.P. Ariyanayagam Laxman Singh S.C. Gupta K.B. Saxena K.C. Jain C. Johansen Y.S. Chauhan
LP-503(90)IC/IC	Epidemiology and integrated control of pigeonpea wilt and sterility mosaic	M.V. Reddy	D.H. Smith D.R. Butler Y.S. Chauhan R.P. Ariyanayagam C. Johansen Laxman Singh K.C. Jain D.V.R. Reddy S.C. Gupta K.B. Saxena

I. SUMMARY

1. **Disease situation in pigeonpea.** A survey was carried out to study the disease problems of pigeonpea in central and southern Malawi in August 1991. *Fusarium* wilt, *Cercospora* leaf spot, powdery mildew, bacterial canker (?), *Macrophomina* root rot and stem canker, and root-knot were observed during the survey (Table 1). *Fusarium* wilt was the most severe and destructive disease of pigeonpea. The average incidence in southern Malawi was about 4.0%. The incidence in different fields ranged from 0-50%. Wilt incidence was high in Lilongwe and Blantyre ADDs. Wilt was not observed in Lilongwe and in Ngabu ADD. The reduced incidence of wilt observed in the present survey compared to that found in the earlier survey (36.3%) in 1980 may be due to the introduction of wilt-resistant cultivar ICP 9145. Wilt was not observed in this cultivar in any of the fields visited. This cultivar is estimated to be grown in 15-20% of the area under pigeonpea cultivation in Malawi. Expanding the area under ICP 9145, incorporation of wilt resistance in local land races, and increasing plant population should help in increasing pigeonpea production in Malawi. The presently cultivated local land races appear to be tolerant to powdery mildew, *Cercospora* leaf spot, *Macrophomina* root rot and stem canker, and root-knot, and while developing new cultivars, these have to be carefully considered.

Observations in farmers' fields in Nepal in February 1992 indicated sterility mosaic (SM) was not a problem during the 1991-92 crop season. However, high incidence (upto 40%) of wilt was found in some farmers' fields in Banke district in the mid-western region. The incidence of *Macrophomina* stem canker was also negligible. It is evident that for Nepal pigeonpea lines with combined resistance to SM and wilt are needed in view of high incidence of SM in certain seasons.

Observations in farmers' fields in Andhra Pradesh, India during the 1991-92 crop season indicated that the incidence of *Macrophomina* stem canker in Khammam district was on increase and this problem need to be watched.

2. **Disease screening nurseries.** The disease screening nurseries were operated at Patancheru during 1991-92 for wilt, *Phytophthora* blight (PB), wilt and SM, and wilt and *Helicoverpa* together (Table 2). Screening for SM resistance was carried out in pots. At Gwalior, screening for only wilt resistance was carried out. The SM part was deleted due to the problem of spread of the disease to other trials. Also, the reactions for SM at Patancheru and Gwalior are not very different which was not the case in wilt. The disease incidence in the susceptible checks in different disease nurseries was high indicating effective evaluation of the germplasm and breeding materials. During the current season, PB appeared very early in the season i.e. within 15 days of sowing. This resulted in higher mortality in many lines compared to the previous seasons as pigeonpeas are more susceptible to PB in the seedling stage than in the advanced stage. In all the wilt nurseries, the population of *Fusarium* was estimated at the time of sowing (Table 3).

3. **Evaluation of breeding material for disease resistance.** A large amount of breeding material was evaluated for resistance to different diseases in collaboration with pigeonpea breeders (Tables 4-8). The major emphasis was on PB and multiple disease (wilt + SM) resistance. The germination in PB nursery was relatively poor due to crust formation necessitating resowing of some lines. This has created a problem as disease incidence in the resown lines was less compared to the lines sown in the beginning. In wilt and SM nursery, PB incidence especially in low-lying areas was high resulting in elimination of high susceptible lines/plants. Identification of several wilt and SM resistant lines in short-duration group in addition to medium-duration group was high-light of 1991-92 season. As several lines are also available with resistance to wilt and SM individually, it is appropriate to reduce the work on resistance to these two individual diseases and increase the efforts on PB for which high and stable resistance is lacking.

In wilt and Helicoverpa nursery (BM 16C), a bulk of the plants selected from ICPL 332 (a known Helicoverpa promising line) in which heavy incidence of wilt was observed during 1991-92 was evaluated and hardly any plant was found promising for wilt. In an alfisol wilt and SM nursery (RM 3C), MS 3783 bulk was evaluated and was found resistant to both wilt and SM.

4. **Preliminary evaluation of germplasm for wilt and SM resistance.** 132 new accessions were evaluated against wilt and SM nursery in collaboration with GRU. Of these, 40 lines showed 20% or less wilt incidence and 61 lines showed 20% or less SM (Table 9). Fifteen accessions, ICP 14644, -14661, -14662, -14679, -14689, -14730, -14747, -14748, -14750, -14751, -14754, -14756, -14757, -14758, and -14763 showed 20% or less incidence for both the diseases. These lines will be evaluated in the 1992-93 season.
5. **Advanced evaluation of germplasm for wilt and SM resistance.** 46 accessions that showed 20% or less SM incidence in pot screening during 1990-91 were re-evaluated against SM and wilt in wilt and SM nursery in field (Table 10). As expected, most of the lines showed promise against SM. A few lines such as ICP 14271, -14280, -14284, -14290, -14469, -14503 showed 10% or less incidence against both the diseases. These will be entered in to international multiple disease nursery during 1992-93.
6. **Effect of Inter-row spacing and weeding on PB incidence.** The experiments conducted in an alfisol PB sick plot (RP 18) to find out the effect of inter-row spacing and weeding on PB incidence in blight susceptible cultivar ICPL 87 showed that they did not have any effect on disease (Tables 11 and 12). The experiment was based on earlier observations when less incidence of PB was noticed in widely-spaced and weedy plots in the previous seasons. Very high incidence of disease (88-100%) that occurred during 1991-92 in the seedling stage itself may be the reason for not observing differences between treatments indicating that at high levels of disease pressure, wider spacing and weeds do not influence PB incidence.
7. **Evaluation of pigeonpea lines for wilt and SM resistance in a perennial system.** The results of trial in which a set of pigeonpea lines evaluated

for wilt and SM resistance and yield in the second year in a wilt and SM nursery are presented in Table 13. In most of the lines, mortality due to wilt increased in the second year than in the first year but there was not much change in SM incidence in the second year. However, in many lines the yield increased over first year due to higher crop canopy obtained by them. In terms of disease resistance and yield, ICP 9174 and PR 5149 were the best.

8. **Evaluation of ACT lines for disease resistance.** 83 lines in different ACT's received from DPR, Kanpur were evaluated against wilt, SM and PB in field (Table 14). Quite a few lines were resistant individually to wilt and SM and a few such as ICPL 227, ICPL 88046, ICPL 88047, ICPL 87119, DA 35, DA 11 were resistant to both the diseases. These were mostly medium- and long-duration types. None was resistant to PB.
9. **Influence of pigeonpea genotypes on *E. udum* population in soil.** The influence of susceptible, resistant and moderately-susceptible pigeonpea genotypes on *E. udum* population was studied in both Alfisol and Vertisol (Tables 15, 16, 17, 18). In all the genotypes and in both the soils, the population increased from sowing to harvest and the increase was slightly less in resistant (ICP 8863) compared to susceptible (ICP 2376) and moderately-susceptible types (C 11 and ICPL 87).
10. **Colonization of *E. udum* in pigeonpea.** The colonization of *E. udum* in pigeonpea cultivars with different levels of susceptibility to wilt was studied in plants raised in both Alfisol and Vertisol sick plots. The fungus was found to infect and colonize all the cultivars (Table 19, 20). In both the soils, the colonization in all the cultivars was maximum in November. The extent of colonization was less in resistant (ICP 8863) compared to susceptible (ICP 2376) and moderately-susceptible (C 11 and ICPL 87) lines.
11. **Preliminary evaluation of germplasm for SM resistance.** 103 new accessions provided by GRU were evaluated for SM resistance in pots (Table 21). Quite a few lines such as ICP 14620, 21, 26-29, 32, 34-46, 44, 47, 52, 53, 67, 80, 81, 87, 89, 92, 98, 99, 47-58, 63-64, 66, 68 showed about 10% or less incidence. These will be evaluated in the next season in the field in wilt and SM nursery.
12. **Reaction of lines received from Kanpur to SM.** Seven lines received from CSAU&T, Kanpur were evaluated for SM resistance in pots (Table 22). All the lines except T 7 were found resistant.
13. **Reaction of waterlogging resistant pigeonpea line to diseases.** ICP 8379, the line found resistant to waterlogging by ICRISAT physiologists was evaluated against wilt, SM and PB in disease nurseries (Table 23). It was found susceptible to all the three diseases.
14. **Multilocation evaluation for disease resistance.** Four nurseries, one each for wilt, SM, PB and one for multiple disease resistance were organized in collaboration with ICAR (Tables 24, 25, 26, 27). The results of the nurseries are yet to be received from some locations. For wilt, ICP 8863 and Sujata-1 showed 20% or less wilt across the locations. For SM, most

of the lines showed high incidence at Bangalore and Delhi. The line ICP 8862 showed 5% or less disease at all the locations except at Bangalore. For phytophthora blight, KPBR 80-2 was the most promising. ICP 7200 and KPBR 80-2 were the most promising against wilt, SM and PB.

