Legumes Pathology
Progress Report-14
(Restricted Circulation)

Legumes Pathology (Chickpea)

Report of work
(June 1989–May 1990)

ICRISAT
Legumes Program

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

C O N T E N T S

Legumes Pathology (Chickpea)

STAFF

Dr. D. McDonald	Principal Legumes Pathologist & Program Director (Legumes)
Dr. M.P. Haware	Plant Pathologist
Dr. A.M. Ghanekar	Plant Pathologist (Hisar)
Mr. J. Narayana Rao	Research Associate
Mr. D.C. Venkaiah	Office Assistant
Ms. I. Radha	Junior Office Assistant
Mr. M. Ramulu	Field Helper
Mr. R. Penta Reddy	Field Helper (Hisar)
Mr. Rahim Pasha	Field Attendant
Mr. B. Yadayya	Field Attendant
Mr. Syed Pasha	Field Attendant
Mr. G. Rama Rao	Sr. Driver-cum-General Assistant
Mr. K. Babu Rao	Sr. Driver-cum-General Assistant

Legumes Pathology

List of Approved Projects (1990-92)

No.	Title	Lead Scientist(s)	ICRISAT Scientists
LC 228(90)IC/IC	Biology and management of wilt and root rots of chickpea	M.P. Haware	H.A. van Rheenen Jagdish Kumar Onkar Singh S.C. Sethi R.P.S. Pundir N.P. Saxena
LC 229(90)IC/IC	Biology and management of foliar diseases of chickpea	M.P. Haware A.M. Ghanekar	H.A. van Rheenen Jagdish Kumar Onkar Singh S.C. Sethi R.P.S. Pundir N.P. Saxena
LC 230(90)IC/IC	Management of stunt and other economically important virus diseases of chickpea	A.M. Ghanekar M.P. Haware	D.V.R. Reddy H.A. van Rheenen S.C. Sethi M. Pimbert R.P.S. Pundir

Project: LC 228(90)IC/IC

Title: Biology and management of wilt and root rots of chickpea

Objectives:

a. Screen chickpea germplasm and breeding materials against races of fusarium wilt and root rots and identify chickpeas with multiple disease resistance.

b. Multilocation testing of disease resistant lines in the Indian subcontinent and countries in Asia, Africa, and North and South America, to identify stable and multiple resistant lines.

c. Study biology of dry root rot pathogen.

d. Develop integrated management system for control of wilt and root rots.

SUMMARY

1. At ICRISAT Center, Patancheru, large number of chickpea breeding materials and several nurseries were screened in wilt sick plots. The material was planted in 4-meter rows, 60 cm apart. Susceptible check JG 62 which was planted after every two test rows, showed 100% mortality within a month after sowing.

2. Breeding materials: Breeding materials from F2 through F7 generations were screened in wilt sick plot. The progenies considered superior by pathologist were advanced through individual plant selections or bulks (Table 1). All entries from breeding nurseries were screened in wilt sick plot. The results were made available to chickpea breeders.

3. Screening of new germplasm: Of the 291 additional germplasm lines screened, 14 lines showed less than 20% wilt incidence. These will be retested again.

4. Screening of chickpea entries from Chickpea Initial Evaluation Trial (IET) and Coordinated Varietal Trials (CVT) 1989-90: The results of screening of IET entries and different CVT entries are presented in tables 2 to 6. Of the 60 entries from IET screened in wilt sick plot, only three lines, BG 357, BG 358 and ICCV 88101 were promising (Table 2). All the lines included in CVT-kabuli were found susceptible to wilt (Table 3). Five entries from CVT, namely KPG 142-1, KPG 143-1, H 86-73, ICCV 10 and ICCV 88101 showed less than 20% wilt (Table 4). In CVT-bold, seven entries namely, GNG 469, H 86-20, H 86-39, H 86-142, ICCC 42, ICCV 88108 and ICCV 88109 were found resistant to wilt (Table 5). In CVT-late, two entries, GL 86152 and H 86-156 were promising to wilt (Table 6).

5. Screening of chickpea lines from Indian National Programs: Chickpea lines received from Kanpur and Ludhiana were screened in wilt sick plot. All the lines were found susceptible to wilt (Table 7 and 8).

6. Multilocation testing of chickpea lines: Forty-nine chickpea lines identified resistant to wilt and root rots were tested at 15 locations in India, thru ICAR-ICRISAT Uniform Chickpea Root Rots/Wilt Nursery (IIUCRRWN) 1989-90 (Table 9). Two lines, ICC 9032 and ICC 11223 were found resistant at 10 locations and five lines, ICC 12408, ICCL 86311, ICCV 89234, ICCV 89306 and ICCV 89313 were found resistant to wilt and root rots at 9 locations. It is to be noted that these lines were tested in wilt sick plots at all the location. The root rot pathogens were different from location to location. Also the lines were exposed to all the four races of chickpea wilt Fusarium in multilocation testing.

7. **Screening for race 1 of *Fusarium oxysporum* f.sp. *ciceri* (FOC):** Forty-nine entries from International Chickpea Root Rots/Wilt Nursery (ICRRWN) 1989-90 were screened in 'pots' for their resistance to race 1. Forty chickpea lines were resistant to race 1 of chickpea wilt *Fusarium* and showed no mortality in 'pot screening' (Table 10). Entries from International Chickpea Wilt and Stunt Disease Nursery (nos. 31) were also tested in pots in green house. Seven lines were resistant to race 1 (Table 11).

8. Screening for race 4 of *F. oxysporum* f.sp. *ciceri* at Hisar: Seventy five chickpea lines identified resistant to wilt at ICRISAT Center were screened in the wilt sick plot at HAU, Hisar. There was some mortality due to root rots also. Thirty one lines showed combined resistant to wilt (race 4) and root rots (Table 12).

9. Yield evaluation of wilt and root rots resistant lines: The yield of 36 chickpea lines resistant to wilt and root rots along with 4 checks (ICCC 32, K 850, Annigeri and Pant G 114) was evaluated at Patancheru, Hisar and Gwalior (Table 13). At Patancheru the trial was conducted in wilt sick plot. Therefore all the lines outyielded check lines. At Hisar and Gwalior some of the lines outyielded one or two of the check lines.

10. Effect of irrigation on chickpea wilt and root rots: Effect of irrigation on wilt and root rots incidence in five chickpea lines (ICCV 2, ICCC 32, K 850, Chafa and NP 59) was studied in wilt sick plot. There was a difference among cultivars for susceptibility to wilt and root rots. The irrigation has increased the wilt and root rot incidence in ICCV 2 and ICCC 32 (Table 14).

11. Survival of 4 races of *F. oxysporum* f.sp. *ciceri* (FOC) in soil: The experiment started on 2-5-1986. Soil samples and infected host tissues buried in soil were examined after every 3 months. Soil samples were analysed for *Fusarium* propagules on selective medium and isolations were attempted from host tissues. Pathogenicity of *F. oxysporum* isolates was proved. All the four races of FOC are surviving in the soil in absence of chickpea (host) since four years (Table 15 and 16). The experiment is continuing.

12. Agronomic management of fusarium wilt of chickpea: The experiment was planned to study preparatory land cultivation practices that enhance the effectiveness of natural solarization process and compare them with soil solarization with polythene mulches during April-May. The soil samples were collected before and after ploughing/solarization of the plots in wilt sick nursery. There was a general increase in *Fusarium* propagules during summer months due to frequent rains and moderately low temperatures in 3 treatments. However solarization with polythene mulch reduced *Fusarium* propagules considerably (Table 17).

13. **Multiple Disease Sick Plot Screening:** The multiple disease sick plot at ICRISAT Center has different root rot pathogens in addition to chickpea wilt Fusarium. We made periodic isolations from dead chickpea plants. Periodic isolations revealed the presence of F. oxysporum f.sp. ciceri as the most dominating fungus in the soil from October 1989 to February 1990. It was followed closely by Rhizoctonia bataticola. Sclerotium rolfsii, R. solani and F. solani were also present in the soil (Table 18).

14. **Screening of chickpea lines developed at ICRISAT for wilt and root rots resistance:** Twenty four ICRISAT's chickpea lines were screened in multiple disease sick plot. ICCV 88101 was found resistant to wilt and root rots (Table 19).

15. **Screening of wilt promising chickpea lines:** Sixty three chickpea lines were screened for their resistance to wilt and root rots. Twenty lines were found resistant with less than 10% mortality due to wilt and root rots. ICCC 40 has been developed at ICRISAT. Others are germplasm selections (Table 20).

16. **Screening of advanced germplasm lines for wilt and root rot resistance:** Seventy five advanced germplasm lines were screened in multiple disease sick plot and in 'pots' in screen house to confirm their resistance to race 1 of FOC. In field screening 24 lines were resistant to wilt and 14 resistant to root rots. In pot screening 26 lines were resistant (0 mortality) to race 1 of FOC (Table 21).

17. **Screening of wild Cicer species in multiple disease sick plot:** Five Cicer species were screened. Cicer judaicum: nos. 182, 183, 185 and 0 were resistant to wilt. C. judaicum (nos. 183, 185) and C. cuniatum (SL 157) showed combined resistant to wilt and root rots (Table 22).

18. **Fungicidal seed treatment to control collar rot (Sclerotium rolfsii) of chickpea:** Seed dressing fungicide Rhizolex [Tolclofos-methyl, chemical name: 0,0-dimethyl-0-(2,6-dichloro-4-methyl-phenyl)-phosphorothioate] at the rate of 3 gm/kg of seed was very effective in controlling collar rot in glass house experiment (Table 23). The germination also improved significantly over control.

19. **Pycnidial production in Rhizoctonia bataticola:** The sclerotial strains of Macrophomina phaseolina are grouped into Rhizoctonia bataticola stage. Strains of R. bataticola infecting chickpea do not form pycnidia naturally on host. However using some special methods, pycnidial formation was induced in the laboratory. Small root pieces (2-3 cm length) after surface sterilization (3 min in 2.5% sodium hypochlorite) were placed on 7-day-old cultures of R. bataticola in petriplates. The cultures were grown on potato-dextrose agar. Petriplates with host tissues were

then incubated at 15, 20, 25, 30 and 35°C with 12 hrs. light. Numerous pycnidia were formed on the surface of root pieces incubated at 25 and 30°C for 30 days. At lower temperature pycnidia were not formed. Pycnidia formation was also very low at 30°C and none at 35°C. The method was repeated several times to confirm the observations. The observation suggest the possibility of pycnidial production during rainy season on chickpea debris left in the field after harvest.

Table 1. Populations and progenies screened in wilt sick plot, ICRISAT Center, Patancheru, during 1989-90.

Sl. No.	Expt. No.	Generation	Number tested	Number selected	
				Plants	Bulks
1	PA 204	F2 (C5) population	1	-	1
2	PA 026	F2 Bulks Desi	60	-	48
3	PA 027	F2 Bulks	19	-	17
4	PA 133	F2 Bulks kabuli	31	376	30
5	PA 134	F2 Bulks kabuli	8	-	8
6	PA 192	F2 Bulks	10	-	9
7	PA 196	F2 Bulks	5	-	5
8	PA 025	F2 Bulks	2	-	2
9	PA 122	F2 Bulks	2	-	1
10	PA 028	F2 back crosses	28	-	19
11	Hi 024	F2 Bulks	6	-	4
12	Hi 026	F2 Bulks	10	-	10
13	Hi 123	F2 Bulks	18	-	9
14	PA 194	F3 populations kabuli	2	-	2
15	PA 193	F3 populations desi	10	-	10
16	PA 206	F3 C4 population	1	-	1
17	PA 037	F3 Bulks	144	-	129
18	Hi 124	F3 Bulks	59	-	51
19	Hi 127	F3 Bulks	7	-	5
20	Hi 128	F3 TWC	6	-	3
21	Hi 129	F3 double cross	3	-	3
22	PA 038	F4 Prog. Bulks	13	-	12
23	PA 139	F4 population	1	51	-
24	PA 209	F4 Interspecific crosses	2	-	2
25	PA 141	F4, F5 Prog. bulks II	8	-	-
26	Hi 136	F4 Progenies Hy, WR, ABR Kabuli	26		
27	Hi 146	F5 Progenies Hy, WR, ABR, WR + STR	64		
28	Hi 046	F5 prog. DL	1770		
29	Hi 051	F5 Prog. LXT	1130		
30	Hi 058	F5 Prog. DL	147		
31	Hi 065	F6 Prog. Bulks	320		
32	PA 054	F6 Back cross prog.	27	39	19
33	PA 050	F6 Prog Bulks	21	-	3
34	PA 054A	F7 Back cross prog.	50	34	34
35	Hi 074	F7 Prog. Bulks BWR, STR, MDSP	59		
36	PA 029	BC1 F2 (JG-62 x ICC 12237)	3	-	-
37	PA 030	BC2 F2 (JG-62 x ICC 12237)	6	1	-
38	PA 031	BC3 F2	4	2	-
39	PA 043A	BC1 F5 Prog	20	4	6
40	PA 033	F3 Back cross prog	100	13	48
41	PA 036	F3 BacK cross population	6	41	6
42	PA 222	DBPB V	2	-	2
43	PA 218	DBPBIB	1216	-	240

Sl. No.	Expt. No.	Generation	Number tested	Number selected	
				Plants	Bulks
44	PA 221	DBPB III	343	-	78
45	PA 219	DBPB IIA	18	-	-
46	PA 059	Germplasm II	6	-	1
47	PA 152	Germplasm	58	-	11
48	PA 129	Germplasm ICARDA	31	-	3
49	PA 148	PYT-5 Kabuli	20	-	11
50	PA 149	PYT-6 Kabuli	22	-	6
51	PA 150	PYT-7 Kabuli	23	-	9
52	PA 117	PYT, AYT	311	-	85
53	PA 237	PYT	69	-	16
54	PA 145	PYT-2 Kabuli	14	-	-
55	PA 147	PYT-4 Kabuli	25	-	8
56	PA 097	PYT-38 Desi	25	-	14
57	PA 099	PYT-40 Desi	25	-	14
58	PA 101	PYT-42 Desi	25	-	9
59	Hi 177	PYT	69		
60	PA 188	Trial entries early planting	36	-	17
61	Hi 082	Trial entries DL	368		
62	Hi 165	Trial entries kabuli	104		
33	Hi 082	Trial entries	13		
34	Hi 186	Advanced germplasm trial entries	12		

Table 2. Reaction of Chickpea Initial Evaluation Trial (IET) 89-90 entries to wilt in wilt sick plot, ICRISAT Center, Patnacheru, during 1989-90.

S.No.	Particulars	Total Plants	Percent wilt
1	BG 349	41	36.6
2	BG 357	34	17.6
3	BG 358	22	18.0
4	BG 359	28	60.7
5	BGM 413	33	90.9
6	BGM 417	40	25.0
7	BGM 465	34	76.5
8	BGM 466	43	72.1
9	GG 828	30	93.3
10	GL 86066	30	93.3
11	GL 87249	24	75.0
12	GL 87307	35	80.0
13	GCP 22	25	100.0
14	GCP 28	33	24.2
15	GCP 45	34	100.0
16	GCP 50	32	100.0
17	GCP 52	32	90.6
18	GNG 380	25	100.0
19	GNG 529	29	100.0
20	GNG 577	31	100.0
21	GNG 581	31	100.0
22	GNG 585	28	100.0
23	GNG 600	25	100.0
24	H 86-18	21	85.7
25	H 86-84	29	100.0
26	H 86-91	30	50.0
27	H 86-96	25	24.0
28	H 86-143	38	84.2
29	H 87-98	37	100.0
30	H 88-123	22	37.3
31	ICCV 10	10	80.0
32	ICCV 18	12	91.7
33	ICCV 19	19	100.0
34	ICCV 88101	16	12.5
35	ICCV 88102	15	100.0
36	ICCV 88103	18	100.0
37	ICCV 88104	23	62.2
38	ICCV 89242	22	54.5
39	ICCV 89244	34	100.0
40	ICCV 89444	36	77.8
41	ICCV 89307	17	52.9
42	KPG 53	20	95.0
43	KPG 63	22	59.1
44	NDG 8605	19	94.7
45	PDG 85-7	32	78.2
46	PDG 85-10	21	90.5

S.No.	Particulars	Total Plants	Percent wilt
47	PG 86-1	13	100.0
48	PG 87-1	22	100.0
49	PG 87-21	30	100.0
50	PG 87-24	19	100.0
51	RSG 2	22	100.0
52	RSG 3-1	8	100.0
53	RSG 242	32	100.0
54	RSG 256	23	100.0
55	RSG 258	29	100.0
56	RSG 503	29	89.7
57	RSG 506	24	100.0
58	RSG 509	31	100.0
59	COG 4	18	100.0
60	COG 6	17	100.0
61	ICC 4951 (Control)	40	100.0

Table 3. Reaction of Chickpea Coordinated Varietal Trial (CVT) - Kabuli-89-90 entries to wilt in wilt sick plot, ICRISAT center, Patnacheru, during 1989-90.

S.No.	Particulars	Total Plants	Percent wilt
1	GNG 149	23	100.0
2	GNG 422	21	100.0
3	GNG 500	24	100.0
4	GNG 504	24	100.0
5	HK 85-703	21	76.2
6	HK 86-122	30	63.3
7	HK 88-176	25	84.0
8	HK 88-232	25	35.0
9	ICCC 32	28	39.3
10	ICCC 49	27	92.6
11	ICCV 13	26	100.0
12	ICCV 14	22	100.0
13	ICC 4951 (control)	40	100.0

Table 4. Reaction of Chickpea Coordinated Varietal Trial (CVT) 89-90 entries to wilt in wilt sick plot, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Total Plants	Percent wilt
1	BG 348	30	100.0
2	BG 351	22	100.0
3	BGM 413	29	100.0
4	BGM 417	36	100.0
5	BGM 438	29	100.0
6	GG 829	27	81.5
7	GL 1002	39	94.9
8	GL 83007	33	100.0
9	GL 83119	31	100.0
10	GL 86066	30	100.0
11	GCP 29	28	100.0
12	GNG 146	24	100.0
13	GNG 426	26	46.2
14	GNG 568	37	100.0
15	H-86-72	35	31.4
16	H-86-158	29	89.7
17	IG 218	38	100.0
18	KPG 142-1	36	5.5
19	KPG 143-1	37	16.2
20	NDG 8606	41	90.2
21	PDG 845	36	100.0
22	RSG 143-1	28	100.0
23	GNG 158	36	100.0
24	H 86-73	41	12.0
25	ICCC 38	31	51.6
26	ICCV 10	33	18.0
27	ICCV 19	37	94.6
28	ICCV 88101	37	5.4
29	ICCV 88102	38	92.1
30	ICCV 88103	43	88.4
31	ICC 4951 (control)	40	100.0

Table 5. Reaction of Chickpea Coordinated Varietal Trial (CVT) -Bold 89-90 entries to wilt in wilt sick plot, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Total Plants	Percent wilt
1	BG 353	36	80.6
2	BG 362	40	95.0
3	BG 363	32	100.0
4	GF 16	29	86.2
5	GF 91	34	44.1
6	GF 92	31	96.8
7	GNG 398	16	93.8
8	GNG 469	22	4.5
9	H 86-20	25	8.0
10	H 86-39	31	3.2
11	H 86-142	22	4.5
12	KPG 33	30	60.0
13	PDG 83-33	30	20.0
14	PDG 84-14	22	13.6
15	PDG 85-9	25	76.0
16	PDG 85-11	38	97.4
17	PDG 85-17	28	75.0
18	ICCC 42	25	0.0
19	ICCV 88108	27	3.7
20	ICCV 88109	35	0.0
21	ICCV 88112	25	36.6
22	ICC 4951 (control)	40	100.0

Table 6. Reaction of Chickpea Coordinated Varietal Trial (CVT) - late sown 89-90 entries to wilt in wilt sick plot, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Total Plants	Percent wilt
1	BG 372	35	71.4
2	BG 373	34	26.5
3	BGM 431	34	44.1
4	BGM 467	30	76.7
5	BGM 468	18	94.4
6	GL 86152	34	20.6
7	GL 87227	28	100.0
8	GL 87308	29	79.3
9	GNG 531	18	100.0
10	H 85-124	30	30.0
11	H 86-156	30	13.5
12	ICCC 14	27	74.1
13	ICCC 41	32	96.9
14	ICCV 15	28	60.7
15	ICCV 88106	27	51.6
16	ICCV 88107	32	84.4
17	ICCV 88108	25	32.0
18	ICCV 89701	20	85.0
19	ICCV 89702	29	96.6
20	KPG 202	25	76.0
21	Phule G 12	30	93.3
22	RSG 256	23	100.0
23	ICC 4951 (control)	40	100.0

Table 7. Reaction of the chickpea promising lines from AICPIP Kanpur to wilt in wilt sick plot, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Total Plants	Percent wilt
1	BCP 2	24	83.3
2	BCP 3	24	37.5
3	BCP 5	20	30.0
4	BCP 11	16	31.3
5	BCP 12	28	100.0
6	BCP 49	22	86.4
7	BCP 53	18	22.3
8	BCP 54	20	50.0
9	BCP 68	22	77.3
10	BCP 95	31	93.5
11	BCP 98	32	90.6
12	ICC 4951 (control)	40	100.0

Table 8. Reaction of chickpea lines from Ludhiana to wilt in wilt sick plot at ICRISAT center, Patancheru, during 1989-90.

S.No.	Particulars	Total plants	Percent wilt
1	GL 87069	36	100.0
2	GL 87070	40	100.0
3	GL 87071	35	100.0
4	GL 87072	33	100.0
5	GL 87073	36	100.0
6	GL 87074	38	100.0
7	GL 87075	35	100.0
8	GL 87076	33	100.0
9	GL 87077	37	83.8
10	GL 87078	16	87.5
11	GL 87079	25	84.0
12	GL 87080	29	96.6
13	GL 87081	13	100.0
14	GL 87082	35	100.0
15	GL 87083	34	100.0
16	GL 87084	37	89.2
17	GL 87085	40	100.0
18	GL 87086	36	100.0
19	GL 87087	27	100.0
20	GL 87088	38	100.0
21	GL 87089	38	100.0
22	GL 87090	38	100.0
23	GL 87091	33	100.0
24	GL 769	37	100.0
25	C 235	38	100.0
26	G 543	38	100.0
27	ICC 4951 (Control)	40	100.0

List of the cooperators and locations for ICRISAT-ICAR Uniform Chickpea Root Rots and Wilt Nursery (IIUCRRWN) 1989-90.