15. **Variability in *Fusarium udum*.** Two experiments were conducted in collaboration with ICAR to study variability in *F. udum*. In one experiment, 12 genotypes were tested in field (wilt sick plots) at seven locations in India (Table 28) and in another the same 12 genotypes were tested in pots at ICRISAT center against 13 isolates (Table 29). In field testing at different locations, wilt incidence varied considerably between the genotypes. Wilt incidence was high in all the genotypes at Sehore and at other locations, a few genotypes showed low incidence (<10% wilt). ICP 8863 and ICP 9174 showed <10% incidence at all other locations except Sehore. In the pot experiment at ICRISAT, ICP 8858 (Sharda, ICP 1-6, ICPL 227) showed differential reaction consistently. While it showed resistance to isolate from ICRISAT, it was susceptible to Delhi, Kanpur and Varanasi isolates.
16. **Variability in sterility mosaic pathogen.** Eleven genotypes were tested at 4 locations in collaboration with ICAR and the reaction of the genotypes was variable across the locations. The disease incidence in the lines at Kanpur was much less compared to last season (Table 30).
17. **Wilt Prediction Model study.** An attempt has been made to predict the fusarium wilt of pigeonpea under field conditions by creating four gradients of inoculum in sick plots with three genotypes of varied degrees of resistance. Initial soil inoculum concentration, an independent biovariable is singled out as the major influencing factor contributing to 90% variability on wilt incidence. This indicates possibility for prediction using soil inoculum estimation. Best equation with highest fitness is possible after regressing with other independent variables viz., soil temperature, soil moisture, ambient temperature, evaporation, rainfall and relative humidity etc. upon the wilt incidence.
18. **Inoculum Density - Disease (ID-D) model (Pigeonpea wilt).** A log-log transformation (as per R. Baker 1968) model constructed in the present study indicated a slope value of 0.93 for wilt susceptible (ICP 2376) and 0.5 for moderately-susceptible (C-11) genotypes. No wilt was observed upto 1:200 dilution of sick soil (15 colony forming unit (cfu)/g soil) for susceptible genotype but incidence was observed at 1:100 dilution (34 cfu/g soil) with increasing disease development till 1:10 dilution (261 cfu/g). Wilt incidence in moderately-susceptible line was observed at 1:25 dilution (111 cfu g/soil) and showed a progressive disease development till 1:5 (517 cfu/g soil) dilution. In this system, where there is a moving infection court (root tip) and the host and pathogen are distributed in a three dimensional substrate of soil, the slope values are in proximity and comparable to models of other soil-borne pathogens.
19. **Temporal and Spatial Dynamics of *F. udum*.** Dynamics of pathogen population was monitored at depths of 15, 30, 60, 90 and 120 cm (space dimension) at 15 days interval (time dimension) in the rhizospheres of ICP

2376 and ICP 8863 genotypes in vertisol and alfisol. Population ranged from 3700- 4500 cfu/g soil at 0-15cm to as low as 260-400 cfu/g soil at 90- 120 cm depths. The spatial pattern of pathogen population differed with respect to rhizospheres of susceptible and resistant genotype. However, the change in pathogen population was influenced upto an "effective zone" of 30 cm depth beyond which little or no change was observed.

20. Population dynamics of *E. udum* in different cropping patterns. Maximum population of 5010 to 8310 cfu/g soil was estimated from the rhizospheres of continuous intercropping of sorghum and pigeonpea, followed by cowpea/pigeonpea and sorghum/safflower (2720-4770 cfu/g soil). The minimum population of 1850-4430 cfu/g soil was recorded in sorghum/pigeonpea and sorghum/safflower followed by sorghum/pigeonpea and sorghum/chickpea (2710-4720 cfu/g soil).
21. Effect of temperature on pigeonpea wilt. The experiment was conducted by following "root-dip transplanting" inoculation technique using three genotypes (viz., ICP 2376, C 11 and ICP 8863) by incubating at 15, 20, 25 and 30°C. No wilt was observed at 15°C in any of the genotypes. Wilt occurred in temperatures ranging from 20 to 30°C with varied incubation periods. ICP 2376 wilted after 14 days of incubation with 28% incidence at 30°C, while it took 18 days (40% wilt) at 25°C and 26 days (20% wilt) at 20°C. ICP 8863 wilted only at 25°C (4% incidence). However, C-11 showed wilting after 15 days at 30°C (16% wilt) followed by 20 days at 25°C (24% wilt) and 26 days at 20°C (16% wilt).

However, *E. udum* was found to be present inside the host system in all genotypes at all temperatures including 15°C, indicating pathogen remaining as symptomless carrier at 15°C.

22. Effect of temperature and moisture levels upon *E. udum* population. Pathogen population was estimated from vertisol sick soil incubated at three moisture (field capacity, 50% field capacity and dry soil) and five temperature (10, 15, 20, 25 and 30°C) combinations. Moisture level of 50% field capacity followed by field capacity at 25 and 30°C supported the proliferation and development of *E. udum* population. The increase was conspicuous after 14 weeks of incubation.
23. Influence of cropping systems on pigeonpea wilt. *E. udum* population and wilt incidence were monitored in Resource Management Program production agronomy experiments in Alfisol and Vertisol involving different crop mixtures and rotations. Observations at the end of second year indicate that the crop mixtures and rotations do not have major effect on *E. udum* population (Table 31) but differences were observed in wilt incidence.
24. Out of 31 germplasm lines evaluated for the second time 11 accessions showed 25% or less *Macrophomina* root rot incidence under natural epiphytic conditions at Madhira in Andhra Pradesh (Table 32).
25. Evaluation of pigeonpea germplasm for phytophthora blight resistance. Out of 184 accessions evaluated for the second time, 33 accessions showed 10% or less blight in blight nursery (Table 33).

26. Recommendations of 1992 AICIP Kharif Pulses Workshop. Some of the recommendations of the workshop held at RAU, Pusa are 1) ICPL 83027, ICPL 88024, ICPL 87119, ICPL 85047 and ICP 8860 have been recommended as sources of wilt and sterility mosaic resistance for crossing in the national program 2) ICPL 89044, ICP 8094, ICPL 86005, ICPL 88023 and ICPL 88025 will be used as wilt and SM resistant parents at MPKV, Rahuri 3) APAU, Lam Center will use ICPL 87119 and ICP 8859 as wilt and SM resistant parents 4) ICPL 87119, a wilt and SM resistant and high yielding cultivar has been identified for release in central and south zones of India.

II. PUBLICATIONS

1. Reddy, M.V., and Raju, T.N. 1992. Investigations on pathogenic variability in the pigeonpea wilt-pathogen *Fusarium udum*. Proc. Symp. on Plant Disease problems in Central India.
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3. Reddy, M.V., Jain, K.C., Remanandan, P., Ariyanayagam, R.P. and D.H. Smith. 1992. Progress in the management of pigeonpea diseases with host-plant resistance. Paper presented at the National Seminar on Changing Scenario in pest and pest management, 31 Jan to 1 Feb 1992, Central Plant Protection Training Institute, Rajendranagar, Hyderabad 500 030.
4. Reddy, M.V., Raju, T.N., Nene, Y.L., Ghanekar, A.M., Amin, K.S., Arjunan, G., Astaputre, J.V., Sinha, B.K., Muniappa, V., Reddy, S.V., Gupta, R.P., and Kausalya Gangadharan. 1992. Variability in sterility mosaic pathogen of pigeonpea in India. Indian Phytopathology.
5. Amin, K.S., Reddy, M.V., Nene, Y.L., Raju, T.N., and others. 1992. Multilocation evaluation of pigeonpea for broad-based resistance to sterility mosaic disease in India. Indian J. of Agric. Sci.
6. Amin, K.S., Reddy, M.V., Raju, T.N., Nene, Y.L., and others. 1992. Multilocation evaluation of pigeonpea for broad-based resistance to fusarium wilt in India. Indian J. of Agric. Sci.
7. Reddy, M.V., and Singh, K.B. 1992. Registration of five chickpea germplasm lines resistant to *Ascochyta* blight. Crop Science.
8. Porta Puglia, A., Bernier, C.C., Jethis, G.J., Kaiser, W.J., and Reddy, M.V. 1992. Screening techniques and sources of resistance to foliar diseases caused by fungi and bacteria in cool season food legumes. Paper presented at the 2nd Cool Season Food Legumes Conference, Cairo, April, 1992.
9. Singh, K.B., and Reddy, M.V. 1992. Sources of resistance to six races of *Ascochyta* blight in the world collection of chickpea. Crop Science.
10. Reddy, M.V., Singh, K.B., and Malhotra, R.S. 1992. Multilocation evaluation of chickpea germplasm and breeding lines for resistance to *Ascochyta* blight. Phytopath. Medit.
11. Singh, K.B., and Reddy, M.V. 1992. Resistance to *Ascochyta* blight in wild *Cicer* species. Theoretical and Applied Genetics.

CHIRADZULU DISTRICT

Jakofa	0.5	PP+M (75)	Brown loamy	1	-	++	5	0	-
Matandika	0.8	PP+M (80)	Red loamy	1	-	++	0	0	-
Neaka	0.4	PP+M+8 (50)	Red loamy	0	-	++	5	0	-
Njeromba	0.8	PP+SP+M (20)	Brown sandy	1	-	++	5	0	-
Kamela	0.8	PP+M (25)	Sandy loam	10	-	+	80	0	-
Miozi	0.4	PP +M (25)	Sandy loam	5	++	+	5	0	-
Chichoge	0.8	PP+M+8 (20)	Red sandy	40	++	-	5	5	-
Kaphikantama	0.4	PP+M (100)	Red sandy	5	+	-	5	0	-
Bani	0.4	PP+M (100)	Sandy loam	1	-	-	0	0	-
District Average				7.1			12.2	0.6	

MWANZA DISTRICT

Shire River	8.0	PP+C+M+GN (50)	Sandy loam	20	-	-	0	0	-
Maminjale	0.4	pp sole (100)	Sandy loam	0	-	+	0	0	-
District Average				10.0			0.0	0.0	
ADD Average				8.5			6.1	0.3	

MGABU ADD

CHIKWANA DISTRICT

Infanzawa	0.4	PP+S (80)	Sandy loam	0	+	-	0	40	-
Ngabu Research Station	Experimental plots	Sole and intercropped	Sandy loam	0	++	+	0	1	-
Infanzawa	0.2	PP+M (80)	Sandy loam	0	+	-	-	40	++
Infanzawa	0.4	PP+M+GN (50)	Sandy loam	0	-	-	5	0	-
Diwa	4.0	PP+M (100)	Sandy loam	0	+	-	0	0	+++
District Average				0.0			1.0	18.2	

LILONGWE ADD

LILONGWE DISTRICT

Chitedze Agricultural Research Station	2.0	Sole and intercrop	Brown sandy	0	+++	+++	80	0	-
Country Average				4.0			24.7	4.8	

PP = Pigeonpea, S = Sorghum, M = Maize, C = Cassava, T = Tomato, B = Beans, GN = Groundnut

+ = disease present and not much defoliation, ++ = up to 40% defoliation

+++ = up to 60% defoliation

Table 2. Final incidence of wilt, SM and PB in susceptible checks in different pigeonpea disease nurseries during 1991-92 at ICRISAT Center, Patancheru.

Field and disease (s)	Area (ha)	Susceptible checks	Percent disease ----- Average (range)	Frequency of susc. check
BIL 2A wilt	1.0	ICP 2376	100 (98-100)	1:2
BIL 2B wilt	1.5	ICP 2376	100 (100)	1:2
RL 8 PB	0.2	ICP 7119	100 (44-100)	1:8
		ICP 2376	100 (50-100)	1:8
RP 18 PB	1.0	ICP 7119	100	
		ICP 2376	100	
BIL 7B wilt SM	2.8	ICP 2376	100 (83-100)	1:2
		ICP 8863	100	1:8
BM 18C wilt + <i>Helicoverpa</i>	1.0	ICP 2376	100	1:2
RM 3C wilt + SM	<1.0	ICP 2376	100	1:2
		ICP 8863	100	1:8
RM 8E	<1.0	ICP 2376	100 (89-100)	1:2

Table 3. *Fusarium* population at sowing and pigeonpea wilt incidence at harvest in different wilt sick plots during 1991-92 at ICRISAT Center, Patancheru.

Field/Nursery	<i>Fusarium</i> population/ g. soil at sowing (range)	Percent wilt at maturity
BIL 2A (Wilt nursery)	1580 (1350-1700)	100
BIL 2B (Wilt nursery)	1810 (1650-1800)	100
BIL 7B (Wilt + SM Nursery)	2800 (2250-3400)	100
RM 3C (Wilt Nursery + SM nursery)	4000 (1750-2400)	100
RP 18 (Blight Nursery)	380 (100-600)	--
BM 16C (Wilt + <i>Helicoverpa</i> Nursery)	2270 (2000-2550)	90
RM 8E (Wilt)	3560 (2350-4500)	99

Table 4. Details of pigeonpea breeding materials screened against PB (RP18) at ICRISAT Center during 1991-92.

Project No.	Name of the Test	No. of entries
<u>Medium-duration</u>		
302-1	PB Yield Observation Nursery	202
302-1	F4 SPS (BDN 1 Group)	96
302-1	F5 SPS (BDN 1 Group)	108
302-1	F4 SPS (C 11 Group)	91
302-1	F5 SPS (C 11 Group)	43
302-1	F5 SPP's (White Seed)	66
302-1	F5 SPP's (Brown Seed)	86
302-2	PB Yield Observation Nursery	51
302-2	F5 White seeded progenies	21
302-2	F5 Brown seeded progenies	71
<u>Short-duration</u>		
301	Monitoring MLT entries (2 reps)	540
301	F7, F8 SPB's NDT	112
301	F7, F8 SPB's DT	48
301	F5 SPB's NDT	227
301	F5 SPB's DT	9
301	F4 SPB's DT & NDT	126
301	F3 SPP's DT & NDT	81
301	F3 SPB's DT & NDT	18
301	F2 bulks	21
304-2	F1's	16
301-1	F1's	4
301-1	F5's	33

Table 5. Details of medium- and long-duration pigeonpea breeding material evaluated against wilt and SM at ICRISAT Center during 1991-92 (BIL 7B).

Project No.	Name of the Test	No. of Entries
302-1	Monitoring of Station trial entries	160
302-	F5 SPS (White Seed)	43
302-	F6 SPP's (White Seed)	121
302-	F5 SPS (Brown Seed)	150
302-	F6 SPP's (Brown Seed)	91
302-	F2 Populations	5
302-2	F6 W & SPR Progenies	92
302-2	F4 SPD Bulks	3
302-2	F2 Populations	7
302-2	W & SM Advanced lines multiplication	29
302-2	Monitoring of WSMALT entries	16
302-2	Japan Tur, ICP 8094	3

Table 6. Details of short-duration pigeonpea breeding materials evaluated against wilt and SM at ICRISAT Center during 1991-92 (BIL 7B).

Project No.	Name of the Test	No. of Entries
301	Monitoring MLT entries	540
301	F7, F8 SPB's DT	48
301	F7, F8 SPB's NDT	112
301	F5 SPB's DT	9
301	F5 SPB's NDT	227
301	F5 SPB's DT & NDT	109
301	TCF4 SPP's DT	126
301	F3, TCF3 SPP's	264
301	F3, TCF3 bulks	21
301	BCF2, F2 bulks	9
301	SMR ICPL's	17
303	ms ICPL 288	2
303-1	Short-duration dwarf trial ents.	89
302-2	ms Dwarf line	1
303	Long-duration hybrids	12

Table 7. Details of pigeonpea breeding materials evaluated against wilt at ICRISAT Center, (BIL 2B) during 1991-92.

Project No.	Test No.	Name of the test	No. of entries	Experimental design	Reps.
<u>Yield trials</u>					
302-1	91P83	WRALT (Wilt Resistant Advanced Lines Yield Test)	16	RBD	3
302-1	91P84	WSWRALT 1 (White seeded Wilt Resis. Adv. Lines Yield Test-1)	16	RBD	3
302-1	91P85	WSWRALT 2 (White Seeded Wilt Resis. Adv. Lines Yield Test-2)	16	RBD	3
<u>Breeding material</u>					
302-2	-	F6 WR lines Yield Observation Nursery	76	-	-
302-2	-	ALT 1 & 2 Entries multiplication	13	-	-
302-1	-	ICP 8863 M4 Progenies	16	-	-
302-1	-	Yield Observation Nursery (WR)	181	-	-
302-1	-	ICPL 270 Multiplication	1	-	-
302-2	-	Medium duration dwarf trial entries	142	-	-
302-3	-	Medium duration WR dwarf lines	2	-	-

Table 8. List of pigeonpea breeding materials evaluated for SM resistance in pots at ICRISAT Center, 1991-92.

Test	No. of entries
1. Dwarf lines	58
2. Ms. 87091 BCS F1 progenies	21
3. Long-duration F6 progenies	18
4. Long-duration f5 progenies	293
5. SMALT-1	14
6. SMALT-2	19
7. SMALT-3	20
8. SMALT-4	19

SMALT - Sterility mosaic advanced lines test

Table 9. Preliminary evaluation of pigeonpea germplasm accessions for resistance to wilt and sterility mosaic, ICRISAT Center, 1991-92 (Single rep., one 4-m row in field).