S.No.	Name of the cooperator(s)	Location
1.	P.N. Chavan and K.B. Wanjari	Akola
2.	J.U. Astaputre, S.P. Shirshikar, S.B. Banchod	Badnapur
3.	A.K. Chattopadhyay and D.K. Roy Choudhury	Berhampore
4.	J.P. Upadhyay and B.K. Sinha	Dholi
5.	Kuldip Singh and T.S. Sandhu	Faridkot
6.	V.B. Bidari	Gulbarga
7.	A. Abbaiah	Guntur
8.	Gurdip Singh, Y.P. Sharma, Lavinda Kaur and A.S. Gill	Gurdaspur
9.	B.L. Jalali, Harichand and M.S. Sangwan	Hisar
10.	K.S. Amin	Kanpur
11.	Gurdip Singh and Y.P. Sharma	Ludhiana
12.	Mahendrapal and Birendra Singh	New Delhi
13.	Y.P.S. Rathi, H.S. Tripathi and N. Singh	Pantnagar
14.	M.P. Haware	Patancheru
15.	Laxman Oraon and D.K. Jha	Ranchi
16.	N.J. Bendre, R.B. Deshmukh and K.B. Pawar	Rahuri
17.	P.S. Bharodia	S.K. Nagar
18.	S.C. Agarwal	Sehore

Table 9. Reaction of chickpea entries from Ninth ICRISAT-ICAR Uniform Chickpea Root Rots/Wilt Nursery (IIUCRRWN) 1989-90 to wilt and root rots at different locations during 1989-90.

S.No.	Entry	Percent wilt/root rots[a]															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	ICC 4918	48	1	42	60	21	11	91	70	90	49	32	77	34	68	32	2
2.	ICC 4928	100	91	98	100	20	40	100	45	100	11	30	31	61	35	100	2
3.	ICC 4934	23	56	68	16	21	0	80	54	100	42	29	54	100	36	25	2
4.	ICC 4973	54	66	87	77	16	63	88	73	100	10	21	56	71	39	0	3
5.	ICC 5003	52	52	49	66	10	8	75	69	100	15	23	64	100	23	3	4
6.	ICC 9032	6	5	39	9	8	8	90	91	20	24	12	16	6	66	16	10
7.	ICC 11223	16	1	0	9	12	14	64	55	3	67	24	11	19	6	65	10
8.	ICC 11320	6	0	7	2	13	1	78	73	91	57	22	23	7	46	20	6
9.	ICC 11322	14	0	17	5	20	5	80	50	16	62	21	52	37	6	25	6
10.	ICC 11323	20	10	30	17	6	10	66	64	75	58	16	21	100	13	10	6
11.	ICC 11324	19	10	62	5	6	5	61	46	100	26	30	52	67	13	25	6
12.	ICC 11329	6	0	7	6	1	1	64	59	13	53	21	46	32	32	12	6
13.	ICC 12205	2	6	37	7	15	7	67	65	70	52	24	26	49	10	0	7
14.	ICC 12263	9	44	27	9	0	17	71	58	6	57	22	66	41	5	75	7
15.	ICC 12265	16	4	19	15	15	5	66	66	93	79	23	36	69	26	10	7
16.	ICC 12408	2	0	5	6	17	13	62	62	33	46	7	56	11	47	0	9
17.	ICC 12884	16	6	1	29	11	13	60	50	1	55	21	39	15	56	0	6
18.	ICCL 83149	16	2	4	24	10	3	94	61	42	60	40	44	10	65	16	7
19.	ICCL 84204	29	10	72	22	26	7	74	69	100	39	26	22	67	62	10	3
20.	ICCL 84303	20	7	31	12	3	22	78	34	95	46	11	36	19	29	0	7
21.	ICCL 85225	4	2	78	1	3	11	71	42	100	26	36	60	50	16	16	7
22.	ICCL 85311	4	6	19	23	4	16	71	69	73	54	20	60	10	16	0	9
23.	ICCL 86001	4	10	36	4	12	6	77	76	76	54	19	90	100	47	5	7
24.	ICCV 89206	6	15	96	10	17	4	71	56	100	27	32	65	31	66	0	6
25.	ICCV 89212	23	10	37	45	22	5	74	67	100	29	16	26	69	62	0	4
26.	ICCV 89213	16	7	6	26	17	2	66	65	62	53	14	31	13	63	0	6
27.	ICCV 89219	0	1	21	19	11	4	91	35	49	37	9	66	31	70	11	7
28.	ICCV 89220	4	1	0	31	10	13	76	57	7	33	16	42	37	60	3	6
29.	ICCV 89223	11	13	51	7	15	5	73	69	60	54	23	66	21	37	75	5
30.	ICCV 89224	4	6	16	6	9	4	75	57	46	44	5	33	25	62	0	6
31.	ICCV 89228	6	6	35	14	6	6	62	96	45	30	36	69	31	63	3	6
32.	ICCV 89234	10	10	29	13	7	9	49	44	12	16	20	50	26	42	0	9
33.	ICCV 89305	4	13	41	10	6	5	67	53	16	10	31	71	31	63	7	6
34.	ICCV 89306	9	16	0	14	13	7	74	71	46	54	17	21	10	75	0	9
35.	ICCV 89309	12	4	33	25	6	0	92	64	30	36	31	35	12	72	0	6
36.	ICCV 89310	7	5	46	25	9	14	66	45	15	14	36	66	42	62	0	7
37.	ICCV 89313	16	0	42	10	13	12	75	73	62	14	27	46	11	19	4	9
38.	ICCV 89316	1	6	46	2	9	13	63	67	2	20	50	54	25	63	13	6
39.	ICCV 89318	22	3	70	12	10	13	67	71	69	26	26	20	37	56	0	6
40.	ICCV 89319	10	0	65	21	16	2	69	67	100	33	29	59	26	60	32	4
41.	ICCV 89337	0	0	66	12	21	2	60	47	61	26	6	43	22	40	5	6
42.	ICCV 89339	5	15	36	24	10	2	70	40	37	53	10	16	40	62	16	7
43.	ICCV 89342	2	5	12	6	24	7	49	41	76	16	24	27	100	41	11	7
44.	ICCV 2	46	15	37	19	6	1	64	64	100	56	35	47	45	19	6	6
45.	ICCV 3	30	7	6	14	7	0	66	75	100	53	60	61	29	9	0	6
46.	ICCV 4	64	39	71	17	10	16	71	70	100	55	43	44	NG	NG	16	4
47.	ICCV 5	35	19	75	12	16	13	60	76	100	41	15	46	41	21	0	6

S.No.	Entry	Percent wilt/root rots*															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
48.	ICCV 6	1	8	58	13	3	13	53	39	68	24	4	43	36	12	15	8
49.	ICCV 11	0	4	5	29	4	15	37	22	94	32	5	26	71	14	0	8
50.	ICC 4951**	100	91-	96-	97-	94-	84-	100	100	100	100	93	68-	100	68-	60-	0
	(Range)		100	100	100	100	100						100		95	100	
	No. of lines found resistant	37	43	16	33	43	46	0	0	11	9	18	4	12	13	40	

* Average of 2 replications; ** Wilt susceptible check
1=Akola, 2=Badnapur, 3=Berhampore, 4=Dholi, 5=Faridkot, 6=Gulbarga, 7=Gurdaspur, 8=Hisar, 9=Patancheru, 10=Ludhiana, 11=New Delhi, 12=Pantnagar, 13=Rahuri, 14=Ranchi, 15=Sehore, 16=No. of locations found resistant. NG=No germination.

Table 10. Reaction of ICRRWN 1989-90 entries to wilt in 'Pot' screening in greenhouse, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Percent wilt*
1	ICC 4918	60.0
2	ICC 4928	80.0
3	ICC 4934	70.0
4	ICC 4973	100.0
5	ICC 5003	100.0
6	ICC 9032	0.0
7	ICC 11223	0.0
8	ICC 11320	0.0
9	ICC 11322	0.0
10	ICC 11323	0.0
11	ICC 11324	22.2
12	ICC 11329	22.2
13	ICC 12205	0.0
14	ICC 12263	0.0
15	ICC 12265	0.0
16	ICC 12408	0.0
17	ICC 12884	0.0
18	ICCL 83149	0.0
19	ICCL 84204	0.0
20	ICCL 84303	0.0
21	ICCL 85225	0.0
22	ICCL 85311	0.0
23	ICCL 88001	0.0
24	ICCV 2	0.0
25	ICCV 3	0.0
26	ICCV 4	0.0
27	ICCV 5	0.0
28	ICCV 6	0.0
29	ICCV 11	0.0
30	ICCV 89208	0.0
31	ICCV 89212	0.0
32	ICCV 89213	0.0
33	ICCV 89219	0.0
34	ICCV 89220	0.0
35	ICCV 89223	0.0
36	ICCV 89224	12.5
37	ICCV 89228	0.0
38	ICCV 89234	0.0
39	ICCV 89305	11.1
40	ICCV 89306	0.0
41	ICCV 89309	0.0
42	ICCV 89310	0.0
43	ICCV 89313	0.0
44	ICCV 89316	0.0
45	ICCV 89318	0.0

S.No.	Particulars	Percent wilt*
46	ICCV 89319	0.0
47	ICCV 89337	0.0
48	ICCV 89339	0.0
49	ICCV 89342	0.0
50	ICC 4951 (control)	100.0

* Average of 2 replications

Table 11. Reaction of International Chickpea Wilt and Stunt Disease Nursery (ICWSDN) entries (1988-89) to wilt in 'pot screening' in greenhouse, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Percent wilt
1	ICC 838	77.7
2	ICC 1005	66.6
3	ICC 1583	28.5
4	ICC 1891	0.0
5	ICC 2210	20.0
6	ICC 2223	40.0
7	ICC 2232	50.0
8	ICC 2430	60.0
9	ICC 2542	11.1
10	ICC 2604	10.0
11	ICC 3034	33.3
12	ICC 3274	70.0
13	ICC 3935	55.5
14	ICC 4935	60.0
15	ICC 4948	60.0
16	ICC 4989	NG
17	ICC 5332	22.2
18	ICC 7254	0.0
19	ICC 7777	40.0
20	ICC 8241	22.2
21	ICC 8383	50.0
22	ICC 9032	0.0
23	ICC 10137	66.7
24	ICC 10503	83.3
25	ICC 10592	37.5
26	ICC 10805	0.0
27	ICC 11502	30.0
28	ICC 11551	10.0
29	ICC 12460	60.0
30	ICC 730020-11-1-1H-BH	0.0
31	ICC 11322	0.0
32	ICC 4951 (Control)	100.0

NG=No germination.

Table 12. Chickpea lines which showed resistance to wilt and root rots in wilt/root rot disease sick plot, HAU, Hisar, during 1989-90.

S.No.	Chickpea lines
1.	ICC 12989
2.	ICC 14303
3.	ICC 14528
4.	ICC 14631
5.	ICC 14680
6.	ICC 14681
7.	ICC 14764
8.	ICC 14765
9.	ICC 15068
10.	ICC 15075
11.	ICC 15105
12.	ICC 15127
13.	ICC 15178
14.	ICC 15236
15.	ICC 15242
16.	ICCL 87401
17.	ICCL 87411
18.	ICCL 87419
19.	ICCL 87424
20.	ICCL 87428
21.	ICCL 87438
22.	ICCX 80555-20-BH-25-BWR-BH
23.	ICCV 15
24.	ICCV 88103
25.	P.No. 30026 (ICCX 800743-2PLB-1PWR-1HL-BHLB-1HWR-BH)
26.	P.No. 30085 (ICCX 800550-32BH-31H-BWR-BH)
27.	P.No. 30093 (ICCX 800550-32BH-47H-BWR-BH)
28.	P.No. 30126 (ICCX 800550-40BH-27H-BWR-BH)
29.	P.No. 30186 (ICCX 800550-43BH-32H-BWR-BH)
30.	P.No. 30418 (ICCX 830697-4H-1H-BH)
31.	P.No. 30094

Table 13. Yield evaluation of chickpea wilt resistant lines at Patancheru, Hisar an Gwalior during 1989-90[1].

Sl. No.	Particulars	Patancheru[1] Percent[2] Wilt	Root rots	100 Seed Wt (g)	Yield kg ha^{-1}	Hisar[1] 100 Seed Wt (g)	Yield kg ha^{-1}	Gwalior[1] Yield kg ha^{-1}	Average yield kg ha^{-1}
1	ICC 925	47.0 (42.6)	8.7 (16.5)	11.8	245	15.2	2185	3070	1833
2	ICC 1435	8.7 (15.6)	19.8 (26.0)	12.9	539	15.5	2503	2837	1893
3	ICC 1437	7.2 (14.0)	14.6 (21.2)	14.6	625	14.6	3050	3032	2236
4	ICC 2595	1.0 (5.8)	5.5 (13.5)	12.5	780	15.0	1731	2407	1639
5	ICC 2882	69.2 (58.3)	1.6 (7.1)	11.4	147	14.5	2048	2727	1640
6	ICC 9001	7.6 (15.9)	24.2 (29.3)	13.6	517	16.1	2702	2689	1969
7	ICC 9023	4.8 (11.8)	6.9 (14.6)	12.7	977	13.4	2672	3321	2323
8	ICC 9032	7.8 (15.9)	8.5 (16.6)	12.7	665	13.9	2214	2435	1771
9	ICC 10803	36.6 (34.8)	11.8 (19.0)	11.7	200	13.6	2136	3317	1884
0	ICC 11223	24.7 (28.0)	17.9 (24.7)	13.5	473	14.8	2524	2452	1816
1	ICC 11224	23.5 (27.7)	7.7 (16.0)	12.6	417	14.7	1953	3010	1793
2	ICC 11313	30.6 (31.2)	20.1 (25.5)	12.7	355	14.3	1932	2947	1745
3	ICC 11322	25.3 (30.7)	12.0 (20.0)	13.6	549	15.7	2302	2991	1947
4	ICC 11329	8.1 (15.9)	9.4 (17.4)	12.8	620	15.7	2221	3387	2076

Sl. No.	Particulars	Patancheru[1] Percent[a] Wilt	Root rots	100 Seed Wt (g)	Yield kg ha^{-1}	Hisar[1] 100 Seed Wt (g)	Yield kg ha^{-1}	Gwalior[1] Yield kg ha^{-1}	Average yield kg ha^{-1}
15	ICC 11550	5.5 (13.0)	8.4 (16.4)	12.5	572	14.2	2202	3406	2060
16	ICC 11581	3.2 (9.5)	7.4 (14.9)	10.8	618	14.7	2969	3260	2282
17	ICC 12205	21.2 (26.6)	12.7 (20.5)	13.7	350	15.9	2723	3154	2076
18	ICC 12241	24.3 (28.2)	13.5 (21.4)	12.7	404	15.5	2785	*2917	2035
19	ICC 12256	29.3 (31.9)	17.0 (23.9)	12.9	340	17.1	2306	2512	1719
20	ICC 12259	14.1 (21.4)	9.2 (17.5)	11.5	564	15.6	2541	2973	2026
21	ICC 12265	4.9 (12.0)	16.4 (22.9)	16.4	440	20.3	1843	2000	1428
22	ICC 12269	5.7 (11.9)	23.4 (27.0)	16.5	494	20.2	2054	2649	1732
23	ICC 12274	6.1 (13.6)	22.5 (26.8)	14.5	668	17.0	2753	3167	2196
24	ICC 12450	4.2 (9.8)	24.5 (27.5)	11.3	164	14.6	1559	1939	1221
25	ICC 12454	18.4 (22.3)	11.0 (18.3)	10.6	553	12.6	1650	2618	1607
26	ICC 12460	6.9 (13.8)	19.2 (24.6)	12.6	609	15.1	2459	2512	1860
27	ICC 12969	8.8 (16.8)	21.5 (26.6)	14.5	423	16.9	2666	2990	2026
28	ICC 12989	6.6 (13.5)	10.5 (18.2)	12.7	723	15.5	2140	2651	1838
29	ICC 12995	36.5 (36.7)	23.4 (28.3)	12.9	281	17.1	2131	3197	1870

Sl. No.	Particulars	Patancheru[1] Percent[a] Wilt	Root rots	100 Seed Wt in g	Yield kg ha^{-1}	Hisar[1] 100 Seed Wt in g	Yield kg ha^{-1}	Gwalior[1] Yield kg ha^{-1}	Average yield kg ha^{-1}
30	ICC 13024	11.8 (19.1)	11.2 (18.1)	11.7	603	12.5	2584	2767	1985
31	ICC 13025	7.4 (15.2)	13.8 (20.9)	11.4	582	13.8	2294	2820	1832
32	ICC 13053	14.7 (22.4)	13.8 (21.1)	14.9	574	19.0	1372	2879	1842
33	ICC 13114	21.8 (27.8)	10.8 (18.7)	15.1	480	17.1	1892	2705	1688
34	ICC 13213	15.4 (22.4)	10.5 (18.4)	14.8	471	15.8	2573	2466	1837
35	ICC 14198	1.9 (5.5)	19.4 (24.7)	43.5	374	50.7	2445	2238	1686
36	ICCX-730020-11-1H-BH	19.8 (26.1)	8.0 (16.1)	10.7	246	12.5	2185	3117	1843
37	ICCC 32	54.9 (47.8)	16.9 (23.6)	17.0	109	20.8	2373	2877	1786
38	K 850	99.3 (87.5)	0.7 (2.4)	-	-	29.3	3309	3205	2171
39	Annigeri	52.4 (46.4)	29.5 (31.9)	16.4	20	21.5	2570	2629	1739
40	Pant G 114	94.0 (82.7)	2.8 (4.9)	10.2	42	17.4	2831	4050	2308
	SE±	(4.844)	(3.831)	0.1274	69.8	0.768	264.4	255.5	
	CV%	(35.4)	(39.1)	1.8	30.5	9.0	21.8	18.0	

[a] Average of 4 replication.

1 At Patancheru the trial was in wilt sick plot, and at Hisar and Gwalior in normal fields.

The figures in the parentheses are after angular transformation

Table 14. Effect of irrigation on chickpea wilt and root rots in wilt sick plot, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Cultivar	Irrigated		Not irrigated	
		Wilt	Root rots	Wilt	Root rots
1	ICCV 2	18.4 (25.0)	31.8 (32.7)	9.5 (17.6)	15.5 (22.3)
2	ICCC 32	36.9 (37.3)	15.6 (23.1)	28.0 (31.5)	11.9 (19.8)
3	K 850	76.3 (61.6)	23.7 (28.4)	80.7 (66.4)	14.8 (20.9)
4	Chafa	87.5 (69.8)	10.4 (17.7)	89.8 (71.8)	6.3 (14.5)
5	NP 59	93.1 (75.4)	5.2 (10.8)	87.7 (70.6)	7.9 (15.7)
		Cultivar	Method	Method*	CV
	SE±	(3.31)	(1.32)	(4.39)	For wilt
	CV%	-	(4.4)	(15.4)	
	SE±	(3.36)	(1.57)	(4.53)	For Root rot
	CV%	-	(13.2)	(40.0)	

* Average of 3 replications (%)

The figures in the parentheses are after angular transformation

Table 15. Survival* of four races of Fusarium oxysporum f.sp. ciceri in soil and in the infected tissues, ICRISAT Center, Patancheru, during 1988-89.

Treatment		Race 1				Race 2				Race 3				Race 4			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1 Fungus multiplied on broth and mixed in the soil	A	483	716	600	533	300	750	550	483	600	900	665	500	550	716	900	383
	B	165	516	950	700	133	200	200	517	250	283	215	217	417	633	285	117
2 Fungus multiplied on Sand-chickpea flour medium and mixed in the soil	A	783	716	615	667	350	366	215	250	750	966	1150	300	317	950	665	483
	B	83	266	200	200	317	266	65	317	400	650	380	133	183	300	250	83
3 Fungus multiplied on healthy host pieces and mixed in the soil	A	++–	+++	+++^{C}	+++^{C}	++–	+++	+++	+++^{C}	+––	++–	+++^{C}	+++^{C}	+++	+++	+++	+++^{C}
	B	++–	+++	+++	+++^{C}	+++	+–+	+++^{C}	+++^{C}	+++	+++	+–+	+++^{C}	+++	++–	+++^{C}	+++^{C}
4 Fungus multiplied on sterilised host pieces and mixed in soil	A	+++	+++	+++	+++^{C}	+++	+++	+++	+++^{C}	+––	+––	+++	+++^{C}	+–+	+––	+++^{C}	+++^{C}
	B	+––	+++	+++	+++^{C}	++–	+++	+++	+++^{C}	+++	+–+	++–	+++^{C}	+––	+––	+++	+++^{C}
5 Wilted plants from wilt sick plot	A	+++	+++	+++	+++^{C}												
	B	++–	++–	+++	+++^{C}												
6 Field soil (wilt sick)																	
BIL 2C		1350	1533	1280	1600												
BUS 9B		1183	1516	1766	1017												

* Experiment started on 2-5-88

Treatments 1,2 and 6 = No of Fusarium propagules/g^{-1} soil

Treatments 3,4 and 5 = Isolation results on czapek dox agar medium

+ Fusarium present; – Fusarium absent

A. Field soil; B. Sterilised soil; C. Host tissues disintegrated.

1= 3.8.88; 2= 2.11.88; 3= 1.2.89; 4=1.5.89 (Dates of samples collected).

Table 16. Survival* of four races of *Fusarium oxysporum* f.sp. *ciceri* in soil and in the infected tissues, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Treatment		Race 1				Race 2				Race 3				Race 4			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Fungus multiplied on broth and mixed in the soil	A	500	883	950	950	750	333	567	400	733	767	950	717	450	883	483	600
		B	650	833	133	483	265	267	400	317	200	217	233	450	80	283	500	500
2	Fungus multiplied on Sand-chickpea flour medium and mixed in the soil	A	850	700	1117	1085	415	333	450	467	667	617	1000	450	580	415	483	650
		B	83	83	1017	150	150	433	633	483	380	350	365	600	80	217	250	233
3	Fungus multiplied on healthy host pieces and mixed in the soil	A	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C
		B	+++C	+++C	+++C	+++C	+++C	+-+C	+++C	+++C	+++C	+++C	+-+C	+++C	+++C	+++C	+++C	+++C
4	Fungus multiplied on sterilised host pieces and mixed in soil	A	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C
		B	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C	+++C
5	Wilted plants from wilt sick plot	A	+++C	+++C	+++C	+++C												
		B	+++C	+++C	+++C	+++C												
6	Field soil (wilt sick)																	
	BIL 2C		1417	1167	1367	1315												
	BUS 98		1217	1167	1700	1417												

* Experiment started on 2-5-88

Treatments 1, 2 and 6 = No of Fusarium propagules/g^{-1} soil

Treatments 3,4 and 5 = tissue disintigrated but pathogenic on susceptible host

+ Fusarium present/pathogenic; - Fusarium absent

A. Field soil; B. Sterilised soil; C. Host tissues disintigrated.

1= 1.8.89; 2= 1.11.89; 3= 1.2.90; 4=1.5.90 (Dates of samples collected).

Table 17. Effect of agronomic management and soil solarization on *Fusarium* propagules in chickpea wilt sick plot, ICRISAT Center, Patancheru during 1989-90.

Treatment	No. of *Fusarium* propagules g^{-1} soil	
	Before solarization	After solarization
F.D.O. Practice: ploughing in April-May	1034	1421
Four times irrigation followed by four time ploughing	1038	1408
Ploughing in October before planting	1179	1425
Solarization during April-May	1049	308
SE ±	139.2	34.2
CV (%)	25.9	6.0

Table 18. Periodic isolations from wilted/dried plants collected from multiple disease sick plot[a].

Date	F. oxysporum f.sp. ciceri	R. bataticola	S. rolfsii	F. solani	R. solani	Sterile fungus	Others
28-11-89	83.0	2.0	5.0	-	-	-	-
18-12-89	55.0	37.0	-	3.0	-	-	-
8-1-90	45.0	42.0	2.0	-	3.0	2.0	-
29-1-90	56.0	39.0	1.0	-	1.0	1.0	-
19-2-90	48.0	52.0	-	-	-	-	-

a Figures are percentage of isolations.

Date of planting 25-10-1989,
Date of irrigation 7-11-1989, 12-12-1989

Table 19. Reaction of chickpea lines developed at ICRISAT to wilt and root rots in multiple disease sick plot, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particular	Percent*	
		Wilt	Root rots
1	ICCV 10	80.3 (64.0)	19.7 (26.0)
2	ICCV 15	90.1 (72.2)	9.9 (17.7)
3	ICCV 18	90.0 (76.7)	10.0 (13.3)
4	ICCV 19	75.6 (62.5)	24.4 (27.5)
5	ICCV 88101	4.4 (8.6)	9.4 (16.6)
6	ICCV 88102	100.0 (90.0)	0.0 (0.0)
7	ICCV 88103	76.3 (68.2)	23.7 (21.8)
8	ICCV 88104	50.1 (45.1)	49.9 (44.9)
9	ICCV 88105	73.7 (59.3)	26.3 (30.7)
10	ICCV 88106	79.7 (70.2)	20.3 (19.8)
11	ICCV 88107	89.2 (76.1)	10.8 (13.9)
12	ICCV 88108	94.7 (80.5)	5.3 (9.5)
13	ICCV 88109	86.1 (68.8)	13.9 (21.2)
14	ICCV 88110	90.4 (72.0)	9.6 (18.0)
15	ICCV 88112	91.3 (77.6)	8.7 (12.4)

S.No.	Particular	Percent*	
		Wilt	Root rote
16	ICCV 89244	73.2 (59.6)	26.8 (30.4)
17	ICCV 89344	57.0 (49.9)	37.7 (36.8)
18	ICCV 89444	88.7 (75.8)	11.3 (14.2)
19	ICCV 89445	100.0 (90.0)	0.0 (0.0)
20	ICCC 14	100.0 (90.0)	0.0 (0.0)
21	ICCC 37	35.4 (36.4)	42.8 (40.8)
22	ICCC 38	92.9 (78.9)	3.5 (7.7)
23	ICCC 41	100.0 (90.0)	0.0 (0.0)
24	ICCC 42	67.5 (56.1)	32.5 (33.9)
25	ICC 4951 (Control)	100.0 (90.0)	0.0 (0.0)
	SE±	(10.24)	(9.89)
	CV%	(21.2)	(76.5)

* Average of 2 replications

The figures in the parentheses are after angular transformation

Table 20. Reaction of wilt promising chickpea lines to wilt and root rots in multiple disease sick plot, ICRISAT Center, Patancheru, during 1989-90.

Sl. No.	Entry	Percent*	
		Wilt	Root rots
1	ICCV 2	38.7 (38.2)	31.2 (33.4)
2	ICCV 3	63.7 (60.8)	36.4 (29.3)
3	ICCV 4	49.7 (44.8)	9.9 (29.7)
4	ICCV 5	93.0 (75.3)	7.0 (14.7)
5	ICCC 32	24.7 (26.5)	32.0 (30.8)
6	ICCC 33	27.2 (28.5)	19.5 (25.7)
7	ICCC 38	46.8 (37.6)	10.4 (13.6)
8	ICCC 40	4.2 (8.5)	2.9 (9.9)
9	ICCC 42	43.6 (41.3)	25.0 (29.7)
10	ICCC 43	65.1 (54.1)	35.0 (35.9)
11	ICCC 44	19.2 (26.0)	34.8 (36.1)
12	ICCC 45	40.5 (39.4)	47.7 (43.7)
13	ICC 11313	17.0 (17.8)	12.5 (19.9)
14	ICC 11315	55.8 (48.4)	40.0 (39.1)
15	ICC 11316	9.1 (12.6)	15.6 (23.0)

Sl. No.	Entry	Percent'	
		Wilt	Root rots
17	ICC 11320	31.8 (26.4)	17.8 (22.8)
18	ICC 11324	87.0 (69.1)	12.9 (20.9)
19	ICC 12236	2.4 (6.3)	6.2 (13.9)
20	ICC 12237	98.1 (84.4)	1.9 (5.6)
21	ICC 12239	0.0 (0.0)	6.4 (14.1)
22	ICC 12241	0.0 (0.0)	8.6 (16.1)
23	ICC 12242	43.3 (39.5)	17.6 (24.6)
24	ICC 12245	14.4 (22.4)	32.2 (34.5)
25	ICC 12249	15.4 (16.9)	33.2 (33.2)
26	ICC 12255	63.6 (53.0)	34.4 (33.5)
27	ICC 12256	33.3 (27.4)	19.7 (24.8)
28	ICC 12257	14.3 (8.6)	21.9 (26.4)
29	ICC 12258	2.6 (9.0)	4.6 (12.4)
30	ICC 12259	15.6 (19.9)	7.9 (15.3)
31	ICC 12268	39.1 (31.1)	9.9 (17.2)
32	ICC 12269	25.0 (22.5)	30.8 (32.4)

Sl. No.	Entry	Percent' Wilt	Root rots
33	ICC 12270	16.4 (17.5)	24.4 (27.1)
34	ICC 12271	44.6 (22.4)	13.8 (21.6)
35	ICC 12273	15.0 (16.9)	24.2 (28.6)
36	ICC 12274	5.2 (25.3)	17.1 (21.7)
37	ICC 12275	34.7 (28.2)	18.5 (24.8)
38	ICC 12428	67.3 (63.0)	23.1 (21.4)
39	ICC 12430	92.0 (78.2)	4.0 (8.2)
40	ICC 12435	39.4 (37.5)	26.4 (30.6)
41	ICC 12437	36.4 (33.9)	15.4 (22.3)
42	ICC 12440	1.5 (5.0)	2.1 (5.9)
43	ICC 12444	13.2 (15.4)	22.8 (28.2)
44	ICC 12450	2.0 (5.8)	4.8 (9.0)
45	ICC 12452	53.1 (46.7)	40.6 (39.5)
46	ICC 12454	0.6 (3.3)	5.2 (12.7)
47	ICC 12460	0.0 (0.0)	7.1 (13.8)
48	ICC 12467	0.7 (3.4)	4.8 (12.6)

Sl. No.	Entry	Percent	
		Wilt	Root rots
49	ICC 12470	40.2 (31.8)	14.3 (21.8)
50	ICC 12471	0.0 (0.0)	6.9 (14.5)
51	ICC 12472	0.8 (3.50)	10.2 (18.6)
52	ICC 14303	1.5 (5.0)	8.2 (15.6)
53	ICC 14374	0.0 (0.0)	3.0 (9.5)
54	ICC 14396	5.7 (9.8)	41.0 (38.9)
55	ICC 14411	0.6 (3.3)	6.4 (14.4)
56	ICC 14425	0.7 (3.4)	3.9 (11.3)
57	ICC 14426	0.0 (0.0)	5.5 (9.6)
58	ICC 14440	4.0 (8.2)	15.0 (22.6)
59	ICC 14442	0.0 (0.0)	5.0 (12.8)
60	ICC 14444	1.8 (5.5)	7.8 (16.0)
61	ICC 14447	26.3 (30.7)	42.5 (40.5)
62	ICC 14449	0.6 (3.3)	3.4 (10.6)
63	ICC 14450	63.1 (52.9)	23.5 (28.4)

Sl. No.	Entry	Percent* Wilt	Root rots
64	ICC 4951 (Control)	100.0 (90.0)	0.0 (0.0)
	SE±	(12.61)	(8.22)
	CV%	(69.2)	(53.3)

* Average of 2 replications

The figures in the parantheses are.after angular transformation.

Table 21. Reaction of advanced germplasm lines to wilt and root rots in multiple disease sick plot, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Entry	Percent *		
		Field screening		Pot screening
		Wilt	Root rots	Wilt
1	ICC 12989	2.7 (9.3)	14.8 (22.2)	0.0
2	ICC 13099	29.4 (28.3)	24.2 (28.8)	35.0
3	ICC 14196	4.6 (8.8)	18.0 (24.9)	NG
4	ICC 14216	0.0 (0.0)	11.6 (14.4)	10.0
5	ICC 14303	1.3 (4.7)	1.1 (4.3)	0.0
6	ICC 14309	1.3 (4.7)	8.9 (15.4)	0.0
7	ICC 14516	0.0 (0.0)	10.8 (19.1)	45.0
8	ICC 14528	1.9 (5.5)	8.1 (15.8)	6.3
9	ICC 14532	2.5 (6.5)	11.4 (19.7)	6.3
10	ICC 14619	9.4 (16.4)	32.3 (31.7)	0.0
11	ICC 14631	2.8 (6.8)	12.9 (20.2)	0.0
12	ICC 14671	67.0 (56.1)	32.4 (33.8)	25.0
13	ICC 14680	29.3 (25.0)	24.7 (28.2)	0.0
14	ICC 14681	28.3 (24.4)	22.6 (24.3)	0.0

S.No.	Entry	Percent *		
		Field screening		Pot screening
		Wilt	Root rots	Wilt
15	ICC 14691	48.9 (44.3)	42.9 (40.8)	0.0
16	ICC 14710	86.8 (68.7)	13.2 (21.3)	0.0
17	ICC 14730	5.9 (13.6)	9.5 (17.1)	10.0
18	ICC 14734	1.7 (5.2)	14.6 (21.9)	0.0
19	ICC 14735	2.2 (6.0)	1.4 (6.6)	37.7
20	ICC 14751	20.1 (24.0)	35.7 (34.6)	0.0
21	ICC 14762	46.1 (42.7)	49.1 (44.5)	0.0
22	ICC 14764	31.1 (26.0)	19.1 (23.5)	0.0
23	ICC 14765	48.7 (44.2)	51.3 (45.8)	0.0
24	ICC 14795	16.2 (20.2)	28.7 (31.2)	0.0
25	ICC 14853	0.0 (0.0)	5.2 (13.1)	0.0
26	ICC 14904	27.6 (24.0)	25.9 (28.6)	15.5
27	ICC 15026	37.6 (37.8)	39.7 (39.0)	5.5
28	ICC 15068	33.2 (30.3)	20.6 (25.3)	15.0
29	ICC 15075	68.8 (58.5)	31.2 (31.5)	0.0
30	ICC 15081	50.0 (45.0)	0.0 (0.0)	13.8

S.No.	Entry	Percent *		
		Field screening		Pot screening
		Wilt	Root rots	Wilt
31	ICC 15090	71.6 (61.1)	28.4 (28.9)	0.0
32	ICC 15094	79.8 (63.3)	20.1 (26.6)	20.0
33	ICC 15105	42.8 (33.8)	10.0 (18.7)	0.0
34	ICC 15108	48.9 (40.6)	4.9 (12.4)	0.0
35	ICC 15125	0.8 (3.5)	7.2 (15.3)	38.6
36	ICC 15127	0.7 (3.4)	4.3 (8.5)	28.3
37	ICC 15133	0.0 (0.0)	12.4 (20.1)	10.0
38	ICC 15135	20.9 (23.8)	30.8 (31.5)	13.6
39	ICC 15140	68.0 (56.6)	27.5 (30.2)	0.0
40	ICC 15146	22.4 (21.0)	30.5 (31.0)	11.1
41	ICC 15166	1.6 (7.3)	8.7 (16.7)	0.0
42	ICC 15167	0.0 (0.0)	9.1 (17.5)	0.0
43	ICC 15168	47.7 (43.5)	50.5 (45.3)	0.0
44	ICC 15178	0.8 (3.6)	3.8 (11.1)	0.0
45	ICC 15228	3.9 (8.2)	18.8 (25.1)	25.0

S.No.	Entry	Percent *		
		Field screening		Pot screening
		Wilt	Root rots	Wilt
46	ICC 15229	14.9 (22.1)	35.4 (36.0)	19.2
47	ICC 15230	1.9 (5.5)	16.1 (23.0)	7.1
48	ICC 15233	0.0 (0.0)	8.3 (16.7)	55.0
49	ICC 15236	1.9 (5.6)	6.4 (13.3)	35.0
50	ICC 15242	52.8 (51.8)	6.2 (10.3)	0.0
51	ICCL 87401	75.0 (67.5)	21.6 (20.6)	66.8
52	ICCL 87406	39.7 (31.5)	13.5 (20.8)	57.2
53	ICCL 87409	70.6 (58.9)	29.4 (31.1)	100.0
54	ICCL 87411	49.9 (44.9)	11.8 (20.1)	65.1
55	ICCL 87419	78.8 (69.7)	20.6 (20.0)	77.2
56	ICCL 87421	28.0 (31.7)	55.0 (47.9)	53.3
57	ICCL 87428	77.8 (69.1)	18.5 (18.7)	100.0
58	ICCL 87438	49.0 (44.2)	25.1 (29.6)	58.5
59	ICCX 80055-20BH 25H-BWR-BH	81.4 (64.4)	16.2 (23.7)	34.9
60	ICCV 10	34.4 (31.4)	23.7 (28.6)	27.2
61	ICCV 15	70.2 (57.5)	22.0 (27.8)	64.0

S.No.	Entry	Percent *		
		Field screening		Pot screening
		Wilt	Root rots	Wilt
62	ICCV 88103	95.5 (81.3)	4.4 (8.7)	55.0
63	ICCX-800743-2PLB-IPWR-IWLB-BHLB-HWR-BH	45.3 (40.3)	8.4 (12.1)	100.0
64	ICCX-800550-28BH-24H-BWR-BH	100.0 (90.0)	0.0 (0.0)	41.5
65	ICCX-800550-29BH-4H-BWR-BH	56.3 (55.4)	22.5 (21.1)	38.9
66	ICCX-800550-29BH-7H-BWR-BH	90.0 (76.7)	6.0 (10.1)	26.6
67	ICCX-800550-32BH-31H-BWR-BH	100.0 (90.0)	0.0 (0.0)	47.8
68	ICCX-800550-32BH-47H-BWR-BH	86.2 (74.1)	1.5 (5.1)	44.4
69	ICCX-800550-33BH-31H-BWR-BH	80.9 (70.9)	13.6 (15.7)	39.4
70	ICCX-800550-40BH-27H-BWR-BH	85.0 (73.4)	7.8 (11.7)	38.2
71	ICCX-800550-43BH-32H-BWR-BH	100.0 (90.0)	0.0 (0.0)	52.6
72	ICCX-800550-44BH-21H-BWR-BH	91.1 (77.5)	3.7 (7.9)	76.7
73	ICCX-800550-44BH-29H-BWR-BH	100.0 (90.0)	0.0 (0.0)	67.5
74	ICCX-810970-BH-BW-70H-1H-1H-1H-BH	100.0 - (90.0)	0.0 (0.0)	95.0
75	ICCX-830697-4H-1H-BH	54.3 (49.7)	15.7 (21.4)	90.0
76	ICC 4951 (Control)	100.0 (90.0)	0.0 (0.0)	100.0

S.No.	Entry	Percent *		
		Field screening		Pot screening
		Wilt	Root rots	Wilt
	SE ±	(15.64)	(9.76)	
	CV %	(59.0)	(66.9)	

* Average of 2 replications
Figures in parentheses are after angular transformation

Table 22. Reaction of promising wild Cicer species to wilt ant root rots in multiple disease sick plot, ICRISAT center, Patancheru, during 1989-90.

S.No.	Entry	Percent *	
		Wilt	Root rots
1	C. bijugum No. 200	29.8 (32.5)	18.3 (25.2)
2	C. bijugum No. 201	21.3 (20.4)	50.5 (45.4)
3	C. bijugum JM. 2113	18.8 (25.4)	18.8 (25.4)
4	C. reticulatum 205	100.0 (90.0)	0.0 (0.0)
5	C. judaicum 182	6.4 (14.0)	43.2 (40.7)
6	C. judaicum 183	4.9 (9.1)	8.6 (16.7)
7	C. judaicum 185	2.4 (8.9)	10.0 (19.1)
8	C. judaicum 0	1.3 (4.5)	22.2 (28.0)
9	C. pinnatifidum 188	17.1 (24.2)	17.0 (24.3)
10	C. cuniatum SL. 157	1.7 (5.3)	1.7 (5.3)
11	ICC 4951 (Control)	100.0 (90.0)	0.0 (0.0)
	SE ±	(7.9)	(7.79)
	CV %	(37.9)	(52.7)

* Average of 2 replications
The figures in parentheses are after angular transormation.

Table 23. Effect of fungicides on collar rot (*Sclerotium rolfsii*) incidence of chickpea in glass house experiments, ICRISAT Center, Patancheru, 1989-90.

	Captan 75 WP percent[a]		Rizolex 50 WP percent[a]		Thirm 75 WP percent[a]		Thirum+Rizolex 1:1 w/w percent[a]		Control percent[a]	
Cultivar	1	2	1	2	1	2	1	2	1	2
Annigeri	80.0 (66.3)	100.0 (90.0)	92.5 (77.4)	32.4 (34.6)	58.3 (49.9)	100.0 (90.0)	91.7 (73.6)	46.4 (42.4)	36.3 (36.0)	100.0 (90.0)
ICCC 32	97.5 (82.5)	95.6 (82.9)	93.3 (76.3)	33.2 (35.1)	66.8 (54.4)	100.0 (90.0)	84.2 (67.0)	40.1 (39.2)	46.3 (44.3)	100.0 (90.0)

	Cult		Fungicides		Cult x Fungicides	
	1	2	1	2	1	2
S.E. +	(0.8)	(1.466)	(3.52)	(1.912)	(4.52)	(2.829)
C.V. (%)	(2.2)	(3.7)	-	-	(13.7)	(6.7)

[a] Average of 3 replications, 1=Germination, 2=Collar rot
The figures in the parentheses are after angular transformation.

Project: LC 229(90)IC/IC

Title: Biology and Management of foliar diseases of chickpea

Objectives:

a. Testing of chickpea germplasm and breeding materials for ascochyta blight and gray mold resistance in cooperation with NARs.

b. Germplasm enhancement for ascochyta blight resistance.

c. Study epidemiology, ecology and variability in Ascochyta rabiei.

d. Develop integrated management system for control of chickpea ascochyta blight and botrytis gray mold.

e. Cooperate with NARs and scientists in developed countries to understand the variability and mechanism of resistance in ascochyta blight of chickpea.

SUMMARY

1. Screening for ascochyta blight resistance: The experiments at HAU-ICRISAT cooperative ascochyta blight nursery were carried out in cooperation with Dr. B.L. Jalali, Professor, and Dr. Harichand, Department of Plant Pathology, HAU, Hisar. A total of 391 breeding lines in 1295 rows (Table 24) were screened in ascochyta blight nursery. Susceptible check pb 7 planted all around and within the nursery was killed. In this nursery, 1 breeding line had a disease rating of 3 and 46 breeding lines had a rating of 5 on 1-9 disease rating scale (Table 25).

2. Confirmation of ascochyta blight resistance of 11 breeding and germplasm lines screened in earlier years: Ten resistant breeding lines and 1 germplasm accession were screened in large size plot to confirm their resistance to ascochyta blight and yield potential. Three lines, namely, ICCX 810800, (C44 x ICG 1772), and E 100Y (m) showed disease rating of 3, others had a rating of 5 (Table 26).

3. Integrated control of ascochyta blight: In collaboration with HAU, a field trial on integrated control of ascochyta blight with host plant tolerance and foliar sprays (2-5 sprays) of Daconil (Bravo W.P. 75) was conducted at Hisar. The trial was artificially inoculated. The varieties used were moderately susceptible, Gaurav (H75-35) and susceptible H 208. The fungicide, daconil was sprayed 2 to 5 times. The data on H 208 was not collected because plant stand was extremely poor. The disease score for Gaurav was 5 in both sprayed and unsprayed plots. There was not much increase in yield irrespective of the number of sprays (2 to 5 sprays) of daconil (Table 27).

4. **Multiplication testing for ascochyta blight resistance:** Thirty chickpea entries from ascochyta blight nursery (ABN) were screened in the fields at Hisar, Ludhiana, Sriganganagar and Delhi. At Hisar, 9 entries were rated 3 on 1-9 point scale. At Ludhiana 5 entries were rated 3 to 3.5 and at Sriganganagar 14 entries were rated 3 to 3.5. At Delhi 7 entries were rated 2.5 and 5 entries were rated 3 to 3.5 (Table 28). Several entries showed resistance at 2 or 3 locations. However in plant growth room screening at ICRISAT center all were found susceptible to ascochyta blight.

5. **Reaction of entries from botrytic gray mold nursery to ascochyta blight:** Of the 32 entries tested, only ICC 1069 was found moderately resistant (rating 5) in the field screening. However in plant growth room screening all were found susceptible to ascochyta blight (Table 29).