S.No.	Accession No.	Percent disease	
		Wilt (BIL 2B)	SM (pot screening)
1	ICP 14614	NT	93.7
2	ICP 14615	100	33.3
3	ICP 14616	40	100
4	ICP 14617	50	100
5	ICP 14618	100	100
6	ICP 14619	6.6	26.9
7	ICP 14620	63.6	0
8	ICP 14621	54.5	10.7
9	ICP 14622	2.5	100
10	ICP 14623	2.2	100
11	ICP 14624	61.9	100
12	ICP 14625	57.1	100
13	ICP 14626	53.8	0
14	ICP 14627	94.7	4.5
15	ICP 14628	60	10.3
16	ICP 14629	74.1	6.0
17	ICP 14630	24.4	100
18	ICP 14631	41.1	50
19	ICP 14632	44.8	0
20	ICP 14633	100	31.0
21	ICP 14634	43.7	0
22	ICP 14635	100	8.6
23	ICP 14636	84.3	5.5
24	ICP 14637	0.0	100
25	ICP 14638	11.1	93.3
26	ICP 14639	15.3	89.2
27	ICP 14640	40	100
28	ICP 14641	44.7	100
29	ICP 14642	30.4	10
30	ICP 14643	5.8	92.5
31	ICP 14644	13.1	8.5
32	ICP 14645	7.1	90
33	ICP 14647	94.7	3.4
34	ICP 14649	100	82.6
35	ICP 14650	11.7	100
36	ICP 14651	28.5	100
37	ICP 14652	94.4	0
38	ICP 14653	86.6	3.2
39	ICP 14654	10.7	38.7
40	ICP 14655	24	100
41	ICP 14656	21.7	86.3
42	ICP 14657	2.4	100
43	ICP 14658	15.7	51

S.No.	Accession No.	Percent disease	
		Wilt (BIL 2B)	SM (pot screening)
44	ICP 14659	0.0	45
45	ICP 14660	9.7	100
46	ICP 14661	8	17.2
47	ICP 14662	20	16.1
48	ICP 14663	100	100
49	ICP 14666	100	34.4
50	ICP 14667	88.8	0
51	ICP 14668	70	86.3
52	ICP 14672	22.7	71.4
53	ICP 14673	31.2	59.4
54	ICP 14674	33.3	46.1
55	ICP 14675	21.7	25
56	ICP 14676	33.3	22.7
57	ICP 14677	40	70.5
58	ICP 14678	50	16.6
59	ICP 14679	16.6	13.7
60	ICP 14680	86.2	8.8
61	ICP 14681	66.6	0
62	ICP 14682	56.2	60
63	ICP 14683	0	50
64	ICP 14684	70.5	92.3
65	ICP 14685	31.2	17.6
66	ICP 14686	17.1	100
67	ICP 14687	25	0
68	ICP 14688	33.3	20
69	ICP 14689	15.7	0
70	ICP 14690	45	62.5
71	ICP 14691	84.2	50
72	ICP 14692	77.1	0
73	ICP 14693	65.3	83.3
74	ICP 14694	85.3	36.3
75	ICP 14695	16.6	50
76	ICP 14696	77.7	50
77	ICP 14697	55.5	50
78	ICP 14698	50	0
79	ICP 14699	38.7	0
80	ICP 14700	50	33.3
81	ICP 14701	23.8	37.5
82	ICP 14702	50	100
83	ICP 14703	84	36.3
84	ICP 14706	88.4	28.5
85	ICP 14708	92.5	31.5
86	ICP 14709	89.2	100
87	ICP 14710	0	100
88	ICP 14712	25	6.2
89	ICP 14714	22.2	0
90	ICP 14715	37.5	100

S.No.	Accession No.	Percent disease	
		Wilt (BIL 2B)	SM (pot screening)
91	ICP 14716	21.4	100
92	ICP 14717	25	100
93	ICP 14720	88.2	71.4
94	ICP 14722	100	0
95	ICP 14723	22.2	100
96	ICP 14724	19.5	100
97	ICP 14725	45.4	92.5
98	ICP 14726	2.9	100
99	ICP 14727	0	50
100	xxxxx	71.8	100
101	ICP 14730	0	14.2
102	ICP 14631	33.3	86.6
103	ICP 14735	50	40
104	ICP 14736	25	10
105	ICP 14737	75	91.6
106	ICP 14738	0	57.1
107	ICP 14741	85.7	50
108	ICP 14743	94.1	85
109	ICP 14745	88.8	85.7
110	ICP 14746	70.3	29.2
111	ICP 14747	7.1	5.6
112	ICP 14748	10.3	4.7
113	ICP 14749	25	0
114	ICP 14750	10	5.8
115	ICP 14751	17.3	5.2
116	ICP 14752	22.2	11.7
117	ICP 14753	100	12.5
118	ICP 14754	0	0
119	ICP 14755	34.7	6.2
120	ICP 14756	4.5	5.8
121	ICP 14757	13.3	4
122	ICP 14758	15.3	9
123	ICP 14759	NT	5.5
124	ICP 14760	3.5	100
125	ICP 14761	18.1	33.3
126	ICP 14762	2.6	100
127	ICP 14763	5.5	6.8
128	ICP 14764	40	6.6
129	ICP 14765	83.3	0
130	ICP 14766	NT	0
131	ICP 14767	NT	0
132	ICP 14768	100	0
133	ICP 2376	100	-
134	ICP 8863	-	100

NT - Not tested

Table 10. Advanced screening of pigeonpea germplasm accessions for resistance to wilt and SM, ICRISAT Center, 1991-92 (BIL 78, 2 reps, RBD, one 4-m row/rep).

S. No.	Germplasm accession	Percent wilt			Percent SM		
		R1	R2	AV	R1	R2	AV
1	ICP 12805	16.1	52.6	34.3	2	3.9	2.8
2	ICP 12812	98.5	98.8	98.6	9.1	19.1	14.1
3	ICP 13508	78.9	98.3	88.6	32	15.5	23.6
4	ICP 13908	83.3	91.4	87.4	18.1	7.4	12.7
5	ICP 13914	95.2	93.1	94.2	15	22.4	18.7
6	ICP 13915	88.9	98.1	93.8	5	18.6	11.8
7	ICP 13932	78.9	88.6	85.0	27.2	23.8	25.5
8	ICP 13952	1	91.1	46.1	8	9.6	8.8
9	ICP 13957	92.5	84.5	88.5	18	10.3	9
10	ICP 13994	95.9	98.6	97.1	5.4	5.5	5.4
11	ICP 13995	100	96.6	98.3	0	0	0
12	ICP 14017	26.2	80.6	53.4	0	2.8	1.4
13	ICP 14018	81	26.1	53.6	0	0	0
14	ICP 14269	15.8	14.1	15	30	32.1	30.9
15	ICP 14271	14	3.2	8.6	9	8.6	8.7
16	ICP 14276	21.7	20.2	21	0	0.9	0.5
17	ICP 14280	4.6	12.2	8.4	5.2	9.5	7.3
18	ICP 14283	6.8	13.3	10	14	7.6	10.6
19	ICP 14284	6	9.2	7.6	10	0	0
20	ICP 14289	79.7	3.1	41.4	0	0	0
21	ICP 14290	8.2	1.5	4.8	4.1	3.0	3.6
22	ICP 14292	90.6	64.8	77.7	10	8.8	9.4
23	ICP 14399	91.9	90.8	91.3	15	10.8	12.8
24	ICP 14410	8.1	18.4	13.2	0	0	0
25	ICP 14415	96	87.6	91.8	45	11.4	28.2
26	ICP 14438	83.4	28	55.7	6	5.6	5.6
27	ICP 14439	90.1	30.8	60.5	4	2.3	3.1
28	ICP 14463	97.1	83.7	90.4	2.2	0	1.1
29	ICP 14464	89.8	91	90.4	85	89.6	87.2
30	ICP 14469	5.6	15.2	10.4	0	0	0
31	ICP 14490	100	97.1	98.6	0	5.7	2.9
32	ICP 14492	100	99.2	99.6	2.2	0.8	1.5
33	ICP 14493	100	100	100.0	0	0	0
34	ICP 14494	83.8	73.8	78.8	5.4	8.3	6.8
35	ICP 14500	95.3	98.1	96.7	11	14.3	12.6
36	ICP 14503	7.8	1.9	4.9	2.2	7.1	4.6
37	ICP 14504	82.5	79.7	81.9	14	11.5	12.6
38	ICP 14506	98.4	97.9	98.1	2.2	1.1	1.6
39	ICP 14507	89.3	86.4	87.9	5	6.2	5.6
40	ICP 14508	97	100	98.5	2	0	0.8
41	ICP 14513	70.9	91.9	81.4	11	14.1	12.6
42	ICP 14514	11.3	13	12.1	6	14	9.9
43	ICP 14523	98.8	98.9	98.8	10	11.8	10.8

Germplasm accession	Percent wilt			Percent SM		
	R1	R2	AV	R1	R2	AV
44 ICP 14553	100	98.7	99.4	2	3.0	2.5
45 ICP 14591	94.4	91	92.7	0	5	2.5
46 ICP 14592	98.6	97.5	98.1	3	8.6	5.7
47 ICP 2376 (W. Check)	100	97.4	97.4	0	0	0
48 ICP 8863 (SM Check)	9	0	4.5	100	100	100
SE ±			12.74			3.427
CV (%)			27.5			43.4

Table 11. Effect of inter-row spacing on phytophthora blight incidence in pigeonpea (ICPL 87), RP 18, ICRISAT Center, 1991-92 (RBD, 3 reps, plot size 3.6 x 4 m of 3 to 12, 4 m rows)

Inter-row spacing	Percent blight			
	R1	R2	R3	Average
30 x 10 cm	100	100	98.0	99.3
60 x 10 cm	97.8	97.5	98.2	97.8
90 x 10 cm	97.3	97.1	98.8	97.7
120 x 10 cm	100.0	100.0	88.0	96.0
SE \pm				2.21
CV (%)				3.9

Table 12. Effect of weeding on phytophthora blight incidence in pigeonpea (ICPL 87), RP 18, ICRISAT Center, 1991-92 (RBD, 3 reps, plot size 3.6 x 4 m, spacing 30 x 10 cm).