6. **Ascochyta blight studies in plant growth room:** Several experiments were conducted to study the reactions of chickpea lines collected from different sources to Ascochyta rabiei isolates in plant growth room. The objects of these experiments were to identify high level of resistance, differentiate chickpea lines on the basis of their reactions to different isolates and study pathogenic variation in A. rabiei. In these experiments, 10-day-old chickpea seedlings raised in plastic trays/pots were inoculated with a spore suspension (200 x 10^4/ml) prepared from 15-day-old cultures of A. rabiei. In the plant growth room, the temperature, 20-22°C and relative humidity 80-90 % was maintained. The disease rating (on 1-9 poing scale) was done 15 days after inoculation.

7. **Reaction of chickpea breeding materials to ascochyta blight:** Chickpea breeding materials which included ICCC 32 and ICCV 2 mutants, F2 population and F3 to F7 progenies were screened in plant growth room. Plants showing resistant reactions to ascochyta blight were transplanted in the field to obtain seeds (Table 30).

8. **Screening of chickpea lines for resistance to two isolates of A. rabiei:** One hundred and forty six chickpea lines reported resistant to ascochyta blight at various locations, were found susceptible to two isolates of A. rabiei in growth room screening (Table 31). One hundred and thirty one chickpea lines were also found susceptible to 'Hisar' isolate (Table 32). Twenty two chickpea entries from CVT-AB 1989-90 were found susceptible to ascochyta blight (Table 33) in plant growth room screening.

9. **Pathogenic variability in Ascochyta rabiei:** Sixteen chickpea lines used as differentials to identify races in A. rabiei were studied for their reaction to 4 isolates in controlled environment. Observations were recorded 4,6,8 and 10 days after inoculation. Differences in blight reaction to

isolates were observed at 4 and 6 days after inoculation. However 10 days incubation period resulted in susceptible reaction of all the lines to 4 isolates (Table 34). Another set of experiment in the glass house, however resulted in slow disease reaction due to the fluctuation in temperature in glass house and low RH during incubation period (Table 35). Such results should be used with caution, since ascochyta blight is influenced by environment. Disease reactions of the cultivars were considerably influenced by the environment. Reaction of seventy six chickpea lines reported resistant from India and Syria were studied against 5 isolates of A. rabiei in control conditions. Several of these lines were used to differentiate races in A. rabiei. In the present experiment the degree of differences in disease reactions were not sufficient to classify these isolates into races. There was no differential reaction. The degree of pathogenicity has varied without significant reversals in the ranking orders of the cultivars (Table 36).

10. Reaction of Cicer species to ascochyta blight: Twenty seven lines were screened for their reaction to 'IARI' isolate of A. rabiei in growth room. All the lines were found susceptible (Table 37).

11. The field experiments on botrytis gray mold of chickpea were carried out in cooperation with Drs. Y.P.S. Rathi and H.S. Tripathi of Department of Plant Pathology, College of Agriculture, GBPUAT, Pantnagar.

    A total of 332 breeding lines (Table 38) in 652 rows (2m) were screened in GBPUAT-ICRISAT Cooperative Botrytis Gray Mold Nursery at Pantnagar. In this nursery, the susceptible check, H 208 was planted all around and within the nursery. The season was very favourable for botrytis disease development, and the susceptible check showed 9 rating in the nursery. In the nursery, 6 breeding lines scored a rating of 3 and 2 breeding lines a rating of 4 (Table 39) on a 1-9 point rating scale.

12. Integrated control of botrytis gray mold: A field trial was conducted for second successive year on the combined effect of host plant tolerance, wider row spacing and Ronilan spray on botrytis gray mold. The trial was artificially inoculated. Ronilan sprays reduced the disease severity. Wider row spacing decreased disease severity and increased yield (Table 40).

13. Multilocation testing for botrytis gray mold resistance: Thirty two entries from botrytis gray mold nursery 1989-90 were screened at Pantnagar (India) and Rampur (Nepal) in the field and at ICRISAT Center in plant growth room. Only one entry ICC 1069 was scored 5 at Pantnagar and 5.5 at Rampur. However in plant growth room screening, all entries were found susceptible to BGM (Table 41).

14. Screening of entries from chickpea ascochyta blight nursery (CABN) 1989-90 to botrytis gray mold of Pantnagar: Of the 30 entries from CABN 1989-90 tested in BGM nursery, 5 entries namely, ILC 3274, ICC 1069, ICCX 800859-BPN, ICCX 81737-BPN and ICCX 830677-10H-BH-BH were found promising (Table 42).

15. Screening for botrytis gray mold resistance in plant growth room: Over 400 lines reported resistant/tolerant in field screening were screened in seedling stage (15-day-old) in plant growth room. Seedlings were inoculated with spore suspension (20×10^4/ml). They were incubated for 15 days at 25°C with relative humidity ranging from 70 to 90%. All the lines were found susceptible (Table 43).

Table 24. Chickpea breeding lines evaluated in HAU-ICRISAT Cooperative Ascochyta blight nursery at Hisar during 1989-90 (Row length 2.5 m at 0.30 m row to row spacing, plot size variable).

Type of material		No. of breeding lines	Remarks
HI 028	F3 TWC-HYWR, ABR, STR, HR (Desi)	3	20 rows
HI 030	F3 TWC-HY with WR, ST, ABR, HR (Desi)	2	20 rows
HI 033	F3 TWC, HY, WR, ST, HR, ABR (Desi)	5	20 rows
HI 035	F3 populations (Desi)	3	Variable # of rows
HI 043	F4 progenies (Desi)	58	1 row
HI 062	F5 prog. intermediate (Desi)	22	1 row
HI 130	F3 populations (Kabuli)	2	Variable # of rows
HI 071	F6 progenies HR III (Desi)	59	1 row
HI 080	F7 bulk prog. HR III (Desi)	53	1 row
HI 162	Germplasm I (Kabuli)	27	1 row
HI 101	PYT 13 (Desi)	36 x 2 reps	1 row
HI 106	PYT 18 (Desi)	14 x 2 reps	1 row
HI 155	PYT 5 (Kabuli)	7 x 2 reps	1 row
HI 126	F3, HY, WR, SS, ABR (Kabuli)	10	20 rows
HI 200	Diversified bulks I	2	26 rows
HI 086	Germplasm selections I (Desi)	31	1 row
HI 027B	F3 bulks (Desi)	57	Variable # of rows
	Total	391	1295 rows

Table 25. Chickpea breeding lines with a rating of 3 and 5 in ascochyta blight nursery (HAU-ICRISAT), Hisar, during 1989-90.

Experiment No.	Plot No.	Pedigree	Disease rating (1-9 scale)
HI 043 (F4 progenies)	3549	ICCX 860010-BP-3H	3
	3501	ICCX 860047-BP-1H	5
	3503	-2H	5
	3505	-5H	5
	3506	-6H	5
	3507	-7H	5
	3508	-8H	5
	3514	-14H	5
	3517	-17H	5
	3518	-18H	5
	3520	-20H	5
	3528	ICCX 860039-BP-3H	5
	3531	870019-BP-1H	5
	3532	-2H	5
	3533	-3H	5
	3534	-4H	5
	3535	-5H	5
	3536	ICCX 860006-BP-1H	5
	3537	-2H	5
	3540	-5H	5
	3545	ICCX 860011-BP-4H	5
	3546	-5H	5
	3555	ICCX 860029-BP-4H	5
	3556	-5H	5
	3557	ICCX 860027-BP-1H	5
	3558	-2H	5
HI 101 (PYT 13 material) (a replicated trial, 2 reps)	122, 203 (Ent 2)	ICCX 860006-BP-2P-BP-BH	5
	118, 224 (Ent 7)	860009-BP-3P-BP-BH	5
	124, 210 (Ent 10)	860010-BP-2P-BP-BH	5
	103, 205 (Ent 16)	860027-BP-BP-BP-3P-BH	5
	126, 214 (Ent 17)	860027-BP-BP-4P-BH	5

Experiment No.	Plot No.	Pedigree	Disease rating (1-9 scale)
HI 101 (PYT 13 material) (a replicated trial, 2 reps)	114, 216 (Ent 17)	860047-BP-2H-BP	5
	105, 220 (Ent 27)	860047-BP-6H-BP	5
	102, 205 (Ent 29)	860047-BP-9H-BP	5
	109, 201 (Ent 33)	860047-BP-16H-BP	5
	117, 212 (Ent 36)	H 86-96	
HI 106 (PYT 18 material) (a replicated trial, 2 reps)	107, 201 (Ent 2)	790151-2P-1H-2H-1H-1HWR-BH-BP	5
	104, 204 (Ent 3)	810974-BH-BW-56H-1H-1HWR-BH-BP	5
	106, 211 (Ent 4)	860047-BP-5H-BP	5
	102, 214 (Ent 5)	860047-BP-10H-BP	5
	103, 205 (Ent 7)	860047-BP-14H-BP	5
	108, 206 (Ent 8)	860047-BP-20H-BP	5
	110, 213 (Ent 12)	800842-BPN-BPN-BPN-BPN-BPN-1H-BH	5
	113, 202 (Ent 14)	Gaurav (or) H 75-35	5
HI 086	31621	FLIP 85-37	5
	31629	PK 51863 x NEC 138-2	5
	31630	PK 51825 x CM 72	5

Table 26. Pedigree and parentage of chickpea breeding lines resistant to ascochyta blight planted in 'demonstration block' in HAU-ICRISAT Ascochyta blight nursery, Hisar, during 1989-90 season.

Sr. No.	Pedigree	Parents	Disease rating on 1-9 scale	Year of earlier screening
1.	ICCX 800839-BPN-BPN-BPN-BPN-BPN-1H	BG 209 x JM 593	5	1987/88
2.	ICCX 800842-BPN-BPN-BPN-BPN-BPN-1H	K 850 x NEC 123	5	1987/88
3.	ICCX 810800-3H-BW-BH-1H-1H-BH	GL 629 x ILC 202	3	1986/87, 1987/88
4.	ICCX 790151-2P-1H-1H-2H-1H-1H-1HWR-BH	Pant G 114 x JM 584	5	1988/89
5.	ICCX 810974-BH-BW-56H-1H-1H-1HWR-BH	G 130 x H 75-35	5	1988/89
6.	ICCX 860023-BP-BP-BP-3P	ICCX 860021 x ICCX 860022	5	1988/89
7.	(C 44 x ICC 1772)-B8-11P-1H-1H-BH	(C 44 x ICC 1772)	3	1987/88, 1988/89
8.	ICCX 810737-BPN-BPN-BPN-3PN-BH	(GL 769 x P 919)	5	1987/88, 1988/89
9.	ICCX 830997-10H-BP-BH	(ICC 10 x H 75-35)	5	1987/88, 1988/89
10.	ICCX 810976-BH-BH-BW-14H-1H-BH-BH	(C 235 X H 75-35)	5	1987/88, 1988/89
11.	E 100 Y (m)		3	Past 6 years
12.	Pb 7 (Control)		9	--
13.	WR 315 (Control)		9	--

Table 27. Efficacy of Deconil for the control of chickpea ascochyta blight, ICRISAT subcenter, HAU, Hisar, during 1989-90[1].

Treatment	Ascochyta blight score					Pod yield (gms)[2]					Yield kg ha^{-1}
	R1	R2	R3	R4	Mean	R1	R2	R3	R4	Mean	
No spray	5	7	5	5	5.5	80	85	65	72	75.5	167
2 sprays	5	5	5	5	5.0	245	250	235	230	240.0	533
3 sprays	5	4	5	5	4.75	240	270	285	245	260.0	577
4 sprays	5	4	5	5	4.75	240	270	285	245	260.0	577
5 sprays	5	4	3	5	4.25	260	280	290	270	275.0	610
			SE ±		0.374						14.3
			CV (%)		15.4						5.7

Plot size: 2.5 m row length x 6 rows at 0.30 m spacing.

Date of inoculation: 11.2.90
Date of 1st spray : 13.2.90
Date of 2nd spray : 23.2.90
Date of 3rd spray : 5.3.90
Date of 4th spray : 15.3.90
Date of 5th spray : 25.3.90

1=Cultivar Gaurav; 2=Plot size=2.5 x 1.8 m

Table 28. Reaction of entries from chickpea Ascochyta blight nursery 1989-90 at different locations during 1989-90.

S.No.	Entry	Disease rating on 1-9 scale			
		Hisar	Ludhiana	New Delhi	Sriganga nagar
1.	ICC 1069	3.0	4.5	6.0	3.0
2.	ILC 72	4.0	4.5	2.5	3.0
3.	ILC 182	5.0	4.0	3.0	4.0
4.	ILC 187	4.0	5.0	3.5	3.5
5.	ILC 194	5.0	5.0	4.0	4.0
6.	ILC 195	6.0	4.5	5.0	3.0
7.	ILC 198	-	4.5	4.0	3.0
8.	ILC 200	5.0	4.0	3.0	3.0
9.	ILC 202	3.0	4.5	5.0	4.0
10.	ILC 249	-	5.0	7.0	7.0
11.	ILC 482	-	5.0	3.0	6.5
12.	ILC 2380	4.0	4.5	2.5	3.5
13.	ILC 2956	3.0	4.5	7.0	3.5
14.	ILC 3274	3.0	3.5	-	4.5
15.	ILC 3856	4.0	3.5	4.0	4.0
16.	ILC 3864	3.0	5.0	2.5	3.5
17.	ILC 3866	5.0	4.0	2.5	4.0
18.	ILC 3870	3.0	4.0	2.5	4.0
19.	ILC 4421	4.0	4.0	3.0	4.5
20.	MCK 54	3.0	4.5	5.0	4.0
21.	Flip 82-1C	4.0	4.5	2.5	5.0
22.	Flip 83-47	3.0	5.0	4.5	3.0
23.	ICCL 86446	9.0	7.5	7.0	9.0
24.	ICCL 86447	5.0	3.5	2.5	3.5
25.	ICCX-790151-2P-1H-1H-2H-1H-1HWR-BH	4.0	3.0	4.5	3.0
26.	ICCX-800859-BPN-BPN-BPN-BPN-3BPN-1HWR-BH	4.0	4.5	6.5	3.0
27.	ICCX-810457-3H-1H-1H-1HWR-BH	5.0	3.5	5.5	4.5
28.	ICCX-81737-BPN-BPN-BPN-3PN-BH	3.0	4.5	9.0	4.0
29.	ICCX-810974-BH-BN-56H-1H-1H-1HWR-BH	5.0	4.0	8.0	4.5
30.	ICCX-830677-10H-BH-BH	6.0	5.5	7.0	3.5
31.	Pb 7 (Control)	9.0	9.0	9.0	8.0-9.0

Table 29. Screening of chickpea entries from Botrytis Gray Mold Nursery (BGMN) (1989-90) to *Ascochyta blight* at Hisar during 1989-90.

S.No.	Particulars	Disease rating on 1-9 scale
1	ICC 1069	5
2	ICC 1894	9
3	ICC 1918	9
4	ICC 1931	9
5	ICC 2550	9
6	ICC 2595	9
7	ICC 2664	9
8	ICC 3075	9
9	ICC 3099	9
10	ICC 3208	9
11	ICC 4105	9
12	ICC 6827	9
13	ICC 8630	9
14	ICC 9033	9
15	ICC 11223	9
16	ICC 11324	9
17	ICCC 4	9
18	ICCV 5	9
19	ICCV 11	9
20	ICCL 83149	9
21	ICCL 83128	9
22	ICCL 85405	9
23	ICCL 86215	9
24	ICCL 86224	9
25	ICCL 86226	9
26	ICCL 86237	9
27	ICCL 86242	9
28	ICCL 86326	9
29	ICCL 86332	9
30	Dhanush	9
31	Pant G-114	9
32	Pusa - 256	9
33	Pb 7 (Control)	9

Table 30. Chickpea breeding materials screened for ascochyta blight resistance in plant growth room, ICRISAT Center, Patancheru, during 1989-90.

Particulars	No. of plants selected
Mutation Material	
1. M3 ICCC-32 15 KR	
2. M3 ICCC-32 30 KR	
3. M3 ICCC-32 30 KR S.P.	1
4. M3 ICCC-32 45 KR S.P.	
5. M4 ICCC-32 15 KR S.P.	10
6. M4 ICCC-32 30 KR S.P.	4
7. M4 ICCC-32 30 B	8
8. M4 ICCC-32 45 KR	6
9. M4 ICCC-32 30 KR S.P.	8
10. M4 ICCV-2 0 KRLL	
11. M4 ICCV-2 15 KRLL	4
12. M4 ICCV-2 30 KRLL	
13. M4 ICCV-2 45 KRLL	4
F2 Populations	
1. C-235 X NEC 138-2	2
2. C-235 X ICC 1903	
3. C-235 X ILC 3279	
4. C-141 X PDG-82-1	
5. E 100Y(M) X PDG-82-1	
6. ICC-1069 X ILC-202	
7. ICC-1903 X ICC 3996	
8. (C-235 X NEC-138-2) X C-235	
9. (C-235 X ICC-1903) X C-235	
10. (C-235 X ILC-3279) X C-235	1
11. (ICC-1069 X ILC 202) X (ICC-1903 X ICC-3996)	1
12. (C-235 X ICC 1903) X (C-235 X ILC 3279)	
13. (C-235 X NEC-138-2) X (C-235 X ILC-3279)	1
14. (C-235 X NEC-138-2) X (C-235 X ICC-1903)	2
15. (E 100Y(M) X PK line) X (ICC-1069 X ILC 202)	
16. (C-141 X Pant 82-1) X (ICC-1069 X ILC-202)	
17. (C-141 X Pant 82-1) x (E100Y(M) X PK 51825 X CM-72)	
18. (C-141 X Pant 82-1) X (ICC-1903 X ICC-3996)	
19. (E-100Y(M) X PK line) x (ICC-1903 X ICC-3996)	
F3 Progenies	
1. ICCX-870032 [(CP-324 X K-850) X ICC-10466] X (E-CM-1164-21-83 X ICC-42)	5
2. ICCX-870033 [D-1934-85 X (ICCX-750073 X BG-254)] X [(ICC-12237 X ICC 1069) X E 100Y]	5

Particulars			No. of plants selected
3.	ICCX-870034 [GNG-146 X (ICC-12237 X ICC-1069)] X [GL-83-119 X (L-132 X ICCL-85216)]		5
4.	C-235 X NEC 138-2		7
F4 Bulks			
1.	ICCX-860010	ICC-1069 X K-850	26
2.	ICCX-860029	(K-850 X Avarodhi) x (ICCC 42 X ICC 1069)	14
F5 Progenies			
1.	ICCX-86001	ICCC 42 X ICC 1237	-
2.	ICCX-86005	COG 2 X ICCV 2	2
3.	ICCX-86007	COG 2 X ICC 506	-
4.	ICCX-860010	ICC-1069 X K 850	32
5.	ICCX-860023	(ICCC-32 X Suritato 77)BC-7 x (ICC-6246 X Flip 83-30C)	5
6.	ICCX-860028	(PRR 1 X K 850) X (ICCC 32 X ICC 1069)	8
7.	ICCX-860029	(K 850 X ILC 151) X (ICC 12237 X ICC 506)	24
8.	ICCX-860085	(ICCC 32 X ILC 151) X (ICC 12237 X ICC 506)	
9.	ICCX-860086	(ICCC 32 X Suritato 77) x (ICC-6246 X Flip 83-30C)	12
F6 Progenies			
1.	ICCX 860027	ICCC 42 X ICC 1069	4
Hisar Material			
1.	Hi 04889 R	F5 progenies (1757 entries)	
2.	Hi 05389 R	F5 progenies (1130 entries)	
3.	Hi 06089 R	F5 progenies (147 entries)	

Particulars			No. of plants selected
4.	Hi 06789 R	F6 progenies (320 entries)	
5.	Hi 07689 R	F7 bulk progenies (59 entries)	
6.	Hi 08489 R	AYT/PYT entries (368 entries)	
7.	Hi 13789 R	F4 progenies Hy, BWR, ABR (26 entries)	
8.	Hi 14889 R	F5 progenies Hy, BWR, ABR WR + ST (64 entries)	
9.	Hi 16789 R	AYT/PYT entries (104 entries)	
Single plant selections (from growth room) 105			28

Table 31. Reaction of chickpea lines (reported resistant to ascochyta blight) to two isolates of Aschochyta rabiei in plant growth room, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Disease rating on 1-9 scale	
		IARI	Hisar
1	ICC 12	9.0	7.6
2	ICC 43	9.0	9.0
3	ICC 76	9.0	8.0
4	ICC 187	9.0	9.0
5	ICC 607	9.0	8.0
6	ICC 688	9.0	9.0
7	ICC 933	9.0	9.0
8	ICC 1087	9.0	8.0
9	ICC 1121	9.0	8.0
10	ICC 1136	9.0	8.6
11	ICC 1411	9.0	9.0
12	ICC 1415	9.0	8.3
13	ICC 1416	9.0	8.0
14	ICC 1466	9.0	8.6
15	ICC 1467	9.0	7.6
16	ICC 1468	9.0	8.0
17	ICC 1472	8.6	7.3
18	ICC 1532	9.0	8.0
19	ICC 1754	9.0	9.0
20	ICC 1762	9.0	8.3
21	ICC 1903	9.0	7.3
22	ICC 1915	8.3	7.3
23	ICC 2160	9.0	9.0
24	ICC 2162	9.0	8.3
25	ICC 2165	9.0	8.3
26	ICC 2191	9.0	9.0
27	ICC 2213	9.0	9.0
28	ICC 2237	9.0	8.6
29	ICC 2270	8.6	8.3
30	ICC 2278	9.0	8.3
31	ICC 2342	9.0	7.6
32	ICC 2360	9.0	9.0
33	ICC 2364	9.0	8.3
34	ICC 2372	9.0	8.6
35	ICC 2374	9.0	8.3
36	ICC 2390	9.0	9.0
37	ICC 2398	9.0	9.0
38	ICC 2411	NG	9.0
39	ICC 2499	9.0	8.3
40	ICC 2500	9.0	8.0
41	ICC 2552	9.0	9.0
42	ICC 2632	9.0	8.3