Treatment	Percent blight			
	R1	R2	R3	Average
Complete hand weeding	100	100	99.1	99.7
Pre-emergence herbicide + Hand weeding	97.7	99.2	99.4	98.8
Pre-emergence herbicide alone	100	98.8	99.3	99.4
No weeding	100	100	100	100
SE \pm				0.409
CV (%)				0.7

Table 13. Wilt and SM incidence (%) and yield in the 2nd year in a set of pigeonpea lines in a wilt and SM nursery at ICRISAT Center, 1991-92, (BIL 7B) (4 reps, RCB, plot size 4.8 m²).

Genotype	% disease in the 2nd year		Yield, kg ha ⁻¹
	Wilt	SM	
ICP 7198	54.6	4.2	1115
ICP 8094	14.5	2.66	3151
ICP 8859	46.1	37.83	792
ICP 8860	24.0	1.58	2031
ICP 8862	68.5	0.63	677
ICP 8867	0.0	0.0	505
ICP 9174	7.5	3.72	4854
ICP 11289	29.8	2.6	4078
ICP 11290	56.0	19.66	2557
ICP 11291	24.0	0.64	2339
ICP 11298	30.1	1.24	4078
PR 5149 Sel.	12.6	0.0	4953
PI 397430 Sel	31.0	1.04	3130
ICPL 227	17.7	1.15	4135
LRG 30	100.0	0.0	0.0
ICP 8863	15.4	100.0	1474
SE ±	5.88	2.57	713.5
CV%	35.3	46.8	55.1

Table 14. Reaction of ACT lines to wilt, SM and PB at ICRISAT Center during 1991/92.

Trial	Entry	Percent disease		
		Wilt	SM	PB
EXACT	AF 98	86	95	99
	MUA 2	70	93	97
	TAT 10	100	100	100
	TAT 14	63	100	100
	UPAS 120	16	100	93
EACT	AT 179	93	91	100
	H 82-1	87	100	100
	H 83-13	77	96	100
	H 86-1	81	92	100
	H 87-7	16	95	100
	H 86-14	86	100	97
	H 87-4	68	94	100
	H 87-12	14	95	100
	ICPH 8	9	82	100
	ICPL 87	17	89	99
	ICPL 151	92	91	89
	ICPL 84031	70	88	96
	ICPL 88026	68	91	100
	P 606	73	54	100
	MUA 1	77	100	100
	MTH 10	24	100	100
	MTH 22	40	100	98
MTH 23	92	84	96	
ACT 1	ICPL 83024	17	0	100
	Pant 8505	95	30	100
	MTH 12	82	94	100
	MTH 20	85	93	98
ACT 2	C 11	76	100	98
	ICPL 227	7	3	100
	ICPL 88046	6	9	100
	ICPL 88047	3	7	91
	ICPL 87119	2	2	97
	MTH 21	16	100	93
	SPMA 3	74	100	100
	SPMA 6	74	98	100
SPMA 8	11	100	95	
ACT 3	Bahar	90	2	100
	DA 35	8	0	100
	ICPL 371	73		100
	KA 32-1	92		94

		Percent disease		
Trial	Entry	Wilt	SM	P:
	NDA 88-2	75	4	98
	Pusa 9	27	97	84
	Pusa 19	73	0	100
	Pusa 5-A	9	99	100
	SPLA 1	17	90	100
	SPLA 11	4	93	89
IET (early)	AL 201	84	99	96
	BWR 22	13	19	98
	ICPL 86015	79	18	100
	ICPL 87104	66	0	94
	IPH 732	79	90	97
	TV 1	52	89	100
IET (Medium)	AK 8811	74	93	95
	BDN 543	69	0	100
	BSMR 203	7	9	85
	GAUT 85-18	14	90	100
	GAUT 86-10	63	29	99
	GAUT 86-31	71	32	98
	GAUT 87-6	87	100	88
	GAUT 87-8	12	100	85
	GAUP 9001	22	100	100
	GAUP 9002	16	99	100
	GAUP 9003	86	90	88
	GAUP 9004	11	25	100
	GAUP 9005	87	79	93
	ICPL 87051	95	0	93
	ICPL 89044	3	11	95
	SPMA 1	1	100	98
Pre-Rabi AVT	AGS 522	19	100	100
	DA 11	9	0	100
	DA 32	93	3	100
	DA 33	95	1	93
	DA 34	98	0	97
	GAUT 82-58	78	97	87
	MA 91-2	23	95	100
	MTH 9	14	100	96
	MTH 12	5	100	92
	PUSA 4	72	93	96
	PUSA 5	63	98	98
	PUSA 14	86	1	100
	PUSA 20	71	0	83
	T-15-15	89	100	100
Susc. checks	ICP 2376 (W)	100	-	-
	ICP 8863 (SM)	-	100	-
	ICP 7119 (PB)	-	-	100

Table 15. Pigeonpea wilt incidence at different intervals in a set of cultivars in a vertisol wilt sick-plot at ICRISAT Center, 1991-92 (4 reps, RBD, 5, 4m rows/plot).

Cultivar	Percent wilt incidence				
	16 July	14 Aug	10 Sept	10 Oct	12 Nov
ICP 2376	3.7	26.8	80.2	95.5	99.4
ICPL 87	0.9	18.7	44.7	74.1	77.3
ICP 8863	0.4	3.7	13.1	15.3	16.1
C 11	0.5	7.0	22.6	67.1	70.1
SE \pm	0.457	3.09	6.86	7.06	7.37
CV (%)	65.4	44.0	34.2	22.4	22.4

Table 16. Pigeonpea wilt incidence at different intervals in a set of cultivars in an Alfisol wilt sick plot at ICRISAT Center, 1991-92 (4 reps, RBD, 5, 4m rows per plot).

Cultivar	Percent wilt incidence				
	16 July	14 Aug	10 Sept	10 Oct	12 Nov
ICP 2376	2.32	8.34	58.6	93.5	98.5
ICPL 87	0.43	3.65	10.6	70.7	73.2
ICP 8863	0	0	0.8	2.3	2.3
C 11	0.16	1.38	10.5	41	42.5
SE \pm	0.486	0.761	6.3	6.21	6.43
CV (%)	133.8	45.5	62.7	24.0	24.0

Table 17. Influence of pigeonpea genotypes on *F. udum* population in a Vertisol wilt-sick plot at ICRISAT Center, 1991-92 (r reps, RBD, 5, 4m rows per plot).

Cultivar	<i>F. udum</i> proipagules g ⁻¹ soil				
	16 July	14 Aug	10 Sept	10 Oct	12 Nov
ICP 8863	2598	3173	3573	3105	3573
C 11	2688	3330	2233	2935	3983
ICPL 87	2388	2973	3055	2978	5035
ICP 2376	2805	2483	3333	3073	4100
SE ±	120.3	349.2	252.5	135.3	265.9
CV (%)	9.2	23.4	16.6	9.0	12.7

Table 18. Influence of pigeonpea genotypes on *F. udum* population in an Alfisol wilt-sick plot at ICRISAT Center, 1991-92 (4 reps, RBD, 5, 4 m rows per plot).

Cultivar	<i>F. udum</i> propagules g ⁻¹ soil				
	16 July	14 Aug	10 Sept	10 Oct	12 Nov
ICP 8863	2068	3080	2243	2960	2973
C 11	2148	2963	3153	3170	3805
ICPL 87	1740	3375	1890	2508	3233
ICP 2376	2550	4003	2443	1933	4190
SE ±	183.8	374.4	275.1	264.5	404.0
CV (%)	17.3	22.3	22.6	20.0	22.8

Table 19. Colonisation of *F. udum* in field grown (Vertisol sick-plot) pigeonpea genotypes with different levels of susceptibility to wilt, BIL 2A, ICRISAT Center, 1991-92.

Culti- var	Plant Part	Percent colonization with <i>F. udum</i> ¹				
		16th July	14th Aug	10th Sept	10th Oct	12th Nov
ICP 2376	Root	65	90	45	85	55
	Collar	80	90	45	90	63
	Middle	-	15	30	75	40
	Tip	20	15	5	75	30
ICP 8863	Root	35	65	40	60	41
	Collar	60	65	25	90	59
	Middle	-	15	20	30	36
	Tip	25	5	5	35	34
ICPL 87	Root	70	85	65	80	57
	Collar	75	70	45	70	67
	Middle	-	35	45	75	36
	Tip	50	5	5	75	39
C 11	Root	70	50	45	95	67
	Collar	85	85	10	85	64
	Middle	-	25	30	85	49
	Tip	20	5	0	55	19
SE ±		11.97	8.66	11.76	10.69	10.78
CV (%)		58.5	38.5	81.8	29.5	41.4

4 reps, RBD, 5, 4 m rows per plot, 5 plants per plot)

Table 20. Colonisation of *F. udum* in field grown (Alfisol) pigeonpea genotypes with different levels of susceptibility to wilt, RM 8E, ICRISAT Center, 1991-92.

Culti- var	Plant Part	Percent colonization with <i>F. udum</i> ¹				
		16th July	14th Aug	10th Sept	10th Oct	12th Nov
ICP 2376	Root	60	70	80	95	-
	Collar	80	70	80	90	-
	Middle	-	35	25	90	-
	Tip	35	35	0	90	-
ICP 8863	Root	45.6	60	40	80	85
	Collar	45.0	70	60	95	60
	Middle	-	40	0	45	40
	Tip	20.0	40	0	35	10
ICPL 87	Root	50	50	95	95	90
	Collar	70	70	50	95	70
	Middle	-	15	15	75	35
	Tip	30	10	10	85	50
C-11	Root	40	40	30	80	80
	Collar	80	70	60	80	70
	Middle	-	10	5	50	35
	Tip	20	10	10	50	30
SE ±		9.88	10.48	10.91	7.12	10.27
CV (%)		34.9	48.3	62.4	18.5	31.7

¹ - 4 reps, RBD, 5, 4 m rows per plot, 5 plants per plot.

Table 21. Reaction of pigeonpea germplasm accessions to sterility mosaic in pot screening at ICRISAT Center, Patancheru, 1991-92.

S.No.	ICP No.	Total plants	SM plants	% SM
1	14614	16	15	93.7
2	14615	9	3	33.3
3	14616	29	29	100.0
4	14617	24	24	100.0
5	14618	25	25	100.0
6	14619	26	7	26.9
7	14620	8	0	0.0
8	14621	28	3	10.7
9	14622	37	37	100.0
10	14623	25	25	100.0
11	14624	25	25	100.0
12	14625	12	12	100.0
13	14626	27	0	0.0
14	14627	22	1	4.5
15	14628	29	3	10.3
16	14629	33	2	6.0
17	14630	30	30	100.0
18	14631	48	24	50.0
19	14632	40	0	0.0
20	14633	29	9	31.0
21	14634	32	0	0.0
22	14635	23	2	8.6
23	14636	36	2	5.5
24	14637	24	24	100.0
25	14638	30	28	93.3
26	14639	28	25	89.2
27	14640	30	30	100.0
28	14641	38	38	100.0
29	14642	40	4	10.0
30	14643	40	37	92.5
31	14644	47	4	8.5
32	14645	40	36	90.0
33	14647	29	1	3.4
34	14649	23	19	82.6
35	14650	44	44	100.0
36	14651	38	38	100.0
37	14652	34	0	0.0
38	14653	31	1	3.2
39	14654	31	12	38.7
40	14655	42	42	100.0
41	14656	44	38	86.3
42	14657	34	34	100.0
43	14658	39	20	51.0
44	14659	40	18	45.0

S.No.	ICP No.	Total plants	SM plants	% SM
45	14660	37	37	100.0
46	14661	29	5	17.2
47	14662	31	5	16.1
48	14663	25	25	100.0
49	14666	29	10	34.4
50	14667	24	0	0.0
51	14668	22	19	86.3
52	14672	49	35	71.4
53	14673	37	22	59.4
54	14674	26	12	46.1
55	14675	40	10	25.0
56	14676	22	5	22.7
57	14677	17	12	70.5
58	14678	36	6	16.6
59	14679	29	4	13.7
60	14680	34	3	8.8
61	14681	2	0	0.0
62	14682	5	3	60.0
63	14683	6	3	50.0
64	14684	13	12	92.3
65	14685	17	3	17.6
66	14686	22	22	100.0
67	14687	4	0	0.0
68	14688	5	1	20.0
69	14689	2	0	0.0
70	14690	8	5	62.5
71	14691	2	1	50.0
72	14692	4	0	0.0
73	14693	6	5	83.3
74	14694	11	4	36.3
75	14695	14	7	50.0
76	14696	6	3	50.0
77	14697	2	1	50.0
78	14698	1	0	0.0
79	14699	4	0	0.0
80	14700	6	2	33.3
81	14701	16	6	37.5
82	14747	36	2	5.5
83	14748	42	2	4.7
84	14749	38	0	0.0
85	14750	17	1	5.8
86	14751	19	1	5.2
87	14752	17	2	11.7
88	14753	16	2	12.5
89	14754	26	0	0.0
90	14755	32	2	6.2
91	14756	34	2	5.8

S.No.	ICP No.	Total plants	SM plants	% SM
92	14757	25	1	4.0
93	14758	11	1	9.0
94	14759	18	1	5.5
95	14760	23	23	100.0
96	14761	21	7	33.3
97	14762	25	25	100.0
98	14763	29	2	6.8
99	14764	15	1	6.6
100	14765	45	11	25.1
101	14766	21	0	0.0
102	14767	19	0	0.0
103	14768	5	0	0.0
104	8863	10	10	100.0

Table 22. Reaction of pigeonpea lines received from Kanpur to SM in pots at ICRISAT Center, 1991-92.

Sl. No.	Pedigree	Total plants	Infected plants	% SM
1	KAL-32-1	5	0	0.0
2	KSMR-P-2	31	0	0.0
3	KSMR-P-5	32	1	3.1
4	KSMR-P-6	52	2	3.8
5	KSMR-P-17	48	0	0.0
6	KSMR-P-18	37	3	8.1
7	T.7	63	57	90.4
8	8863 (Susc. check)	33	33	100.0
9	8867 (Res. check)	16	0	0.0
10	2376 (Ring spot check)	35	0	0.0

Table 23. Reaction of ICP 8379 waterlogging tolerant pigeonpea line to wilt, SM and PB at ICRISAT Center, Patancheru, 1991-92.

Disease	Total plants	Diseased plants	Percent disease (Susc. check)
Wilt	24	15	83.3 (100.0)
SM	24	20	83.3 (89.1)
PB	41	17	41.0 (100.0 ^a)

* Susceptible check not shown with ICP 8379. It was sown earlier than check. Blight pressure in ICP 8379 was lower than in check.
Needs retesting.

Table 24. Percent wilt incidence in IIUTPWR-1991-92 entries at different locations in India.

Entry	ICRISAT	Ranchi	Gulbarga	Kanpur	Vadodara	Dholi	Sehore	Gwalior	Rahuri
ICP 8859	13.5	17.4	6.2	0.0	13.1	45.3	2.9	0	0
ICP 8864	29.7	6.3	5.9	41.0	7.6	71.5	8.4	26.89	33.8
ICP 8861	6.7	4.1	13.9	0.0	12.7	45.8	15.0	9.0	0
ICP 6997	79.9	7.7	25.0	33.3	36.7	82.6	35.4	64.66	36.6
ICP 8858	5.5	12.0	0.0	14.3	20.5	40.1	16.7	43.31	4.0
ICP 8862	25.7	5.8	30.6	13.3	17.5	63.4	47.2	31.51	31.8
ICPL87119	3.2	16.4	3.3	14.5	16.8	13.7	44.0	9.19	4.3
ICP 8863	5.3	4.0	0.0	0.0	20.4	2.1	10.4	1.06	8.2
ICPL84031	66.0	18.1	54.8	64.7	71.0	75.1	28.7	76.56	49.3
GPS 3	0.9	3.0	0.0	1.2	25.8	2.0	7.7	0.96	17.8
GPS 33	2.7	14.5	0.0	3.7	26.7	5.2	1.1	2.30	7.5
SHARANI-2	6.8	12.4	1.4	46.3	21.2	11.8	1.4	12.04	1.6
SUJATA-1	4.9	7.0	1.5	10.7	20.5	11.3	3.9	0.71	0
GPS 26-C	5.3	14.7	0.0	47.3	42.6	6.5	2.5	3.96	7.6
GPS-30	0	12.9	1.4	2.9	47.4	4.4	6.0	0.78	8.5
GPS-36	2.6	4.1	5.0	0.0	35.1	7.7	0.0	0.76	16.4
GPS-7	22.7	4.8	1.9	2.9	50.0	17.2	6.4	9.39	22.2
GPS-52	6.0	6.7	1.6	0.0	55.4	6.9	0.0	0.85	4.1
GODU	8.1	25.7	6.8	16.7	19.2	4.2	32.4	1.04	1.8
ICP 2376	98.8	36.7	92.4	58.6	43.3	96.2	27.6	98.57	100.0
SE \pm	5.65	2.504	5.15	12.04	8.06	12.85	7.26	3.734	5.24
CV (%)	40.5	30.3	57.8	91.7	37.8	59.3	69.0	26.8	41.7

Table 25. Percent SM incidence IIUTPSR-1991-92 entries at different locations in India.