S.No.	Particulars	Disease rating on 1-9 scale	
		IARI	Hisar
43	ICC 2681	9.0	8.3
44	ICC 2737	9.0	8.3
45	ICC 2747	9.0	8.6
46	ICC 2779	9.0	7.6
47	ICC 2839	9.0	9.0
48	ICC 2891	8.6	8.0
49	ICC 2924	9.0	8.3
50	ICC 3114	9.0	8.6
51	ICC 3141	8.6	8.0
52	ICC 3221	8.0	7.3
53	ICC 3338	9.0	8.3
54	ICC 3340	9.0	9.0
55	ICC 3477	8.3	8.3
56	ICC 3481	9.0	8.6
57	ICC 3534	9.0	9.0
58	ICC 3592	9.0	9.0
59	ICC 3596	8.6	8.0
30	ICC 3597	9.0	9.0
31	ICC 3598	9.0	9.0
32	ICC 3599	9.0	8.3
33	ICC 3600	9.0	8.3
34	ICC 3605	9.0	8.6
35	ICC 3606	9.0	8.6
36	ICC 3610	9.0	7.6
37	ICC 3611	9.0	8.0
38	ICC 3614	8.3	7.6
39	ICC 3615	9.0	9.0
70	ICC 3616	9.0	8.0
71	ICC 3619	9.0	8.6
72	ICC 3624	7.3	7.6
73	ICC 3639	9.0	7.6
74	ICC 3640	9.0	7.6
75	ICC 3642	7.6	7.0
76	ICC 3687	8.0	8.3
77	ICC 3694	9.0	7.0
78	ICC 3832	9.0	8.0
79	ICC 3841	9.0	7.6
30	ICC 3842	9.0	8.0
31	ICC 3844	9.0	8.0
32	ICC 3846	9.0	8.3
33	ICC 3912	9.0	6.6
34	ICC 3916	9.0	6.3
35	ICC 3918	8.3	7.0
36	ICC 3919	8.6	7.3
37	ICC 3921	8.6	7.0
38	ICC 3932	8.0	6.6
39	ICC 3940	9.0	7.0
90	ICC 3996	8.3	6.6

S.No.	Particulars		Disease rating on 1-9 scale	
			IARI	Hisar
91	ICC	4033	9.0	8.3
92	ICC	4055	9.0	8.6
93	ICC	4061	9.0	8.6
94	ICC	4074	9.0	9.0
95	ICC	4075	9.0	9.0
96	ICC	4087	9.0	8.6
97	ICC	4092	9.0	9.0
98	ICC	4107	9.0	8.6
99	ICC	4192	9.0	8.0
100	ICC	4200	9.0	9.0
101	ICC	4208	9.0	8.6
102	ICC	4248	9.0	8.0
103	ICC	4294	9.0	8.0
104	ICC	4362	9.0	8.6
105	ICC	4368	9.0	8.6
106	ICC	4472	9.0	8.6
107	ICC	4475	7.0	7.0
108	ICC	4500	8.6	7.3
109	ICC	4819	8.0	7.6
110	ICC	4950	8.3	8.3
111	ICC	4977	8.6	9.0
112	ICC	5022	9.0	9.0
113	ICC	5033	8.6	7.0
114	ICC	5093	7.3	7.3
115	ICC	5099	7.3	7.0
116	ICC	5116	8.3	9.0
117	ICC	5568	9.0	9.0
118	ICC	6250	7.6	6.6
119	ICC	6269	9.0	7.6
120	ICC	6270	7.3	7.3
121	ICC	6330	9.0	9.0
122	ICC	6373	9.0	7.0
123	ICC	6981	9.0	8.3
124	ICC	7000	9.0	8.0
125	ICC	7002	9.0	7.6
126	ICC	7389	9.0	9.0
127	ICC	7520	9.0	8.0
128	ICC	7773	8.6	8.6
129	ICC	8160	9.0	9.0
130	ICC	8161	9.0	8.6
131	ICC	8189	8.3	7.3
132	ICC	8536	9.0	7.3
133	ICC	8638	7.6	7.3
134	ICC	8639	9.0	7.0
135	ICC	9214	8.6	7.6
136	ICC	11514	8.6	7.6
137	ICC	12229	9.0	9.0

S.No.	Particulars	Disease rating on 1-9 scale*	
		IARI	Hisar
138	ICC 12509	9.0	8.6
139	ICC 12510	9.0	8.6
140	ICC 12511	9.0	8.6
141	ICC 13108	9.0	8.0
142	ICC 13819	9.0	9.0
143	ICC 14912	7.3	6.0
144	ICCW 33	NG	NG
145	ICCW 37	9.0	3.6
146	PK 4	9.0	8.6
147	B 98 (Control)	9.0	9.0
148	Pb 7 (Control)	9.0	9.0
	SE±	0.247	0.378
	CV %	4.9	8.0

* Average of 3 replications
Observation taken 15 days after inoculation

Table 32. Reaction of chickpea lines (reported resistant from different locations) to 'Hisar' isolate of Ascochyta rabiei in plant growth room, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Disease rating on 1-9 scale[a]	S.No.	Particulars	Disease rating on 1-9 scale[a]	S.No.	Particulars	Disease rating on 1-9 scale[a]
1	ICC 131	9.0	47	ICC 1288	9.0	93	ICC 8618	8.6
2	ICC 156	9.0	48	ICC 1289	9.0	94	ICC 8640	9.0
3	ICC 165	9.0	49	ICC 1290	9.0	95	ICC 8658	9.0
4	ICC 188	9.0	50	ICC 1304	9.0	96	ICC 8661	7.6
5	ICC 239	9.0	51	ICC 1312	9.0	97	ICC 8664	8.0
6	ICC 326	9.0	52	ICC 1313	9.0	98	ICC 8666	8.0
7	ICC 601	9.0	53	ICC 1314	9.0	99	ICC 8638	8.6
8	ICC 622	9.0	54	ICC 1322	9.0	100	ICC 8639	8.6
9	ICC 757	9.0	55	ICC 1905	9.0	101	ICC 9214	9.0
10	ICC 786	9.0	56	ICC 3282	9.0	102	ICC 10632	9.0
11	ICC 808	9.0	57	ICC 3540	9.0	103	ICC 11507	9.0
12	ICC 826	9.0	58	ICC 3601	9.0	104	ICC 11614	8.3
13	ICC 833	9.0	59	ICC 3634	9.0	105	ICC 11620	9.0
14	ICC 835	8.6	60	ICC 4000	9.0	106	ICC 12229	9.0
15	ICC 885	8.6	61	ICC 4014	9.0	107	ICC 12508	9.0
16	ICC 893	9.0	62	ICC 4018	9.0	108	ICC 12958	8.0
17	ICC 894	9.0	63	ICC 4065	9.0	109	ICC 13819	9.0
18	ICC 902	9.0	64	ICC 4066	9.0	110	ILC 187	8.3
19	ICC 917	9.0	65	ICC 4324	9.0	111	ILC 195	7.6
20	ICC 991	9.0	66	ICC 4950	9.0	112	ILC 215	7.3
21	ICC 992	9.0	67	ICC 4956	9.0	113	ILC 249	8.6
22	ICC 994	9.0	68	ICC 4977	9.0	114	ILC 295	7.3
23	ICC 1001	8.6	69	ICC 5022	9.0	115	ILC 263	9.0
24	ICC 1057	9.0	70	ICC 5124	9.0	116	ILC 2380	8.6
25	ICC 1058	9.0	71	ICC 6988	8.6	117	ILC 2958	7.0
26	ICC 1065	9.0	72	ICC 7022	8.6	118	ILC 3856	8.3
27	ICC 1148	9.0	73	ICC 7029	9.0	119	ILC 3866	5.6
28	ICC 1266	9.0	74	ICC 7037	9.0	120	ILC 3884	5.6
29	ICC 1267	9.0	75	ICC 7046	9.0	121	ILC 3888	8.0
30	ICC 1269	9.0	76	ICC 7067	9.0	122	ILC 3870	8.6
31	ICC 1270	9.0	77	ICC 7080	9.0	123	ILC 5928	9.0
32	ICC 1271	9.0	78	ICC 7084	9.0	124	Flip 81-70	8.6
33	ICC 1272	9.0	79	ICC 7192	8.6	125	Flip 82-144	4.6
34	ICC 1273	9.0	80	ICC 7193	8.3	126	Flip 82-150	5.0
35	ICC 1274	9.0	81	ICC 7321	9.0	127	Flip 82-258	9.0
36	ICC 1275	9.0	82	ICC 7323	9.0	128	Flip 83-7	9.0
37	ICC 1276	9.0	83	ICC 7369	9.0	129	Flip 83-15	5.3
38	ICC 1277	9.0	84	ICC 7514	9.0	130	Flip 83-22	5.6
39	ICC 1278	9.0	85	ICC 7516	9.0	131	Flip 83-28	9.0
40	ICC 1279	9.0	86	ICC 7740	8.6	132	Pb 7 (Control)	9.0
41	ICC 1280	9.0	87	ICC 8202	9.0			
42	ICC 1282	9.0	88	ICC 8476	9.0			
43	ICC 1283	9.0	89	ICC 8486	7.0			
44	ICC 1284	9.0	90	ICC 8495	7.0			
45	ICC 1285	9.0	91	ICC 8497	7.6			
46	ICC 1287	9.0	92	ICC 8498	7.0			

[a] Average of 3 replications
Observation taken 15 days after inoculation

Table 33. Reaction of Chickpea Coordinated Varietal Trial (CVT) (ascochyta blight) 1989-90 entries to 'Hisar' isolate of Aschochyta rabiei in plant growth room, ICRISAT Center, Patancheru, during 1989-90.

S. No.	Particulars	Disease rating on 1-9 scale*
1	BG 366	9.0
2	BG 367	9.0
3	BG 368	9.0
4	C 235	9.0
5	Gaurav	9.0
6	GG 575	9.0
7	GG 715	9.0
8	GG 829	9.0
9	GL 83119	9.0
10	GL 84125	9.0
11	GL 86051	9.0
12	GL 86123	9.0
13	GL 86138	9.0
14	GL 86152	9.0
15	GNG 295	9.0
16	GNG 483	9.0
17	H 83-18	9.0
18	H 83-60	8.6
19	H 86-7	8.6
20	H 86-21	7.6
21	H 86-100	9.0
22	ICCV 89445	9.0
23	Pb 7 (Control)	9.0

* Average of 3 replications
Observation taken 15 days after inoculation

Table 34. Reaction of Chickpea lines to four isolates of Ascochyta rabiei in plant growth room at ICRISAT center, Patancheru, during 1989-90.

S.No.	Particulars	Disease rating on 1-9 scale*															
		Ascochyta rabiei isolates															
		Gurudaspur				E 100 YH				Hisar				IARI			
		Ob1	Ob2	Ob3	Ob4	Ob1	Ob2	Ob3	Ob4	Ob1	Ob2	Ob3	Ob4	Ob1	Ob2	Ob3	Ob4
1	C 235(4935)	2.0	5.6	9.0	9.0	1.0	2.9	8.2	9.0	1.6	4.2	8.8	9.0	1.8	5.0	8.8	9.0
2	G C Bijapur(5032)	1.2.	5.4	8.5	9.0	1.2	4.0	8.4	9.0	1.4	4.0	7.1	9.0	2.8	5.0	9.0	9.0
3	EC 21629(5098)	1.0	3.0	7.6	9.0	1.0	3.0	7.3	9.0	1.0	3.1	6.8	8.2	1.0	4.6	8.0	9.0
4	EC 26414(5099)	1.0	5.0	6.4	8.5	1.0	4.0	6.9	9.0	1.0	3.0	5.7	7.9	1.0	4.0	6.5	8.0
5	EC 26435(5116)	1.0	7.0	9.0	9.0	1.0	4.8	9.0	9.0	1.0	5.0	9.0	9.0	3.2	6.4	9.0	9.0
6	EC 26446(5124)	1.0	6.0	8.5	9.0	1.0	3.3	7.4	9.0	2.0	5.0	7.2	8.5	1.0	4.8	8.5	8.7
7	F8(5127)	1.0	5.5	8.1	9.0	1.0	4.4	7.6	9.0	1.0	3.0	7.3	9.0	1.0	4.2	8.0	9.0
8	V 138(5568)	2.4	7.0	9.0	9.0	1.6	4.8	9.0	9.0	2.6	5.2	9.0	9.0	2.6	6.6	9.0	9.0
9	B 98(8302)	2.8	8.0	9.0	9.0	3.0	7.4	9.0	9.0	3.0	7.0	9.0	9.0	3.0	7.0	9.0	9.0
10	C 727(11218)	3.0	7.0	9.0	9.0	2.2	6.6	9.0	9.0	2.0	6.0	8.7	9.0	3.0	6.2	9.0	9.0
11	ICC 1069	1.0	3.0	6.7	8.4	1.0	2.6	6.3	7.7	1.0	2.1	4.3	8.4	1.5	3.0	8.3	7.8
12	ICC 1891	1.0	5.6	9.0	9.0	1.0	4.1	7.8	9.0	1.0	4.4	8.3	9.0	1.2	3.6	7.8	9.0
13	ICC 3932	1.0	4.2	6.8	8.0	1.0	1.6	6.2	8.0	1.0	1.8	4.4	6.7	1.0	4.0	6.8	8.8
14	ICC 8269	1.0	5.0	9.0	9.0	1.0	3.0	7.1	8.5	1.0	3.6	6.7	9.0	1.0	4.0	8.3	9.0
15	ICC 8373	1.0	2.0	6.0	7.3	1.0	1.2	5.4	7.7	1.0	4.0	5.5	8.0	1.0	2.4	4.2	7.1
16	Pb 7	1.6	6.0	8.9	9.0	1.2	4.8	8.4	9.0	2.2	6.0	8.8	9.0	2.8	5.4	9.0	9.0
	SE±	0.252	0.412	0.423	0.303	0.178	0.534	0.520	0.485	0.140	0.989	0.917	0.507	0.272	0.767	0.616	0.29
	CV%	24.9	10.9	7.3	4.9	20.0	19.3	9.5	7.8	38.9	33.3	17.8	8.3	21.6	22.7	11.0	4.8

* Average of 2 replications
Ob1: 4 days after inoculation
Ob2: 6 days after inoculation
Ob3: 8 days after inoculation
Ob4: 10 days after inoculation

Table 35. Reaction of chickpea lines to four isolates of Ascochyta rabiei in Glass house I Bay No. 2 at ICRISAT center, Patancheru, during 1989-90.

		Disease rating on 1-9 scale*											
		Ascochyta rabiei isoaltes											
		Gurudaspur			E 100 YM			Hisar			IARI		
	Particulars	Ob1	Ob2	Ob3	Ob1	Ob2	Ob3	Ob1	Ob2	Ob3	Ob1	Ob2	Ob3
1	C 235(4935)	1.0	1.4	2.6	1.0	1.6	2.7	1.0	2.0	2.6	1.0	1.5	2.2
2	G C Bijapur(5032)	1.0.	1.8	3.0	1.0	2.1	2.4	1.0	1.5	2.1	1.0	1.4	2.5
3	EC 21629(5098)	1.0	1.0	3.3	1.0	1.0	2.5	1.0	1.5	2.9	1.0	1.2	2.5
4	EC 26414(5099)	1.0	1.0	2.5	1.0	1.0	2.2	1.0	1.0	1.4	1.0	1.0	1.1
5	EC 26435(5116)	1.0	3.1	3.8	1.0	1.8	2.8	1.0	2.6	3.3	1.0	1.5	2.2
6	EC 26446(5124)	1.0	1.0	1.5	1.0	1.5	2.5	1.0	1.0	1.6	1.0	1.0	1.9
7	F8(5127)	1.0	1.2	2.6	1.0	1.0	1.4	1.0	1.6	2.3	1.0	1.0	2.0
8	V 138(5568)	1.0	2.7	3.0	1.0	2.0	2.7	1.0	2.4	3.3	1.0	1.6	2.5
9	B 98(8302)	1.0	4.4	6.2	1.0	3.4	4.5	1.0	3.1	4.9	1.0	2.7	3.1
10	C 727(11218)	1.0	4.0	5.8	1.0	2.7	4.4	1.0	2.5	3.3	1.0	1.7	3.1
11	ICC 1069	1.0	1.0	2.1	1.0	1.0	1.7	1.0	1.0	1.3	1.0	1.0	1.1
12	ICC 1591	1.0	1.6	2.6	1.0	1.2	2.7	1.0	1.0	2.2	1.0	1.0	1.7
13	ICC 3932	1.0	1.0	1.9	1.0	1.0	1.8	1.0	1.0	1.0	1.0	1.0	1.3
14	ICC 6269	1.0	1.0	1.8	1.0	1.0	2.2	1.0	1.0	1.2	1.0	1.0	1.3
15	ICC 6373	1.0	1.0	1.6	1.0	1.0	1.5	1.0	1.0	1.1	1.0	1.0	1.0
16	Pb 7	1.0	1.7	2.8	1.0	1.8	3.5	1.0	2.8	3.8	1.0	1.9	2.3
	SE±	0.0	0.259	0.427	0.0	0.383	0.481	0	0.357	0.629	0.0	0.294	0.475
	CV%	0.0	23.1	20.5	0.0	32.7	26.2	0.0	30.0	36.1	0.0	30.9	33.8

* Average of 2 replications
Ob1: 8 days after inoculation
Ob2: 8 days after inoculation
Ob3: 10 days after inoculation

Table 36. Reaction of chickpea lines to 5 isolates of Ascochyta rabiei in plant growth room, ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Disease Rating on 1-9 scale*									
		C 235		E 100 YM		Gurdaspur		Hisar		IARI	
		Ob1	Ob2	Ob1	Ob2	Ob1	Ob2	Ob1	Ob2	Ob1	Ob2
1	ILC 72	3.6	5.3	4.0	6.6	5.0	6.6	4.6	7.3	4.6	7.6
2	ILC 182	3.6	7.0	4.3	6.6	3.6	7.0	4.0	8.0	4.6	8.0
3	ILC 187	5.6	9.0	6.0	8.6	7.0	9.0	5.3	9.0	6.0	8.3
4	ILC 191	4.0	5.3	4.0	6.3	4.0	6.0	4.6	7.3	4.6	7.3
5	ILC 194	4.6	8.3	3.6	8.0	4.6	8.0	4.3	8.3	5.0	8.6
6	ILC 196	5.6	9.0	6.6	8.6	7.6	8.6	5.6	9.0	5.0	8.3
7	ILC 200	4.6	7.0	4.3	7.0	4.0	6.3	5.0	8.3	5.6	8.0
8	ILC 201	5.3	9.0	5.6	8.6	6.6	9.0	5.3	8.6	5.0	9.0
9	ILC 215	5.3	7.3	7.3	8.6	6.6	8.0	7.0	8.6	6.3	9.0
10	ILC 249	7.3	8.6	7.0	8.0	6.6	8.0	8.0	8.3	7.3	9.0
11	ILC 263	7.3	8.0	7.0	9.0	7.6	9.0	7.6	8.3	8.0	8.3
12	ILC 482	7.0	8.3	6.6	8.3	5.6	8.3	7.0	8.6	7.3	9.0
13	ILC 484	5.0	7.0	5.6	7.6	5.3	8.0	5.6	8.0	5.6	8.0
14	ILC 1929	7.0	8.0	6.6	8.3	6.6	8.3	7.6	9.0	8.0	8.6
15	ILC 2380	5.6	8.0	5.3	9.0	6.3	8.6	4.6	8.6	5.0	9.0
16	ILC 2956	4.6	7.6	5.3	8.3	5.6	7.3	6.3	8.3	5.3	8.3
17	ILC 3279	4.3	6.0	4.0	7.3	3.6	6.3	3.6	6.3	4.6	8.0
18	ILC 3346	7.3	9.0	6.6	9.0	7.3	9.0	6.3	8.3	6.3	9.0
19	ILC 3856	5.3	8.6	5.6	9.0	6.3	8.6	5.3	8.0	6.3	8.0
20	ILC 3864	6.0	9.0	5.3	9.0	7.0	8.6	5.0	8.0	5.3	9.0
21	ILC 3866	5.3	8.3	5.6	9.0	6.3	9.0	5.0	8.3	5.3	9.0
22	ILC 3868	5.3	8.6	5.3	8.6	7.3	9.0	4.6	8.3	5.3	8.0
23	ILC 3870	5.3	9.0	5.3	9.0	7.0	9.0	4.6	7.6	6.0	8.6
24	ILC 4421	6.3	9.0	6.6	8.6	7.3	9.0	5.3	9.0	5.3	9.0
25	ILC 5928	3.0	9.0	NG	NG	NG	NG	NG	NG	NG	NG
26	ICC 202	8.0	9.0	8.0	9.0	8.5	9.0	8.0	9.0	8.0	9.0
27	ICC 1069	7.3	9.0	7.0	9.0	7.0	8.6	6.3	8.6	7.3	8.6
28	ICC 1467	7.0	9.0	6.5	9.0	6.0	9.0	6.0	9.0	6.0	9.0
29	ICC 1591	6.3	9.0	6.3	9.0	5.3	9.0	6.3	9.0	6.3	9.0
30	ICC 1903	8.6	9.0	7.3	9.0	8.0	9.0	7.0	9.0	8.3	9.0
31	ICC 3932	5.3	7.0	6.0	8.6	5.3	8.3	5.0	8.6	6.3	9.0
32	ICC 3935	9.0	9.0	9.0	9.0	8.6	9.0	9.0	9.0	9.0	9.0
33	ICC 3996	6.0	9.0	5.5	9.0	4.0	9.0	5.0	9.0	9.0	9.0
34	ICC 4107	4.6	9.0	5.0	9.0	4.0	9.0	5.6	9.0	6.6	9.0
35	ICC 4181	5.3	8.6	5.0	8.6	6.0	9.0	6.0	9.0	6.3	9.0
36	ICC 4475	6.3	9.0	5.0	8.6	5.3	9.0	6.3	9.0	7.3	9.0
37	ICC 5032 (GC Bijapur)	8.0	9.0	8.3	9.0	8.3	9.0	8.0	9.0	8.6	9.0
38	ICC 5035	6.5	8.5	6.6	9.0	7.6	8.6	8.0	9.0	7.6	8.6
39	ICC 5116 (EC 26435)	8.0	9.0	8.0	9.0	8.3	9.0	8.0	9.0	8.6	9.0
40	ICC 5127 (F 8)	7.6	9.0	7.6	9.0	7.6	9.0	8.0	9.0	8.0	9.0