Entry	ICRISAT	Banga-lore	Badnapur	Dholi	Kanpur	Pudu-kkottai	Rahuri Varnasi
ICP 2376	0	98.6	0.3	100	27.7	57.8	4.17
ICP 6997	3.6	100	0	91.7	0	0	0
ICP 7035	0	34.8	0	63.2	0	0	23.8
ICP 7234	0	87.2	0	68.2	0	52.8	6.3
ICP 7867	0	100	0	49.4	0	0	0
ICP 7898	0	100	0	87	10.0	58.3	7.9
ICP 8094	0	100	0	100	0	70.8	34.7
ICP 8862	0	63.4	0	4.1	1	0	0
ICP 10976	0	96.4	0	23.9	0	0	0
ICPL 84031	91.3	95.0	0	91.5	1	0	22.9
ICPL 86005	0	94.1	0	100	1.9	0	100.0
ICPL 87101	0	79.0	0	87.5	0	0	61.9
ICPL 87108	4.3	92.9	0	96.8	0	0	32.2
ICPL 88023	0	96.2	0	100	1.5	0	28.1
ICPL 88025	0	93.0	0	82.1	0	0	0
ICP 8863	100	100	70.8	100	39.5	92.9	10.0
SE ±	1.417	3.51	1.076	11.08	5.21	4.26	1.042
CV (%)	16.1	5.5	34.2	20.1	146.5	29.0	11.5
							69.0

1. Gulbarga: Due to poor rain Experiment failed, data not recorded.

Table 26. Percent blight incidence in IIUTPPBR 1991-92 entries at different locations in India

Entry	ICRISAT	IARI Delhi	Sehore
ICP 8892	60.7	35.0	26.2
ICP 12749	56.1	55.0	28.6
ICP 8921	46.7	43.8	23.5
ICP 8564	36.8	56.1	47.2
ICP 8610	32.9	25.0	19.9
ICP 9046	43.9	26.7	21.3
KPBR 80-2-1	38.3	0.0	10.7
ICP 9252	45.1	47.8	21.2
ICPL 84023	89.5	31.7	20.7
ICP 2376 Check	100.0	90.0	69.0
ICP 7119 Check	100.0	100.0	70.1
SE \pm	11.49	11.69	9.86
CV (%)	27.5	35.6	42.8

Table 27. Percent wilt, SM, and PB incidence in IJUNR-1991-92 entries at different locations in India.

Entry	IARI																								
	Badnapur			Delhi			Patancheru			Sahore			Lanour			Pudukkottai			Raburi			Vernasi			
	Wilt	SM	PB	Wilt	SM	PB	Wilt	SM	PB	Wilt	SM	PB	Wilt	SM	PB	Wilt	SM	PB	Wilt	SM	PB	Wilt	SM	PB	
ICP 4789	12.5	0	25	4.4	4.22	67.4	36	3.5	6	0	14	0	13.9	0	0	0	0	0	0	0	0	0	0	0	0
ICP 6831	0	0	45	3.3	21.77	76.4	74.5	0	16.1	25	19.5	0	65.4	0	0	0	0	0	0	0	0	0	0	0	0
ICP 7186	7	0	66.75	9.5	3.1	34.9	49	0	11.5	0	15	0	28.2	0	0	0	0	0	0	0	0	0	0	0	0
ICP 7200	0	3	11.25	2.2	17.84	11.1	11.5	0	4.3	18.4	22.6	0	27.1	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8037	12.5	0	55	6.4	63.63	24.9	11	1.5	2.2	17.1	21.8	0	68.4	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8094	0	4	10	3.4	4.11	22.8	30	2	0.0	0	15.6	0	13.0	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8103	26.5	0	0	30.3	8.64	24	21	2	1.2	19	13.1	0	43.3	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8410	44.5	50	56.25	59.4	83.78	23.9	19	0	45.4	9.1	47.3	0	82.4	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8692	56.5	18	50	23.7	18.32	38.5	27.5	6.5	8	34.8	17.5	0	32.0	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8860	2.5	0	45	0	0.96	37.6	68.5	4	4.8	12.9	3.3	0	41.8	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8861	11.5	0	85	3.6	2.68	75.9	57.5	5	2.2	24.8	23.5	0	21.2	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8862	8.5	0	84.0	9.5	1.27	97.5	96.5	0	1.3	0	0	0	7.2	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8867	0	0	100	2.6	0	94.9	96.5	0	0.0	0	7.1	0	7.7	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8869	4.5	0	100	4.5	0.59	60.2	61.5	0	0.0	0	8.8	0	6.5	0	0	0	0	0	0	0	0	0	0	0	0
ICP 9020	5	0	61.25	3.5	9.21	19.9	14.5	0	2.8	21.9	25.4	0	25	0	0	0	0	0	0	0	0	0	0	0	0
ICP 9174	4.5	0	52.75	1.8	6.99	19.4	21.5	2	4.4	52.8	15.6	0	1.72	0	0	0	0	0	0	0	0	0	0	0	0
ICP 9199	69	0	25	49.4	34.82	20.6	28.5	7	23.3	71.5	10.7	0	63.2	0	0	0	0	0	0	0	0	0	0	0	0
ICP 9540	27	15.50	5	17.3	57.25	33.5	55.5	0	8	33.6	9.1	0	25.4	0	0	0	0	0	0	0	0	0	0	0	0
ICP 9739	46	8	0	10	58.17	14.5	17.5	1.5	8	40.8	7.2	0	58.2	0	0	0	0	0	0	0	0	0	0	0	0
ICP 10958	0	3	5	3.4	3.96	43.4	36.0	2	8	11.5	14.6	0	58.2	0	0	0	0	0	0	0	0	0	0	0	0
ICP 11298	21	0	45	10.1	2.64	71.9	81	0	8	20.2	8.6	0	7.3	0	0	0	0	0	0	0	0	0	0	0	0
PT 397430 Sa1	12.5	0	4.7	6.52	24.9	18	0	8	34.7	32.9	0	6.4	0	0	0	0	0	0	0	0	0	0	0	0	0
ICPL 227	17	0	5	4.5	9.55	41.1	2.5	0	8	55.0	45.0	0	16.2	0	0	0	0	0	0	0	0	0	0	0	0
ICPL 83024	53	0	15	5.7	9.29	15.9	47.5	5	8	7.1	0	8.7	3.4	0	0	0	0	0	0	0	0	0	0	0	0
ICPL 87051	11	0	100	14.8	0.94	95	90.0	25.0	8	24.5	5	0	9.5	0	0	0	0	0	0	0	0	0	0	0	0
ICPL 87104	0	0	100	11.2	1.79	79.4	96	0	8	17.8	7.1	0	33.1	0	0	0	0	0	0	0	0	0	0	0	0
ICPL 87119	19.5	20.50	100	15.1	4.62	96.7	92.5	0	8	58.8	7.7	0	51.8	0	0	0	0	0	0	0	0	0	0	0	0
ICPL 87128	45	0	100	13.4	25.43	67.4	57	0	10	12.4	33.1	0	33.1	0	0	0	0	0	0	0	0	0	0	0	0
ICPL 88046	37.5	0	45	6.5	12.7	10.3	35.5	3	38	5	9.43	6.3	13.3	0	0	0	0	0	0	0	0	0	0	0	0
ICPL 88047	5.5	0	10	11.5	15.15	25.8	41	3.5	8	52.8	21.1	0	35.0	0	0	0	0	0	0	0	0	0	0	0	0
ICPL 88049	0	0	95	21	10.49	25.9	33	4.5	8	44.2	11.7	0	28.3	0	0	0	0	0	0	0	0	0	0	0	0
ICPL 89044	5	0	0	9.9	22.66	42.5	51	0	8	53.2	12.9	0	81.0	0	0	0	0	0	0	0	0	0	0	0	0
ICPL KPBR-80-2-2	96.5	0	89.60	100	0	61.8	76.5	11.5	8	100	6	0	10.5	0	0	0	0	0	0	0	0	0	0	0	0
ICP 2376	16	69.50	90.33	7.1	100	-	25	0	8	100	0	0	82.6	0	0	0	0	0	0	0	0	0	0	0	0
ICP 8883	1	0	100	-	-	76	88.5	11.5	8	100	19.5	0	0.6	0	0	0	0	0	0	0	0	0	0	0	0
ICP 7119	9.3	3.802	3.443	6.06	5.753	10.95	9.87	4.624	5.66	8.83	6.99	2.967	6.42	0	0	0	0	0	0	0	0	0	0	0	0
SE 1	70.9	103.9	9.6	61.7	45.5	33.6	30.1	221.4	152.0	43.3	60.3	39.6	46.8	55.9	0	0	0	0	0	0	0	0	0	0	0
CV (%)																									

Table 28. Percent wilt incidence in pigeonpea differential lines at different locations in India during 1991-92.

Pigeonpea Genotype	ICRISAT	Badna-pur	Dholi barga	Gul-barga	Sehore	Pudu-kkottai	Kan-pur	Rahuri
ICP 9145	9.5	22.1	13.3	11.0	57.1	10.2	0.0	6.5
ICP 8862	58.1	44.4	28.4	34.8	56.7	18.9	55.0	30.0
ICP 8863	1.2	5.6	1.6	2.6	61.1	0.0	1.7	5.6
ICP 9174	4.8	5.9	10.7	6.0	63.3	5.7	0.0	9.7
ICP 2376	94.0	100.0	27.9	100.0	94.4	86.3	66.7	100.0
ICP 8858	4.0	8.5	20.9	6.3	52.8	17.4	53.8	2.4
C 11	51.7	50.4	21.2	31.5	61.1	30.1	0.0	97.9
ICP 8859	10.1	15.9	14.2	22.1	56.7	10.3	0.0	0.0
BDN 2	49.4	88.9	11.0	29.7	66.3	26.9	2.8	91.1
BDN 1	45.9	100.0	71.2	33.5	61.3	37.8	0.3	100.0
T 21	72.4	94.9	36.6	97.8	70.8	19.8	43.8	100.0
LRG 30	96.2	100.0	58.4	96.6	55.4	9.6	47.6	100.0
SE \pm	7.7	7.82	8.45	3.9	12.9	4.35	5.42	3.53
CV (%)	32.2	25.5	55.7	17.2	35.4	33.1	33.9	11.40

Table 21. Percent elite incidences in differential P. parasitica genotypes associated with different isolates of *Emm319* when 10 seed cultures following root-dip and cross-pollinating techniques, 1971-72.

P. parasitica genotype	Percent elite incidences with different isolates of <i>Emm319</i>										
	12134	20139	021	332199	64120	561	142	446247	44134	4434	4434
12134	100	100	100	100	100	100	100	100	100	100	100
20139	100	100	100	100	100	100	100	100	100	100	100
021	100	100	100	100	100	100	100	100	100	100	100
332199	100	100	100	100	100	100	100	100	100	100	100
64120	100	100	100	100	100	100	100	100	100	100	100
561	100	100	100	100	100	100	100	100	100	100	100
142	100	100	100	100	100	100	100	100	100	100	100
446247	100	100	100	100	100	100	100	100	100	100	100
44134	100	100	100	100	100	100	100	100	100	100	100
4434	100	100	100	100	100	100	100	100	100	100	100

Table 30. Percent disease incidence in pigeonpea differential genotypes to sterility mosaic at different locations in India, 1991-92.

Pigeonpea genotypes	ICRISAT (SM+MM)	Percent sterility mosaic					
		Dholi		Pudukkottai		Kanpur	
		SM	MM	SM	MM	SM	MM
ICP 2376	2.3	69.2	14.5	15.4	23.5	15.26	0.0
ICP 7035	0.0	10.0	16.9	0.0	0.0	0.0	0.0
ICP 8862	0.0	3.9	6.9	5.3	2.2	0.0	0.0
ICP 8863	100	25.3	71.6	14.3	46.4	25.0	0.0
ICP 10976	4.9	6.5	2.9	0.0	0.0	0.0	0.0
ICP 11164	3.4	44.2	17.5	7.1	39.3	0.0	4.76
BAHAR	7.7	47.5	19.8	0.0	0.0	0.0	0.0
Purple 1	11.6	18.1	43.7	0.0	2.6	0.0	0.0
BDN-1	100.0	75.3	10.0	29.2	16.3	61.22	0.0
C-11	100.0	73	6.2	2.8	32.1	0.0	5.16
LRG 30	100.0	73.6	17.3	7.1	34.9	44.49	0.0
SE ±	1.76	7.38	6.41	9.2	9.91	2.89	1.61
CV(%)	6.40	31.5	53.9	215.9	95.7	37.8	309.1

SM = Severe mosaic; MM = Mild mosaic

Table 31. Influence of cropping patterns on fusarium wilt, Vertisol, ICRISAT Center, 1991-92.

Cropping pattern		<i>F. udum</i> propagules g ⁻¹ soil	Wilt incidence
1989	1990	1991	1991
PPP 1	PPP 1	4100	0.4
PPP 2	PPP 2	3960	2.2
MDPP	GG+Sun	3910	5.4
ESDPP+Sun	GG+Sun	3910	17.7
Sor+ESDPP	M+ESDPP	4243	0.1
SOr+SDPP	M+SDPP	4750	0.3
MDPP/Sor	Soy+Sun	4440	0.9
MDPP/Gro	Soy+Sun	4973	3.1
ESDPP+Sor1	GG+Sor2	5097	16.0
ESDPP+Sor2	GG+Sor2	4720	22.0
ESDPP+Sor3	GG+Sor3	4563	27.3

PPP1 = ICP 8094; PPP2 = ICP8860; MDPP = ICP 1-6
 ESDPP = ICPL 83015; SDPP = ICPL 87

Table 32. Results of APAU/ICRISAT Pigeonpea Macrophomina screening trial, Madhira, Andhra Pradesh, 1991-92.

S.No.Entry	Total plants		Days to 50% flowering	Stem canker (1-9 scale)			% Root rot			
	RI	RII		RI	RII	Average	RI	RII	Average	
1	ICP 1	70	62	150	5	9	7	56	63	60
2	ICP 29	88	57	150	6	4	5	27	11	19
3	ICP 41	63	58	144	5	6	6	37	45	41
4	ICP 43	56	62	162	4	4	4	9	8	9
5	ICP 64	72	63	141	8	9	9	56	75	66
6	ICP 79	54	66	153	4	7	6	20	29	25
7	ICP 81	52	52	144	8	9	9	15	17	16
8	ICP 95	49	56	144	8	9	9	51	54	53
9	ICP 102	53	66	162	3	4	4	19	17	18
10	ICP 113	53	32	144	6	7	7	11	9	10
11	ICP 130	54	45	141	8	8	8	33	40	37
12	ICP 131	78	83	134	8	9	9	28	64	46
13	ICP 132	71	89	144	8	8	8	27	13	20
14	ICP 147	75	70	136	8	9	9	61	44	53
15	ICP 151	59	62	150	8	9	9	27	34	31
16	ICP 163	90	83	150	8	9	9	20	24	22
17	ICP 167	87	96	144	8	9	9	53	47	50
18	ICP 178	85	66	144	8	9	9	41	53	47
19	ICP 182	66	59	144	6	8	7	33	54	44
20	ICP 202	76	63	144	7	6	7	43	43	43
21	ICP 219	78	66	144	5	4	5	36	6	22
22	ICP 238	61	63	136	7	6	7	74	29	52
23	ICP 268	74	64	144	4	5	5	14	28	21
24	ICP 294	62	55	137	5	6	6	52	27	40
25	ICP 305	72	59	141	8	9	9	89	39	64
26	ICP 308	46	49	144	4	5	5	7	35	21
27	ICPL 86005	36	39	97	4	6	5	36	64	50
28	ICPL 87105	39	53	94	5	6	6	28	64	46
29	ICPL 84023	52	51	64	8	9	9	92	100	96
30	ICP 8863	66	63	134	7	9	8	26	36	31
31	MRG 66	124	91	153	2	2	2	5	5	5

Table 33. Pigeonpea germplasm accessions promising against Phytophthora blight, ICRISAT Center, Patancheru, 1991-92 (RL 8).

S.No.	Accession No.	% PB
1	ICPL 13900	0
2	ICPL 13911	20.4
3	ICPL 13923	3.9
4	ICPL 13933	14.3
5	ICPL 13935	16.2
6	ICPL 14036	14.8
7	ICPL 14054	8.7
8	ICPL 14190	19.1
9	ICPL 14198	10.2
10	ICPL 14226	1.7
11	ICPL 14287	17.1
12	ICPL 14292	10.2
13	ICPL 14293	4.5
14	ICPL 14431	18.9
15	ICPL 14488	2.3
16	ICPL 14489	19.2
17	ICPL 14494	12.5
18	ICPL 14512	20.3
19	ICPL 14513	15.7
20	ICPL 14521	17.4
21	ICPL 14524	4.2
22	ICPL 14542	12.6
23	ICPL 14549	14.7
24	ICPL 14553	14.5
25	ICPL 14554	9.2
26	ICPL 14602	1.8
27	ICPL 14603	10.8
28	ICPL 14604	17.1
29	ICP 14607	10.5
30	ICP 14608	17.0
31	ICP 14609	6.0
32	ICP 14610	2.9
33	ICP 14613	6.8
34	ICP 7119	100.0
35	ICP 2376	100.0