S.No.	Particulars	Disease Rating on 1-9 scale*									
		C 235		E 100 YM		Gurdaspur		Hisar		IARI	
		Ob1	Ob2	Ob1	Ob2	Ob1	Ob2	Ob1	Ob2	Ob1	Ob2
41	ICC 5566	7.0	9.0	7.3	9.0	8.3	9.0	7.0	8.6	8.0	9.0
42	ICC 5568 (V 138)	7.3	9.0	8.6	9.0	8.6	9.0	8.3	9.0	8.0	9.0
43	ICC 6269	7.6	9.0	8.0	9.0	8.0	9.0	7.3	9.0	8.0	9.0
44	ICC 6306	7.3	8.6	6.6	8.3	7.3	9.0	7.0	9.0	7.0	8.3
45	ICC 6373	5.0	8.0	6.5	8.5	8.0	9.0	6.0	7.3	6.6	8.0
46	ICC 6945	7.0	9.0	6.6	9.0	6.0	8.6	7.3	9.0	7.3	9.0
47	ICC 8302 (B-98)	8.6	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
48	ICC 9189	8.3	9.0	7.3	9.0	8.3	9.0	7.0	9.0	7.6	9.0
49	ICC 9689	8.0	9.0	8.6	9.0	8.3	9.0	8.3	9.0	8.3	9.0
50	F 83 28C	4.0	6.3	4.6	7.0	4.6	7.6	4.6	6.3	5.0	5.6
51	F 84 145	5.6	7.6	7.3	8.6	6.6	8.6	7.3	9.0	7.3	9.0
52	F 85 122	3.4	6.3	5.3	8.0	4.0	7.0	4.6	8.3	4.6	9.0
53	GL 1194	8.0	9.0	7.0	9.0	8.0	9.0	7.5	9.0	7.5	9.0
54	GL 83119	5.5	9.0	7.0	9.0	6.5	9.0	6.5	9.0	7.5	9.0
55	GL 84097	7.0	9.0	6.5	9.0	7.0	9.0	7.0	9.0	7.0	9.0
56	GL 84098	5.5	9.0	7.0	9.0	6.5	8.5	6.5	9.0	7.0	9.0
57	GL 84139	7.0	9.0	6.5	9.0	7.0	9.0	7.5	9.0	6.5	9.0
58	GL 84297	7.0	9.0	7.0	9.0	6.5	9.0	6.5	8.5	7.0	8.5
59	GL 85086	7.0	8.5	7.0	9.0	6.5	9.0	6.5	9.0	7.0	9.0
60	GL 85103	7.5	9.0	6.0	9.0	6.0	9.0	6.0	9.0	6.5	8.5
61	GL 85105	6.5	9.0	6.5	9.0	6.0	8.5	7.0	8.0	7.0	9.0
62	E 100Y	6.5	8.5	6.5	8.0	6.0	8.0	7.0	8.5	6.0	8.0
63	GG 828	6.5	9.0	7.5	9.0	6.0	9.0	7.0	9.0	7.0	9.0
64	GG 829	7.0	9.0	7.5	9.0	7.5	9.0	7.0	9.0	7.0	9.0
65	G 543	7.0	9.0	7.0	9.0	7.0	9.0	6.5	9.0	7.5	9.0
66	C 235 (ICC 4935)	7.3	9.0	7.3	9.0	8.0	9.0	8.0	9.0	8.3	9.0
67	L 550	8.0	9.0	8.0	9.0	8.0	9.0	8.5	9.0	8.0	9.0
68	Pch 70	7.6	9.0	8.0	9.0	7.6	9.0	8.0	9.0	7.3	9.0
69	Mck 54	7.0	9.0	7.0	8.6	7.6	9.0	6.6	9.0	7.0	8.6
70	NEC 138-2	6.5	9.0	6.0	7.5	5.5	7.5	6.5	8.0	5.5	8.0
71	E 100 YM	6.5	9.0	7.0	9.0	7.0	9.0	6.0	9.0	6.5	9.0
72	I 13	6.5	8.0	6.0	9.0	7.0	8.5	7.0	8.0	7.0	8.5
73	CM 72	7.0	9.0	8.0	9.0	6.5	8.5	6.5	9.0	7.0	9.0
74	PK 51825 x CM72	6.5	9.0	6.0	8.5	6.0	9.0	7.0	8.0	7.0	9.0
75	PK 51832 x CM72	6.5	9.0	6.5	8.5	6.0	9.0	7.0	8.5	8.0	9.0
76	BG 261	7.0	9.0	7.0	9.0	7.0	9.0	7.0	9.0	7.0	9.0
77	Pb 7 (Control)	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0

S.No.	Particulars	Disease Rating on 1-9 scale*									
		C 235		E 100 YM		Gurdaspur		Hisar		IARI	
		Ob1	Ob2	Ob1	Ob2	Ob1	Ob2	Ob1	Ob2	Ob1	Ob2
	SE±	(isolate* cultivar 0.45)									
	CV%	(isolate* cultivar 10.8)						for observation 1			
	SE±	(isolate* cultivar 0.31)									
	CV%	(isolate* cultivar 5.7)						for obeervation 2			

* Average of 3 replications
Ob 1 Obeervation taken 10 days after inoculation
Ob 2 Obeervation taken 15 days after inoculation

Table 37. Reaction of *Cicer* species to *Ascochyta rabiei* (IARI isolate) under controlled environment at ICRISAT Center, Patancheru, 1989-90.

S.No.	Entry	Rating on 1-9 scale (Average of 3 replications) Ob1	Ob2
1	ICC 202	7.7	9.0
2	ICC 607	6.4	8.9
3	ICC 1903	8.2	8.9
4	ICC 3996	2.0	9.0
5	ICC 5127	7.8	9.0
6	I 13	5.7	8.8
7	EC 26435	8.0	9.0
8	C 235	7.3	9.0
9	V 138	7.1	9.0
10	NEC 138-2	4.7	7.4
11	CM 72	6.9	9.0
12	E 100YM	5.1	9.0
13	BG 261	6.5	9.0
14	GG 575	6.5	8.9
15	E 100Y	5.7	8.5
16	PK 51825 x 72	5.0	9.0
17	PK 51832 x 72	4.3	8.9
18	ILC 72	2.0	6.1
19	ILC 191	7.0	9.0
20	ILC 195	2.7	5.1
21	ILC 249	6.7	9.0
22	ILC 482	5.6	7.9
23	ILC 2380	2.0	5.3
24	ILC 3279	2.0	5.8
25	C. *judaium* 185	4.2	6.8
26	C. *reticulatum* (No. 205)	1.2	8.4
27	B 98	9.0	9.0
28	Pb 7	8.5	9.0
	SE ±	0.327	0.214
	CV (%)	22.7	10.1

Ob1 10 days after inoculation.
Ob2 15 days after inoculation.

Table 38. Chickpea breeding lines evaluated in GBPUA&T-ICRISAT cooperative botrytis gray mold nursery, Pantnagar, 1989-90 (Row length 2.0 m at 0.30 m row to row spacing).

Experiment	Details of Expt.	No. of breeding lines	Remarks
PN001	F4 populations	1	25 rows
PN002	F4 progenies	53	1 row
PN003	F4 progenies	45	1 row
PN004	F5 progenies	104	1 row
PN005	F6 progenies	34	1 row
PN006	PYT-1	20x2 reps	1 row
PN007	PYT-2	14x3 reps	1 row
PN008	PYT-3	36x2 reps	1 row
HI027	F3 TWC-HY, WR, BMR	6	10 rows
HI029	F3 TWC, HRWR, ABR, BMR	6	10 rows (last entry only 2 rows)
HI032	F3 SC HY with WR, ABR, BMR	13	10 rows (for second entry only 5 rows)

Table 39. Chickpea breeding lines with a disease rating of 3 and 4 in botrytis gray mold nursery, GBPUA&T Pantnagar, 1989-90.

Experiment	Plot No.	Pedigree	Disease rating (1-9 point scale)
PN002	102	ICCX 860443-BP-2PN	3
	106	-8PN	3
	111	-11PN	3
PN003	202	ICCX 860451-BP-2PN	3
	203	-3PN	3
	204	-4PN	3
PN008	205, 119 (entry # 2)	ICCX 860006-BP-2P-BP-BH	4
	206, 130 (entry # 20)	ICCX 860023-BP-BP-BP-5P-BH	4

Table 40. Influence of growth habit of chickpea genotypes and row spacing on botrytis gray mold severity and grain yield[1], Pantnagar 1989-90.

Treatment		Disease rating 1-9 scale	Grain yield kg ha^{-1}
Sprayed with Ronilan[2]			
ICCL 87322 (30 X 10 cm)		5.0	2901
ICCL 87322 (60 X 5 cm)		3.3	3062
H 208 (30 X 10 cm)		6.0	1309
H 208 (60 X 5 cm)		4.7	1981
Not sprayed			
ICCL 87322 (30 X 10 cm)		6.0	2444
ICCL 87322 (60 X 5 cm)		5.7	2444
H 208 (30 X 10 cm)		9.0	321
H 208 (60 X 5 cm)		7.3	864
Cultivar	SE ±	0.2	48.9
	CV (%)	6.0	4.4
Spacing	SE ±	0.10	27.7
	CV (%)	-	-
Spray	SE ±	0.10	27.7
	CV (%)	-	-
Cultivar x Spacing	SE ±	0.23	56.2
	CV (%)	-	-
Cultivar x spray	SE ±	0.23	56.2
	CV (%)	-	-
Spacing x Spray	SE ±	0.15	39.2
	CV (%)	-	-
Cultivar x Spacing x Spray	SE ±	0.28	68.5
	CV (%)	6.3	5.0

1. Plot size 3 x 1.8 m
2. Fungicide Ronilan was sprayed two times at 15 days intervals: 15 Feb and 2 Mar 1990 and concentration used was 0.2%.

Table 41. Reaction of chickpea entries from Botrytis Gray Mold Nursery (1989-90) to botrytis gray mold at different locations during 1989-90.

S.No.	Entry	Disease rating on 1-9 scale[1]		
		Pantnagar	Rampur (Nepal)	ICRISAT (Patancheru)
1.	ICC 1069	5.0	5.5	8.6
2.	ICC 1894	8.5	6.0	7.0
3.	ICC 1918	9.0	7.0	8.3
4.	ICC 1931	8.5	8.5	8.0
5.	ICC 2550	8.0	8.0	8.0
6.	ICC 2595	9.0	6.5	8.3
7.	ICC 2664	8.0	7.5	N.G.
8.	ICC 3075	9.0	7.0	8.3
9.	ICC 3099	8.5	8.0	8.0
10.	ICC 3208	8.5	7.0	8.0
11.	ICC 4105	8.5	8.5	9.0
12.	ICC 6827	8.0	9.0	8.6
13.	ICC 8630	8.5	8.0	9.0
14.	ICC 9033	9.0	8.5	9.0
15.	ICC 11223	8.5	8.0	8.3
16.	ICC 11324	8.0	7.5	9.0
17.	ICCC 4	8.5	6.5	8.3
18.	ICCC 5	8.5	7.5	6.3
19.	ICCV 11	7.5	6.5	9.0
20.	ICCL 83149	8.0	9.0	7.6
21.	ICCL 83128	8.0	8.5	8.3
22.	ICCL 85405	9.0	5.5	8.6
23.	ICCL 86215	9.0	8.0	8.3
24.	ICCL 86224	9.0	6.5	8.0
25.	ICCL 86226	7.5	6.0	7.6
26.	ICCL 86237	9.0	5.0	8.6
27.	ICCL 86242	8.5	6.0	8.0
28.	ICCL 86326	8.5	8.0	8.6
29.	ICCL 86332	8.0	6.5	8.0
30.	Dhanush	8.5	5.0	9.0
31.	Pant G 114	7.0	5.0	7.6
32.	Pusa 256	8.5	5.5	6.0
	H 208* (range) (control)	9.0	6.0 to 8.0	9.0

1=Average of 2 replications; N.G.=No germination.

Table 42. Rection of chickpea lines (reported resistant/tolerant from different locations) to 'Pantnagar' isolate of Botrytis cineria in plant growth room at ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Disease rating on 1-9 scale*	S.No.	Particulars	Disease rating on 1-9 scale*
1	ICC 28	8.3	46	ICC 1351	8.6
2	ICC 30	9.0	47	ICC 1400	8.3
3	ICC 35	9.0	48	ICC 1403	8.6
4	ICC 36	8.6	49	ICC 1407	8.0
5	ICC 38	8.0	50	ICC 1414	8.3
6	ICC 39	8.3	51	ICC 1436	7.6
7	ICC 121	9.0	52	ICC 1451	9.0
8	ICC 280	8.3	53	ICC 1467	8.6
9	ICC 292	8.0	54	ICC 1519	8.3
10	ICC 435	8.0	55	ICC 1525	9.0
11	ICC 466	9.0	56	ICC 1548	8.3
12	ICC 478	9.0	57	ICC 1565	8.0
13	ICC 587	9.0	58	ICC 1577	7.0
14	ICC 600	9.0	59	ICC 1591	9.0
15	ICC 662	9.0	60	ICC 1606	7.3
16	ICC 708	9.0	61	ICC 1710	9.0
17	ICC 739	8.6	62	ICC 1762	8.3
18	ICC 740	8.0	63	ICC 1764	9.0
19	ICC 755	9.0	64	ICC 1809	8.6
20	ICC 756	9.0	65	ICC 1926	8.0
21	ICC 779	9.0	66	ICC 1943	9.0
22	ICC 797	8.6	67	ICC 1947	9.0
23	ICC 798	9.0	68	ICC 1963	8.6
24	ICC 799	8.6	69	ICC 2042	9.0
25	ICC 807	9.0	70	ICC 2052	8.6
26	ICC 880	7.6	71	ICC 2082	8.0
27	ICC 896	8.6	72	ICC 2083	7.6
28	ICC 898	9.0	73	ICC 2084	9.0
29	ICC 922	9.0	74	ICC 2086	8.3
30	ICC 923	8.3	75	ICC 2107	8.6
31	ICC 961	8.3	76	ICC 2165	9.0
32	ICC 1061	8.6	77	ICC 2232	8.6
33	ICC 1062	8.6	78	ICC 2341	8.6
34	ICC 1069	8.6	79	ICC 2342	8.6
35	ICC 1084	9.0	80	ICC 2364	8.6
36	ICC 1085	9.0	81	ICC 2374	9.0
37	ICC 1091	9.0	82	ICC 2506	9.0
38	ICC 1093	9.0	83	ICC 2538	9.0
39	ICC 1102	9.0	84	ICC 2539	7.3
40	ICC 1117	9.0	85	ICC 2540	9.0
41	ICC 1147	9.0	86	ICC 2541	9.0
42	ICC 1150	7.6	87	ICC 2542	9.0
43	ICC 1234	8.3	88	ICC 2547	8.3
44	ICC 1299	8.6	89	ICC 2548	8.0
45	ICC 1301	8.6	90	ICC 2556	9.0

S.No.	Particulars	Disease rating on 1-9 scale*	S.No.	Particulars	Disease rating on 1-9 scale*
91	ICC 2565	8.3	141	ICC 3610	9.0
92	ICC 2673	7.3	142	ICC 3611	9.0
93	ICC 2690	9.0	143	ICC 3612	9.0
94	ICC 2773	8.0	144	ICC 3613	9.0
95	ICC 2789	9.0	145	ICC 3614	9.0
96	ICC 2903	8.3	146	ICC 3615	9.0
97	ICC 3121	9.0	147	ICC 3616	9.0
98	ICC 3123	8.3	148	ICC 3617	9.0
99	ICC 3128	8.0	149	ICC 3618	9.0
100	ICC 3152	8.6	150	ICC 3619	9.0
101	ICC 3165	7.0	151	ICC 3620	9.0
102	ICC 3264	8.6	152	ICC 3621	9.0
103	ICC 3371	8.3	153	ICC 3622	9.0
104	ICC 3372	8.0	154	ICC 3623	9.0
105	ICC 3373	7.3	155	ICC 3624	9.0
106	ICC 3375	8.0	156	ICC 3625	9.0
107	ICC 3381	8.6	157	ICC 3628	9.0
108	ICC 3385	7.6	158	ICC 3629	9.0
109	ICC 3388	9.0	159	ICC 3630	9.0
110	ICC 3389	8.6	160	ICC 3639	9.0
111	ICC 3390	7.6	161	ICC 3640	9.0
112	ICC 3394	9.0	162	ICC 3641	8.6
113	ICC 3422	9.0	163	ICC 3648	8.5
114	ICC 3484	8.3	164	ICC 3659	8.0
115	ICC 3538	7.6	165	ICC 3662	8.6
116	ICC 3540	9.0	166	ICC 3665	8.6
117	ICC 3557	8.0	167	ICC 3666	9.0
118	ICC 3558	9.0	168	ICC 3667	8.6
119	ICC 3574	8.6	169	ICC 3668	9.0
120	ICC 3576	8.6	170	ICC 3670	9.0
121	ICC 3577	8.6	171	ICC 3671	8.6
122	ICC 3584	9.0	172	ICC 3672	9.0
123	ICC 3585	9.0	173	ICC 3720	9.0
124	ICC 3587	9.0	174	ICC 3721	9.0
125	ICC 3588	9.0	175	ICC 3793	9.0
126	ICC 3589	9.0	176	ICC 3794	8.6
127	ICC 3590	9.0	177	ICC 3798	9.0
128	ICC 3591	9.0	178	ICC 3802	9.0
129	ICC 3592	9.0	179	ICC 3807	9.0
130	ICC 3593	9.0	180	ICC 3813	9.0
131	ICC 3595	8.3	181	ICC 3817	9.0
132	ICC 3596	9.0	182	ICC 3819	9.0
133	ICC 3600	9.0	183	ICC 3820	9.0
134	ICC 3602	9.0	184	ICC 3822	9.0
135	ICC 3603	9.0	185	ICC 3823	9.0
136	ICC 3604	9.0	186	ICC 3826	9.0
137	ICC 3605	9.0	187	ICC 3827	9.0
138	ICC 3607	9.0	188	ICC 3828	9.0
139	ICC 3608	9.0	189	ICC 3842	9.0
140	ICC 3609	9.0	190	ICC 3859	8.6

S.No.	Particulars	Disease rating on 1-9 scale*	S.No.	Particulars	Disease rating on 1-9 scale*
191	ICC 3940	8.3	241	ICC 5329	7.3
192	ICC 4006	8.6	242	ICC 5389	8.6
193	ICC 4014	9.0	243	ICC 5391	9.0
194	ICC 4018	9.0	244	ICC 5893	8.3
195	ICC 4020	8.6	245	ICC 6019	9.0
196	ICC 4030	8.3	246	ICC 6026	8.6
197	ICC 4045	9.0	247	ICC 6038	9.0
198	ICC 4055	8.6	248	ICC 6067	9.0
199	ICC 4063	9.0	249	ICC 6093	8.0
200	ICC 4065	8.6	250	ICC 6143	7.3
201	ICC 4070	9.0	251	ICC 6250	8.6
202	ICC 4071	9.0	252	ICC 6257	8.3
203	ICC 4073	9.0	253	ICC 6327	9.0
204	ICC 4074	9.0	254	ICC 6504	8.6
205	ICC 4075	8.6	255	ICC 6511	9.0
206	ICC 4083	9.0	256	ICC 6516	9.0
207	ICC 4090	9.0	257	ICC 6566	9.0
208	ICC 4092	9.0	258	ICC 6571	8.6
209	ICC 4111	9.0	259	ICC 6583	9.0
210	ICC 4147	9.0	260	ICC 6586	9.0
211	ICC 4168	9.0	261	ICC 6598	9.0
212	ICC 4176	9.0	262	ICC 6600	9.0
213	ICC 4178	9.0	263	ICC 6652	9.0
214	ICC 4179	9.0	264	ICC 6653	7.3
215	ICC 4181	9.0	265	ICC 6658	9.0
216	ICC 4187	9.0	266	ICC 6660	9.0
217	ICC 4190	9.0	267	ICC 6670	8.0
218	ICC 4192	9.0	268	ICC 6673	8.6
219	ICC 4203	9.0	269	ICC 6677	8.0
220	ICC 4222	9.0	270	ICC 6681	8.3
221	ICC 4223	9.0	271	ICC 6684	8.3
222	ICC 4231	9.0	272	ICC 6686	8.0
223	ICC 4241	9.0	273	ICC 6688	7.0
224	ICC 4243	9.0	274	ICC 6697	8.0
225	ICC 4280	9.0	275	ICC 6707	8.3
226	ICC 4282	9.0	276	ICC 6712	9.0
227	ICC 4294	7.6	277	ICC 6715	9.0
228	ICC 4304	9.0	278	ICC 6718	9.0
229	ICC 4322	9.0	279	ICC 6805	7.6
230	ICC 4347	9.0	280	ICC 6856	8.6
231	ICC 4349	9.0	281	ICC 6914	8.3
232	ICC 4352	8.3	282	ICC 7513	9.0
233	ICC 4916	8.6	283	ICC 7520	8.6
234	ICC 4930	8.6	284	ICC 7574	9.0
235	ICC 4948	8.6	285	ICC 7585	8.6
236	ICC 4950	8.6	286	ICC 7592	9.0
237	ICC 4956	8.6	287	ICC 7594	8.6
238	ICC 4987	8.3	288	ICC 7600	8.0
239	ICC 5035	8.6	289	ICC 7626	7.3
240	ICC 5255	8.0	290	ICC 7628	7.0

S.No.	Particulars	Disease rating on 1-9 scale*	S.No.	Particulars	Disease rating on 1-9 scale*
291	ICC 7634	6.6	341	ICC 10245	9.0
292	ICC 7638	7.3	342	ICC 10246	9.0
293	ICC 7640	7.6	343	ICC 10247	9.0
294	ICC 7669	8.3	344	ICC 10251	9.0
295	ICC 7670	8.3	345	ICC 10252	9.0
296	ICC 7673	9.0	346	ICC 10253	9.0
297	ICC 8210	8.3	347	ICC 10255	9.0
298	ICC 8234	8.6	348	ICC 10257	9.0
299	ICC 8383	8.6	349	ICC 10258	8.6
300	ICC 8476	8.6	350	ICC 10259	9.0
301	ICC 8542	8.6	351	ICC 10261	9.0
302	ICC 8565	9.0	352	ICC 10262	9.0
303	ICC 8583	9.0	353	ICC 10263	9.0
304	ICC 8620	9.0	354	ICC 10264	9.0
305	ICC 8637	9.0	355	ICC 10265	9.0
306	ICC 8638	7.3	356	ICC 10266	8.3
307	ICC 8919	8.0	357	ICC 10267	8.6
308	ICC 8920	8.3	358	ICC 10269	8.6
309	ICC 8921	8.3	359	ICC 10270	8.6
310	ICC 8924	8.3	360	ICC 10271	8.3
311	ICC 8927	7.3	361	ICC 10273	8.3
312	ICC 8930	8.3	362	ICC 10276	9.0
313	ICC 9006	8.6	363	ICC 10279	8.6
314	ICC 9968	8.3	364	ICC 10282	8.3
315	ICC 9976	8.6	365	ICC 10283	8.6
316	ICC 9991	8.3	366	ICC 10284	8.6
317	ICC 10189	8.6	367	ICC 10285	9.0
318	ICC 10191	8.6	368	ICC 10286	8.6
319	ICC 10192	8.0	369	ICC 10287	8.3
320	ICC 10193	9.0	370	ICC 10289	8.3
321	ICC 10194	9.0	371	ICC 10290	8.3
322	ICC 10210	9.0	372	ICC 10291	9.0
323	ICC 10211	9.0	373	ICC 10292	9.0
324	ICC 10212	8.6	374	ICC 10293	9.0
325	ICC 10213	8.3	375	ICC 10294	8.3
326	ICC 10214	8.6	376	ICC 10295	8.3
327	ICC 10215	9.0	377	ICC 10296	8.3
328	ICC 10216	9.0	378	ICC 10297	9.0
329	ICC 10217	9.0	379	ICC 10298	9.0
330	ICC 10218	9.0	380	ICC 10300	9.0
331	ICC 10219	8.6	381	ICC 10302	7.3
332	ICC 10221	8.6	382	ICC 10307	8.3
333	ICC 10234	8.3	383	ICC 10308	8.6
334	ICC 10235	8.6	384	ICC 10310	8.0
335	ICC 10236	9.0	385	ICC 10311	7.6
336	ICC 10238	9.0	386	ICC 10312	7.6
337	ICC 10239	8.6	387	ICC 10313	7.6
338	ICC 10242	9.0	388	ICC 10317	9.0
339	ICC 10243	9.0	389	ICC 10318	8.0
340	ICC 10244	8.0	390	ICC 10319	8.3

S.No.	Particulars		Disease rating on 1-9 scale*
391	ICC	10325	8.0
392	ICC	10327	7.6
393	ICC	10876	7.3
394	ICC	10881	7.6
395	ICC	11321	6.6
396	ICC	11494	9.0
397	ICC	11502	8.6
398	ICC	11507	8.0
399	ICC	11859	8.0
400	ICC	11870	8.0
401	ICC	11871	8.0
402	ICC	12474	9.0
403	ICC	12506	8.0
404	ICC	12508	9.0
405	ICC	12509	9.0
406	ICC	12510	9.0
407	ICC	12512	8.3
408	ICC	12961	8.6
409	ICC	13817	9.0
410	ICC	13819	9.0
411	ICC	14344	8.6
412		E-100Y	9.0
413		H 208 (Control)	9.0

* Average of 3 replications

Table 43. Screening of chickpea entries from Ascochyta Blight Nursery 1989-90 to botrytis gray mold at Pantnagar during 1989-90.

S.No.	Entry	Rating on 1-9 scale*
1.	ICC 1069	5.0
2.	ILC 72	6.0
3.	ILC 182	9.0
4.	ILC 187	9.0
5.	ILC 194	9.0
6.	ILC 195	6.0
7.	ILC 198	9.0
8.	ILC 200	8.0
9.	ILC 202	8.5
10.	ILC 249	9.0
11.	ILC 482	9.0
12.	ILC 2380	8.5
13.	ILC 2956	7.0
14.	ILC 3274	5.5
15.	ILC 3856	8.5
16.	ILC 3864	9.0
17.	ILC 3866	9.0
18.	ILC 3870	8.0
19.	ILC 4421	9.0
20.	MCK 54	8.5
21.	Flip 82-1C	8.5
22.	Flip 83-47	9.0
23.	ICCL 86446	7.5
24.	ICCL 86447	6.0
25.	ICCX-790151-2P-1H-1H-2H-1H-1HWR-BH	6.0
26.	ICCX-800859-BPN-BPN-BPN-BPN-3BPN-1HWR-BH	5.5
27.	ICCX-810457-3H-1H-1H-1HWR-BH	6.5
28.	ICCX-81737-BPN-BPN-BPN-3PN-BH	5.5
29.	ICCX-810974-BH-BW-56H-1H-1H-1HWR-BH	6.0
30.	ICCX-830677-10H-BH-BH	5.5
31.	H 208 (Control)	9.0

* Average of 2 replications

Project: LC 230(90)IC/IC

Title: Management of stunt and other economically important virus diseases of chickpea

Objectives:

a. Develop field screening procedures for economically important chickpea viruses.

b. Study epidemiology of disease(s) and ecology of insect vectors.

c. Screen chickpea germplasm and breeding materials in stunt nursery.

SUMMARY

1. Screening for stunt resistance: A total of 2513 breeding lines (Table 44) were screened in stunt disease nurseries in Government Livestock Farm (GLF) and in Haryana Agricultural University (HAU) at Hisar. The susceptible check cv. WR 315 showed average stunt incidence of 49.70 percent (range 32.0 - 68.81) in GLF location and 48.41 percent (range 29.92 - 64.11) in HAU location (Table 45 and 46).

2. Screening of entries from ICSDN 1989-90: Twenty entries from international chickpea stunt disease nursery were screened in stunt nursery. Of them, 8 entries, namely, ICC 858, -1005, -3034, -4948, -10136, -10503, ICCX 790446-BH-BH-19H-3H-2H-BH-6HWR-BH, ICCX 800550-19BH-18H-BWR-BH had less than 10.0 percent stunt incidence (Table 47).

3. Screening of entries from International Chickpea Root Rots/Wilt Nursery (ICRRWN) 1989-90 in stunt nursery: Of 49 lines from ICRRWN, 6 lines, namely ICC 12205, ICCL 84303, ICCV 89234, ICCV 89337, ICCV 89339 and ICCV 6 showed less than 10 percent stunt (Table 48).

4. Evaluation of promising lines for resistance to stunt: A total of 104 germplasm and breeding lines which were observed as resistant to stunt in earlier years were screened in a replicated trial at Hisar. Of 104 lines, 26 had less than 10 percent stunt (Table 49 and 50).

Table 44. Chickpea breeding lines evaluated in stunt nursery at ICRISAT subcenter, Hisar during 1989-90 (Row length 3 m at 0.75 m row to row spacing; 1 row plots).

Type of material		Number of breeding lines
Location: GLF Area, Hisar		
HI061	F5 progenies V	147
HI068	F6 progenies V	320
HI077	F7 bulk progenies, STR, MSDP	59
HI049	F5 progenies V	1362
Location: HAU area, Hisar		
HI013	ICSN-DL, ICCT-DL, ICCTK II	59
HI085	PYT/AYT entries IV (Desi)	381
HI168	PYT/AYT entries (Kabuli)	104
HI190	Trial entries IV, adaptation to early and late planting	69
HI189	Advanced adaptation trial IV	12
	Total	2513

Table 45. Chickpea stunt incidence in susceptible check cv. WR 315 planted after every 2 rows in stunt nursery (field no. 12A, HAU location), Hisar during 1989-90.

Row Numbers[a]	Progressive stunt incidence (%) in susceptible WR 315 (days after sowing)[b]							
	27	41	55	73	105	115	130	155
1	0.47	8.92	12.21	16.43	23.90	27.70	34.30	37.6
2	0.56	3.89	7.91	15.82	24.86	28.80	35.60	43.50
3	1.03	7.59	12.31	16.92	34.87	37.90	47.20	52.30
4	2.76	11.55	17.13	22.65	38.67	45.90	56.40	64.11
5	0.97	4.85	7.28	13.11	13.09	34.50	42.20	48.50
6	0.56	11.66	17.22	22.78	37.77	43.30	58.30	62.20
7	0.53	10.75	13.98	20.43	34.94	39.80	48.40	57.00
8	1.44	10.05	13.88	18.66	31.57	34.90	45.00	47.80
9	1.00	7.00	12.00	17.00	28.00	31.00	36.00	41.00
10	1.94	7.76	14.08	21.84	35.52	36.40	44.70	47.10
11	2.55	16.33	22.96	30.61	43.87	48.00	55.60	60.20
12	0.55	10.39	15.85	20.76	36.06	37.70	42.1	45.40
13	1.62	13.51	18.92	24.86	28.64	31.40	40.5	43.80
14	1.80	7.78	12.58	17.36	27.54	30.50	43.7	47.30
15	1.45	15.22	19.57	26.09	39.85	45.60	54.3	58.00
16	2.61	10.45	13.72	19.61	27.45	34.60	35.90	37.30
17	1.94	8.32	10.32	14.84	21.93	26.50	35.05	40.60
18	0.56	7.81	10.61	18.99	34.07	37.40	46.90	49.70
19	0.70	11.87	15.38	20.98	30.76	34.30	55.90	57.30
20	1.80	7.78	10.18	13.77	13.77	16.80	28.1	29.92
Average stunt % incidence	1.33	9.61	11.08	19.62	31.14	35.12	44.21	48.41

a Row length was 45m; there were 34 rows in the field 12A, out of which observations were taken in 20 rows as shown in table.

b Nursery was sown on 24 Oct 1989.

Table 46. Chickpea stunt incidence in susceptible check cv. WR 315 planted after every 2 rows in stunt nursery (GLF location, B block), Hisar during 1989-90.

Row Numbers[a]	Progressive stunt incidence (%) in susceptible WR 315 (days after sowing)[b]							
	24	38	52	80	102	112	125	147
1	0.51	13.32	20.90	27.55	39.30	40.80	46.91	55.61
2	0.45	9.55	18.18	26.36	37.72	41.40	46.82	57.70
3	0.0	5.34	16.50	21.35	34.95	38.31	43.20	49.50
4	0.43	14.34	15.65	19.13	27.82	30.92	37.81	42.22
5	0.99	9.45	14.42	20.39	23.38	28.91	37.32	44.83
6	0.0	11.90	22.85	29.05	42.38	42.92	49.51	57.61
7	1.41	12.26	23.11	28.77	34.43	37.72	43.40	53.80
8	0.46	14.02	17.75	26.17	32.71	35.00	47.70	54.70
9	0.97	10.68	15.04	19.90	28.15	30.63	37.42	44.21
10	1.70	13.06	18.75	24.43	32.38	35.81	54.52	68.81
11	0.48	10.14	17.39	20.77	26.08	29.01	38.60	48.83
12	0.0	15.84	17.33	19.80	26.73	29.72	37.12	43.11
13	0.52	12.70	16.93	23.81	31.74	33.93	40.70	50.30
14	0.53	12.36	19.89	29.03	34.94	38.21	46.22	58.12
15	0.0	18.99	20.89	29.85	42.28	44.30	51.22	58.70
16	0.0	10.67	16.85	23.59	34.26	39.91	50.00	56.20
17	0.0	3.06	9.21	16.23	21.49	25.00	32.51	39.52
18	0.92	4.65	9.67	16.13	24.88	30.00	35.92	39.61
19	0.48	11.65	15.05	19.90	27.18	31.11	35.40	46.60
20	0.0	4.24	5.45	11.52	17.57	21.81	32.11	40.00
21	0.0	1.60	4.0	15.2	20.0	21.62	28.00	32.00
Average stunt % incidence	0.47	10.61	16.24	22.42	30.63	33.80	41.61	49.70

a Row length was 45m; there were 35 rows in the field, out of which observations were taken in 21 rows as shown in table.

b Nursery was sown on 28 Oct 1989.

Table 47. Reaction of entries from International Stunt Disease Nursery (1989-90) at Hisar during 1989-90.

Sl. No.	Entry	Percent stunt		
		Rep. I	Rep. II	Average
1.	ICC 858	0.0	4.8	2.4
2.	ICC 1005	13.3	0.0	6.7
3.	ICC 2430	30.8	28.6	29.7
4.	ICC 2542	23.1	8.3	15.7
5.	ICC 3034	13.3	0.0	6.7
6.	ICC 4948	13.3	0.0	6.7
7.	ICC 10136	15.4	0.0	7.7
8.	ICC 10503	6.2	0.0	3.1
9.	ICC 10805	14.3	29.4	21.8
10.	ICC 11502	12.5	25.0	18.7
11.	ICC 11551	17.8	4.2	11.0
12.	ICCL 83408	23.3	0.0	11.7
13.	ICCL 86401	23.3	8.0	15.7
14.	ICCL 86416	15.4	11.1	13.2
15.	ICCL 86446	28.0	31.2	29.6
16.	ICCV 88106	13.3	33.3	23.3
17.	ICCX-790496-BH-BH-19H-3H-2H-BH-6HWR-BH	10.7	0.0	5.4
18.	ICCX-800550-19BH-11H-BWR-BH	19.2	19.0	19.1
19.	ICCX-800550-19BH-18H-BWR-BH	0.0	3.7	1.8
20.	ICCX-820669-BH-34H-BH-3HWR-BH	10.0	12.5	11.2
21.	ICC 11322* (Range)	(33.3-52.9)	(11.1-46.6)	
		(42.7)	(30.9)	36.8

Note: Repeat rows of alfalfa (Medicago sativa) were planted after every 10.5 m in the field. It is known that alfalfa is a host for the aphid vector, A. craccivora and the stunt pathogens.

Table 48. Reactions of entries from ICRRWN to stunt disease at Hisar during 1989-90.

S.No.	Entry	Percent stunt disease incidence		
		Replication I	Replication II	Average
1.	ICC 4918	53.3	32.1	42.7
2.	ICC 4928	17.9	21.4	19.6
3.	ICC 4934	37.5	25.0	31.2
4.	ICC 4973	16.7	33.3	25.0
5.	ICC 5003	36.0	33.3	34.7
6.	ICC 9032	4.5	20.8	12.7
7.	ICC 11223	14.3	26.9	20.6
8.	ICC 11320	7.7	17.9	12.8
9.	ICC 11322	39.1	29.6	34.4
10.	ICC 11323	43.3	33.3	38.3
11.	ICC 11324	37.9	52.4	45.2
12.	ICC 11329	29.2	34.8	32.0
13.	ICC 12205	0.0	14.3	7.1
14.	ICC 12263	33.3	36.8	35.1
15.	ICC 12265	27.6	11.8	19.7
16.	ICC 12408	32.0	13.6	22.8
17.	ICC 12884	14.8	26.7	20.7
18.	ICCL 83149	38.5	10.3	24.4
19.	ICCL 84204	23.3	44.4	33.9
20.	ICCL 84303	0.0	9.5	4.8
21.	ICCL 85225	27.8	12.0	19.9
22.	ICCL 85311	29.2	3.3	16.2
23.	ICCL 88001	32.1	32.0	32.1
24.	ICCV 89208	3.7	40.0	21.8
25.	ICCV 89212	37.0	50.0	43.5
26.	ICCV 89213	15.0	34.6	24.8
27.	ICCV 89219	13.6	8.0	10.8
28.	ICCV 89220	22.7	19.2	21.0
29.	ICCV 89223	30.4	40.7	35.6
30.	ICCV 89224	14.3	20.0	17.1
31.	ICCV 89228	26.9	43.3	35.1
32.	ICCV 89234	12.0	7.1	9.6
33.	ICCV 89305	22.2	15.4	18.8
34.	ICCV 89306	11.5	24.0	17.8
35.	ICCV 89309	5.3	34.6	19.9
36.	ICCV 89310	31.0	19.2	25.1
37.	ICCV 89313	31.8	7.7	19.8
38.	ICCV 89316	37.9	37.0	37.5
39.	ICCV 89318	8.7	38.1	23.4
40.	ICCV 89319	10.7	12.0	11.4
41.	ICCV 89337	0.0	4.0	2.0
42.	ICCV 89339	6.7	10.0	8.3
43.	ICCV 89342	25.0	42.3	33.7
44.	ICCV 2	29.6	6.9	18.3
45.	ICCV 3	12.0	18.5	15.3

S.No.	Entry	Percent stunt disease incidence		
		Replication I	Replication II	Average
46.	ICCV 4	30.0	20.8	25.4
47.	ICCV 5	0.0	50.0	25.0
48.	ICCV 6	4.2	3.3	3.7
49.	ICCV 11	9.5	20.0	14.8
50.	ICC 11322 (range)	20.8-68.8	14.2-71.4	

Table 49. Evaluation of chickpea promising lines for stunt disease in stunt nursery at Hisar during 1989-90.

S.No.	Particular	Percent* stunt incidence
1.	ICC 403	30.0
2.	ICC 516	30.1
3.	ICC 591	4.8
4.	ICC 613	20.5
5.	ICC 667	9.8
6.	ICC 685	41.5
7.	ICC 690	6.7
8.	ICC 693	3.8
9.	ICC 954	28.5
10.	ICC 1003	35.3
11.	ICC 1005	12.0
12.	ICC 1012	6.7
13.	ICC 1024	20.3
14.	ICC 1044	13.8
15.	ICC 1202	25.0
16.	ICC 1272	12.9
17.	ICC 1407	23.1
18.	ICC 1583	14.1
19.	ICC 1754	35.2
20.	ICC 1891	45.1
21.	ICC 1911	8.0
22.	ICC 2204	11.2
23.	ICC 2210	17.2
24.	ICC 2232	8.0
25.	ICC 2233	18.3
26.	ICC 2264	12.5
27.	ICC 2334	16.4
28.	ICC 2352	53.3
29.	ICC 2356	11.8
30.	ICC 2367	54.9
31.	ICC 2385	2.1
32.	ICC 2388	32.0
33.	ICC 2427	15.5
34.	ICC 2430	20.1
35.	ICC 2542	34.8
36.	ICC 2546	5.6
37.	ICC 2604	25.2
38.	ICC 2607	23.8
39.	ICC 2617	27.4
40.	ICC 2713	16.8
41.	ICC 2925	15.7
42.	ICC 3034	16.9
43.	ICC 3127	19.3

S.No.	Particular	Percent* stunt incidence
44.	ICC 3133	17.7
45.	ICC 3330	25.0
46.	ICC 3587	28.2
47.	ICC 3718	13.4
48.	ICC 3735	7.4
49.	ICC 3786	31.1
50.	ICC 4869	15.4
51.	ICC 4928	20.6
52.	ICC 4935	26.8
53.	ICC 4939	10.5
54.	ICC 4943	2.4
55.	ICC 4948	42.4
56.	ICC 4949	20.1
57.	ICC 4954	5.6
58.	ICC 4963	15.5
59.	ICC 4973	21.9
60.	ICC 4989	7.7
61.	ICC 4992	17.2
62.	ICC 5008	9.4
63.	ICC 6285	13.8
64.	ICC 6371	9.1
65.	ICC 6433	3.7
66.	ICC 6459	45.6
67.	ICC 6462	16.7
68.	ICC 6634	6.7
69.	ICC 6905	11.9
70.	ICC 6934	16.3
71.	ICC 7254	15.8
72.	ICC 8149	17.6
73.	ICC 8209	26.8
74.	ICC 8241	1.8
75.	ICC 8252	19.2
76.	ICC 8383	37.6
77.	ICC 8786	19.6
78.	ICC 8847	32.0
79.	ICC 10104	36.7
80.	ICC 10137	7.2
81.	ICC 10466	16.0
82.	ICC 10490	30.4
83.	ICC 10495	30.9
84.	ICC 10502	19.3
85.	ICC 10508	7.8
86.	ICC 10586	41.4
87.	ICC 10587	15.7
88.	ICC 10592	10.6
89.	ICC 10594	20.8
90.	ICC 10596	17.0

S.No.	Particular	Percent* stunt incidence
91.	ICC 10597	2.8
92.	ICC 10805	11.1
93.	ICC 11324	41.1
94.	ICC 12208	5.8
95.	ICC 639	12.7
96.	ICC 838	6.0
97.	ICC 1166	19.2
98.	ICCC 2	6.2
99.	ICCC 5	17.6
100.	ICCC 10	3.4
101.	ICCC 11	13.4
102.	ICCC 12	30.9
103.	G 543	27.7
104.	GG 669	9.2

* Average of 3 replications.

Note: Incidence of stunt disease in susceptible check cv. WR 315 was recorded in alternate rows (range 16.9-68.5).

Table 50. Twenty-six chickpea lines which had below 10 percent stunt incidence under the experiment "evaluation of promising lines for stunt resistance", Hisar, 1989/90.

S.No.	Chickpea line	Percent stunt[1]
1.	ICC 591	4.76
2.	ICC 667	9.85
3.	ICC 690	6.67
4.	ICC 693	3.79
5.	ICC 1012	6.67
6.	ICC 1911	8.00
7.	ICC 2232	8.01
8.	ICC 2385	2.08
9.	ICC 2546	5.56
10.	ICC 3735	7.41
11.	ICC 4943	2.38
12.	ICC 4954	5.56
13.	ICC 4989	7.73
14.	ICC 5008	9.45
15.	ICC 6371	9.12
16.	ICC 6433	3.70
17.	ICC 6634	6.67
18.	ICC 8241	1.79
19.	ICC 10137	7.21
20.	ICC 10508	7.78
21.	ICC 10597	2.78
22.	ICC 12208	5.85
23.	ICC 838	6.00
24.	ICCC 2	6.25
25.	ICCC 10	3.45
26.	GG 669	9.20

1. Average of 2 replications.

Screening for multiple disease resistance

Entries from International Chickpea Screening Nurseries (1989-90) and International Chickpea Cooperative Trials (1989-90) were screened for multiple disease resistance. All the entries were screened in multiple disease sick plot. They were tested in 'pot' screening in screen house for their resistance to race 1 of FOC, collar rot (Sclerotium rolfsii), dry root rot (Rhizoctonia bataticola) and black root rot (Fusarium solani). Screening for ascochyta blight and botrytis gray mold resistance was done in plant growth room under control environment. Few chickpea lines showed the resistance to more than one disease (Tables 51 to 57).

Table 51. Reaction of ICCT. DM. entries 89-90 to wilt, root rots, collar rot, ascochyta blight and botrytis gray mold at ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale**	
		Mortality in MDSP***	Wilt	Collar rot	AB	BGM
1	ICC 5003	94.1 (80.0)	56.3	100.0	9.0	6.6
2	ICCV 89301	42.4 (38.8)	42.8	100.0	9.0	7.0
3	ICCV 89302	58.8 (50.2)	30.0	100.0	9.0	5.6
4	ICCV 89303	49.7 (44.7)	37.8	100.0	9.0	8.0
5	ICCV 89304	57.1 (56.1)	20.0	100.0	9.0	7.0
6	ICCV 89305	77.3 (64.9)	68.2	100.0	9.0	8.0
7	ICCV 89306	97.2 (83.2)	45.9	100.0	9.0	7.0
8	ICCV 89307	97.2 (83.1)	95.5	33.3	9.0	7.6
9	ICCV 89308	100.0 (90.0)	44.6	87.5	9.0	7.3
10	ICCV 89309	34.8 (34.3)	55.0	100.0	9.0	8.0
11	ICCV 89310	88.1 (70.1)	36.7	100.0	9.0	8.3
12	ICCV 89311	51.3 (49.6)	68.9	40.0	9.0	7.3
13	ICCV 89312	64.6 (61.3)	65.0	100.0	9.0	9.0
14	ICCV 89313	55.0 (49.1)	62.5	100.0	9.0	8.3
15	ICCV 89314	94.9 (80.6)	70.0	71.4	9.0	7.4

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale**	
		Mortality in MDSP***	Wilt	Collar rot	AB	BGM
	ICC 4951[a]	100.0 (90.0)	100.0	-	-	-
	Annigeri[b]	-		100.0	-	-
	Pb 7[c]	-		-	9.0	-
	H 208[d]	-		-		9.0
	SE±	(14.48)				
	CV%	(31.9)				

Susceptible checks for

a = wilt (W)
b = collar rot (CR)
c = Ascochyta blight (AB)
d = Botrytis gray mold (BGM)
* Average of 2 replications
** Average of 3 replications
*** Multiple disease sick plot
The figures in the parentheses are after angular transformation

Table 52. Reaction of ICCT. DL. entries 89-90 to wilt, root rots, collar rot, ascochyta blight and botrytis gray mold at ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale**	
		Mortality in MDSP***	Wilt	Collar rot	AB	BGM
1	ICC 10136	100.0 (90.0)	69.7	100.0	9.0	8.3
2	ICCV 89401	100.0 (90.0)	90.0	80.0	9.0	8.3
3	ICCV 89402	91.7 (77.9)	62.8	100.0	9.0	7.6
4	ICCV 89403	94.3 (80.1)	77.8	100.0	9.0	7.6
5	ICCV 89404	100.0 (90.0)	66.4	83.3	9.0	9.0
6	ICCV 89405	100.0 (90.0)	66.6	87.5	9.0	7.6
7	ICCV 89406	100.0 (90.0)	100.0	80.0	9.0	8.3
8	ICCV 89407	100.0 (90.0)	80.1	100.0	9.0	6.6
9	ICCV 89408	100.0 (90.0)	90.0	66.7	9.0	8.0
10	ICCV 89409	100.0 (90.0)	68.4	66.7	9.0	8.0
11	ICCV 89410	100.0 (90.0)	55.7	100.0	9.0	7.3
12	ICCV 89411	100.0 (90.0)	85.7	75.0	9.0	8.0
13	ICCV 89412	100.0 (90.0)	100.0	75.0	9.0	7.6
14	ICCV 89413	100.0 (90.0)	87.5	100.0	9.0	7.6
15	ICCV 89414	100.0 (90.0)	100.0	100.0	9.0	7.6

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale**	
		Mortality in MDSP***	Wilt	Collar rot	AB	BGM
	ICC 4951[a]	100.0 (90.0)	100.0			
	Annigeri[b]	-		100.0	-	-
	Pb 7[c]	-		-	9.0	-
	H 208[d]	-		-	-	9.0
	SE±	(4.03)				
	CV%	(6.4)				

Susceptible checks for

a = wilt (W)
b = collar rot (CR)
c = Ascochyta blight (AB)
d = Botrytis gray mold (BGM)
* Average of 2 replications
** Average of 3 replications
*** Multiple disease sick plot
The figures in the parentheses are after angular transformation

Table 53. Reaction of ICCT. K. entries 89-90 to wilt, root rots, collar rot, ascochyta blight and botrytis gray mold at ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale**	
		Mortality in MDSP***	Wilt	Collar rot	AB	BGM
1	ICCV 6	100.0 (90.0)	69.5	100.0	9.0	6.3
2	ICCV 89501	100.0 (90.0)	100.0	100.0	9.0	7.6
3	ICCV 89502	100.0 (90.0)	100.0	100.0	9.0	6.0
4	ICCV 89503	100.0 (90.0)	100.0	100.0	9.0	6.6
5	ICCV 89504	100.0 (90.0)	100.0	100.0	9.0	6.6
6	ICCV 89505	100.0 (90.0)	100.0	100.0	9.0	7.0
7	ICCV 89506	100.0 (90.0)	100.0	100.0	9.0	7.6
8	ICCV 89507	100.0 (90.0)	100.0	N.G	9.0	6.0
9	ICCV 89508	100.0 (90.0)	100.0	N.G	9.0	6.6
10	ICCV 89509	100.0 (90.0)	100.0	100.0	9.0	5.6
11	ICCV 89510	100.0 (90.0)	100.0	66.7	9.0	7.0
12	ICCV 89511	100.0 (90.0)	100.0	100.0	9.0	7.0
13	ICCV 89512	100.0 (90.0)	94.5	100.0	9.0	8.0
14	ICCV 89513	100.0 (90.0)	100.0	100.0	9.0	6.6
15	ICCV 89514	100.0 (90.0)	100.0	100.0	9.0	6.3

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale**	
		Mortality in MDSP***	Wilt	Collar rot	AB	BGM
16	ICC 4973	100.0 (90.0)	100.0	100.0	9.0	7.6
	ICC 4951[a]	100.0 (90.0)	100.0			
	Annigeri[b]			100.0	-	-
	Pb 7[c]				9.0	-
	H 208[d]				-	9.0
	SE±	(0.0)				
	CV%	(0.0)				

Susceptible checks for

a = wilt (W)
b = collar rot (CR)
c = Ascochyta blight (AB)
d = Botrytis gray mold (BGM)
* Average of 2 replications
** Average of 3 replications
*** Multiple disease sick plot
The figures in the parentheses are after angular transformation

Table 54. Reaction of ICSN DL 89-90 entries to wilt, root rots, collar rot, ascochyta blight and botrytis gray mold at ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale**	
		Mortality in MDSP***	Wilt	Collar rot	AB	BGM
1	ICCV 89415	100.0 (90.0)	40.0	100.0	9.0	7.6
2	ICCV 89416	100.0 (90.0)	70.9	100.0	9.0	7.3
3	ICCV 89417	100.0 (90.0)	100.0	100.0	9.0	7.6
4	ICCV 89418	100.0 (90.0)	80.0	100.0	9.0	7.0
5	ICCV 89419	100.0 (90.0)	85.0	100.0	9.0	7.6
6	ICCV 89420	100.0 (90.0)	75.7	100.0	9.0	8.0
7	ICCV 89421	100.0 (90.0)	83.4	100.0	9.0	7.6
8	ICCV 89422	100.0 (90.0)	70.0	100.0	9.0	7.6
9	ICCV 89423	100.0 (90.0)	67.5	100.0	9.0	7.0
10	ICCV 89424	100.0 (90.0)	100.0	100.0	9.0	8.3
11	ICCV 89425	100.0 (90.0)	60.0	100.0	9.0	8.6
12	ICCV 89426	100.0 (90.0)	70.0	100.0	9.0	9.0
13	ICCV 89427	92.5 (78.6)	64.6	100.0	9.0	7.3
14	ICCV 89428	92.5 (77.7)	53.5	83.3	9.0	8.0

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale**	
		Mortality in MDSP***	Wilt	Collar rot	AB	BGM
15	ICCV 89429	100.0 (90.0)	80.0	100.0	9.0	7.6
16	ICCV 89430	100.0 (90.0)	89.5	87.5	9.0	7.0
17	ICCV 89431	93.7 (79.7)	70.0	100.0	9.0	7.6
18	ICCV 89432	100.0 (90.0)	95.0	100.0	9.0	8.0
19	ICCV 89433	100.0 (90.0)	94.5	100.0	9.0	7.6
20	ICCV 89434	100.0 (90.0)	55.0	100.0	9.0	5.6
21	ICCV 89435	100.0 (90.0)	100.0	100.0	9.0	8.3
22	ICCV 89436	100.0 (90.0)	34.9	100.0	9.0	8.3
23	ICCV 89437	100.0 (90.0)	40.0	100.0	9.0	8.0
24	ICCV 89438	100.0 (90.0)	70.0	100.0	9.0	7.6
25	ICCV 89439	100.0 (90.0)	80.7	100.0	9.0	9.0
26	ICCV 89440	80.9 (65.7)	28.8	100.0	9.0	8.6
27	ICCV 89341	72.3 (58.4)	81.7	100.0	9.0	7.6
28	ICCV 89442	100.0 (90.0)	90.0	100.0	9.0	8.6
29	ICCV 89443	100.0 (90.0)	100.0	100.0	9.0	8.0
30	ICC 10136	100.0 (90.0)	80.4	100.0	9.0	7.0

S.No.	Particulars		Percent mortality*			Disease rating on 1-9 scale**	
			Mortality in MDSP***	Wilt	Collar rot	AB	BGM
ICC	4951[a]	100.0	100.0 (90.0)	-	-	-	
	Annigeri[b]		-	-	100.0	-	-
	Pb 7[c]		-	-	-	9.0	-
	H 208[d]		-	-	-	-	9.0
	SE±		(3.642)				
	CV%		(5.9)				

Susceptible checks for

a Wilt (W)
b Collar rot (CR)
c Ascochyta blight (AB)
d Botrytis gray mold (BGM)
* Average of 2 replications
** Average of 3 replications
*** Multiple disease sick plot

The figures in the parentheses are after angular transformation.

Table 55. Reaction of ICSN DN 89-90 entries to wilt, dry root rot, collar rot, black root rot, ascochyta blight and botrytis gray mold at ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale			
		Mortality in MDSP**	Wilt	Collar rot	DRR*	BRR*	AB**	BGM**
1	ICCV 89315	98.0 (84.4)	81.3	100.0	7.0	7.0	9.0	8.0
2	ICCV 89316	17.5 (24.6)	51.6	100.0	7.0	6.0	9.0	8.6
3	ICCV 89317	100.0 (90.0)	100.0	66.7	7.0	6.0	9.0	8.0
4	ICCV 89318	100.0 (90.0)	44.4	85.7	7.0	6.0	9.0	7.3
5	ICCV 89319	100.0 (90.0)	60.0	50.0	7.0	6.0	9.0	7.6
6	ICCV 89320	100.0 (90.0)	35.0	33.0	6.0	6.0	9.0	8.3
7	ICCV 89321	100.0 (90.0)	23.7	60.0	6.0	6.0	9.0	8.0
8	ICCV 89322	100.0 (90.0)	100.0	100.0	7.0	7.0	9.0	9.0
9	ICCV 89323	90.0 (76.7)	91.7	62.5	6.0	6.0	9.0	8.3
10	ICCV 89324	98.3 (84.7)	100.0	85.7	7.0	7.0	9.0	8.3
11	ICCV 89325	52.0 (46.3)	83.4	40.0	6.0	7.0	9.0	9.0
12	ICCV 89326	71.3 (60.1)	47.2	50.0	5.0	7.0	9.0	7.0
13	ICCV 89327	100.0 (90.0)	47.8	100.0	5.0	6.0	9.0	9.0
14	ICCV 89328	100.0 (90.0)	88.9	50.0	5.0	7.0	9.0	7.3
5	ICCV 89329	100.0 (90.0)	75.0	60.0	4.0	6.0	9.0	8.0

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale			
		Mortality in MDSP**	Wilt	Collar rot	DRR*	BRR*	AB**	BGM**
16	ICCV 89330	100.0 (90.0)	72.2	77.7	5.0	6.0	9.0	8.0
17	ICCV 89331	98.7 (85.4)	55.0	60.0	5.0	7.0	9.0	8.0
18	ICCV 89332	100.0 (90.0)	45.0	100.0	6.0	7.0	9.0	7.6
19	ICCV 89333	100.0 (90.0)	100.0	75.0	6.0	6.0	9.0	9.0
20	ICCV 89334	98.5 (85.0)	52.5	75.0	8.0	7.0	9.0	9.0
21	ICCV 89335	98.4 (84.8)	93.8	100.0	7.0	6.0	9.0	8.3
22	ICCV 89336	96.4 (82.2)	55.0	100.0	6.0	5.0	9.0	7.6
23	ICCV 89337	100.0 (90.0)	100.0	100.0	7.0	7.0	9.0	9.0
24	ICCV 89338	100.0 (90.0)	75.0	100.0	7.0	7.0	9.0	8.6
25	ICCV 89339	40.0 (38.1)	70.2	100.0	7.0	7.0	9.0	8.0
26	ICCV 89340	100.0 (90.0)	100.0	100.0	7.0	6.0	9.0	7.0
27	ICCV 89341	100.0 (90.0)	80.0	100.0	8.0	7.0	9.0	7.6
28	ICCV 89342	100.0 (90.0)	52.8	100.0	7.0	6.0	9.0	7.3
29	ICCV 89343	96.5 (82.3)	83.4	100.0	6.0	5.0	9.0	8.6
30	ICC 5003	100.0 (90.0)	88.9	100.0	6.0	5.0	9.0	7.6

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale			
		Mortality in MDSP***	Wilt	Collar rot	DRR*	BRR*	AB**	BGM**
	ICC 4951[a]	100.0 (90.0)	100.0	-	-	-	-	-
	Annigeri[b]	-	-	100.0	-	-	-	-
	BG 212[c]	-	-	-	9.0	-	-	-
	ICC 12248[d]	-	-	-	-	8.0	-	-
	Pb 7[e]	-	-	-	-	-	9.0	-
	H 208[f]	-	-	-	-	-	-	9.0
	SE±	(6.11)						
	CV%	(10.6)						

Susceptible checks for

a Wilt (W)
b Collar rot (CR)
c Dry root rot (DRR)
d Black root rot (BRR)
e Ascochyta blight (AB)
f Botrytis gray mold (BGM)
* Average of 2 replications
** Average of 3 replications
*** Multiple disease sick plot

The figures in the parentheses are after angular transformation

Table 56. Reaction of ICSN 06 89-90 entries to wilt, dry root rot, collar rot, black root rot, ascochyta blight and botrytis gray mold at ICRISAT Center, Patancheru, during 1989-90.

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale			
		Mortality in MDSP**	Wilt	Collar rot	DRR*	BRR*	AB**	BGM**
1	ICCV 89215	50.3 (45.3)	85.0	100.0	8.0	5.0	9.0	8.6
2	ICCV 89216	52.5 (51.5)	70.0	77.8	5.0	5.0	9.0	8.6
3	ICCV 89217	61.8 (59.6)	100.0	90.0	8.0	5.0	9.0	9.0
4	ICCV 89218	68.8 (63.9)	80.0	100.0	5.0	5.0	9.0	9.0
5	ICCV 89219	62.8 (60.2)	0.0	90.0	5.0	5.0	9.0	8.3
6	ICCV 89220	36.8 (29.5)	0.0	100.0	8.0	5.0	9.0	8.6
7	ICCV 89221	62.0 (59.7)	75.0	100.0	8.0	6.0	9.0	9.0
8	ICCV 89222	98.3 (84.7)	100.0	100.0	7.0	6.0	9.0	8.0
9	ICCV 89223	76.1 (60.7)	55.0	100.0	7.0	7.0	9.0	7.3
10	ICCV 89224	70.0 (64.6)	20.0	88.9	7.0	6.0	9.0	8.0
11	ICCV 89225	67.7 (62.4)	88.8	100.0	7.0	6.0	9.0	8.3
12	ICCV 89226	72.5 (66.1)	77.7	62.5	7.0	7.0	9.0	7.6
13	ICCV 89227	91.5 (77.8)	55.0	90.0	8.0	6.0	9.0	8.3
14	ICCV 89228	68.8 (63.9)	91.6	77.8	7.0	7.0	9.0	7.3
15	ICCV 89229	91.1 (77.5)	100.0	83.3	7.0	7.0	9.0	7.3

S.No.	Particulars	Percent mortality[@]			Disease rating on 1-9 scale			
		Mortality in MDSP[@@@]	Wilt	Collar rot	DRR[@]	BRR[@]	AB[@@]	BGM[@@]
16	ICCV 89230	97.4 (83.3)	100.0	100.0	7.0	6.0	9.0	8.3
17	ICCV 89231	80.8 (70.9)	100.0	100.0	8.0	6.0	9.0	8.6
18	ICCV 89232	55.3 (54.5)	100.0	87.5	7.0	7.0	9.0	9.0
19	ICCV 89233	95.3 (81.1)	38.5	100.0	6.0	7.0	9.0	8.3
20	ICCV 89234	20.4 (25.2)	30.0	NT	6.0	6.0	9.0	9.0
21	ICCV 89235	100.0 (90.0)	100.0	100.0	7.0	6.0	9.0	8.3
22	ICCV 89236	68.0 (63.4)	71.4	100.0	6.0	6.0	9.0	8.3
23	ICCV 89237	50.0 (45.0)	32.7	100.0	6.0	6.0	9.0	8.3
24	ICCV 89238	55.4 (54.5)	94.4	100.0	7.0	6.0	9.0	7.6
25	ICCV 89239	16.4 (22.0)	75.0	100.0	6.0	7.0	9.0	7.3
26	ICCV 89240	27.1 (31.4)	6.0	100.0	6.0	6.0	9.0	9.0
27	ICCV 89241	51.5 (50.0)	100.0	100.0	6.0	7.0	9.0	8.6
28	ICCV 89242	54.8 (54.1)	100.0	100.0	7.0	6.0	9.0	8.6
29	ICCV 89243	74.9 (67.5)	100.0	100.0	7.0	6.0	9.0	8.0
30	ICC 4918	62.9 (59.4)	100.0	100.0	7.0	6.0	9.0	9.0

S.No.	Particulars	Percent mortality[a]			Disease rating on 1-9 scale			
		Mortality in MDSP[***a]	Wilt	Collar rot	DRR[*]	BRR[*]	AB[**]	BGM[**]
	ICC 4951[a]	100.0 (90.0)	100.0	-	-	-	-	-
	Annigeri[b]	-	-	100.0	-	-	-	-
	BG 212[c]	-	-	-	9.0	-	-	-
	ICC 12246[d]	-	-	-	-	9.0	-	-
	Pb 7[e]	-	-	-	-	-	9.0	-
	H 208[f]	-	-	-	-	-	-	9.0
	SE±	(13.14)						
	CV%	(30.8)						

Susceptible checks for

a Wilt (W)
b Collar rot (CR)
c Dry root rot (DRR)
d Black root rot (BRR)
e Ascochyta blight (AB)
f Botrytis gray mold (BGM)
* Average of 2 replications
** Average of 3 replications
*** Multiple disease sick plot

The figures in the parentheses are after angular transformation

Table 57. Reaction of ICCT DS 89-90 entries to wilt, root rots, collar rot, ascochyta blight and botrytis gray mold at ICRISAT Center, Patancher, during 1989-90.

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale**	
		Mortality in MDSP***	Wilt	Collar rot	AB	BGM
1	ICC 4918	68.2 (62.6)	100.0	100.0	9.0	9.0
2	ICCV 89201	100.0 (90.0)	45.0	83.3	9.0	7.3
3	ICCV 89202	39.6 (37.8)	40.0	75.0	9.0	8.0
4	ICCV 89203	47.0 (42.9)	40.0	100.0	9.0	8.3
5	ICCV 89204	76.5 (62.8)	37.2	60.0	9.0	8.3
6	ICCV 89205	43.0 (40.6)	46.1	100.0	9.0	7.3
7	ICCV 89206	55.4 (54.5)	60.0	100.0	9.0	8.3
8	ICCV 89207	70.0 (64.6)	100.0	100.0	9.0	8.6
9	ICCV 89208	55.4 (54.5)	65.7	100.0	9.0	7.6
10	ICCV 89209	75.0 (67.5)	44.5	100.0	9.0	7.3
11	ICCV 89210	100.0 (90.0)	5.0	100.0	9.0	8.3
12	ICCV 89211	60.6 (58.7)	25.0	100.0	9.0	8.6
13	ICCV 89212	60.7 (58.8)	45.0	100.0	9.0	8.6
14	ICCV 89213	55.7 (54.9)	87.5	100.0	9.0	7.6
15	ICCV 89214	62.2 (59.8)	75.0	100.0	9.0	9.0

S.No.	Particulars	Percent mortality*			Disease rating on 1-9 scale**	
		Mortality in MDSP***	Wilt	Collar rot	AB	BGM
	ICC 4951[a]	100.0 (90.0)	100.0			
	Annigeri[b]	-	-	100.0	-	-
	Pb 7[c]	-	-	-	9.0	-
	H 208[d]	-	-	-	-	9.0
	SE±	(15.17)				
	CV%	(34.7)				

Susceptible checks for

a Wilt (W)
b Collar rot (CR)
c Ascochyta blight (AB)
d Botrytis gray mold (BGM)
* Average of 2 replications
** Average of 3 replications
*** Multiple disease sick plot

The figures in the parantheses are after angular transformation

PUBLICATIONS

Kaiser, W.J., Ghanekar, A.M., Nene, Y.L., Rao, B.S., and Anjaiah, V. (In press). Viral diseases of chickpea. Chickpea in the Nineties. (accepted for publication)

Sethi, S.C., Ghanekar, A.M., and Gowda, C.L.L. (In press). Recent advances in chickpea improvement and prospects for the nineties: ICRISAT Cooperative Research Station, Hisar. Chickpea in the Nineties. (accepted for publication)

Ghanekar, A.M., Manohar, S.K., Reddy, S.V., and Nene, Y.L. 1988. Association of a mycoplasma-like organism with chickpea phyllody. Indian Phytopathology 41:462-464.

Nene, Y.L., Haware, M.P., Reddy, M.V., Phillips, J.C., Castro, E.L., Kotasthane, S.R., Om Gupta, Gurdip Singh, Prabhakar Shukla, and Sah, R.P. 1989. Identification of broad-based and stable resistance to wilt and root rots of chickpea. Indian Phytopathology 42:499-505.

Haware, M.P., Nene, Y.L., Pundir, R.P.S., and Narayana Rao, J. Screening of world chickpea germplasm for resistance to fusarium wilt (1990). Field Crops Research. (accepted for publication)

Haware, M.P., Diaz, R.M.J., Amin, K.S., Phillips, J.C., and Habib Halila. 1989. Integrated management of wilt and root rots of chickpea. Chickpea in Nineties. (accepted for publication)

Singh, K.B., Kumar, J., Haware, M.P., and Lateef, S.S. 1989. Disease and insect resistance breeding in chickpea: which way to go in the Nineties. Chickpea in the Nineties. (accepted for publication)

THIS REPORT HAS BEEN PREPARED BY Dr. M.P. HAWARE

OCTOBER 1990