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Res is tance screening was the main i tem of' research during the year 1988. This included v i r u s and bacterial hlight screening in the field as well as in the screen house under artifici a l inoculation. Resistance screeni ng for other diseases such as web blight, ash y stem blight , cercosporiose and choane-phora pod rot. was done under fi e l d con d itions only in the disease nursery plot. Virus transmission stcdies through seed and by insects were continced during this year also. Similarly a statistically laid out experiment for estimation of yield loss due to virus was conducted to confirm the results of last: year 's filler trial. A new experiment on chemical control of ashy stem blight was initiated. The results of all these experiments are discussed in the following pages.

I. RESISTANCE SCREENING FOR MAJORDISEASES.

1 .1. Screening for virus resistance :

5 2 entries comprising of 48 breeding lines from advanced generat ions and 4 varieties were screened for their virus resi s tance under field condit ions at Djibelor. These entries were divided into 4 sets each with 11 breeding lines 3 varie tes and 5 promi s i ng brecding li nes which are likely to go into minikit trials . In the f irst set one breeding line was replaced by Ndiambour. Thus each set had 19 entries with 4 replications. They were planted i n a randomised block design. Each entry h a d 4 rows of 5m l e ngth spaced at 50 cm. The spacing wi thin the plants was kept at 50cm.

One row of a local susceptible variety was sown in between 2 replications of each experiment. This served as spreader row. The spreader rows were inocul ated with the sap from the virus infected leaves which helped to spread the infection to the test entries. The inoculum was prepared by blending virus infected leaves in the phosphate buffer. Carborundum powder was added to the inoculum to act as an abrasive. The inoculation was done by rubbing the fully grown wel l expanded primary leaves with a forefinger wetted wi th the inoculum. The sowing was done on 6/08 while the inoculation was done on 31/08. The infection on the spreader rows was quite satisfactory. The observations on test entries were recorded twice. The summary of observations is presented in table 1.

Table 1 : Virus incidence in the field at Djibelor on the entries of advanced yield trials.

Sr.N°	Cross	Entry	Virus Incidence (... of 4 rep)	Remarks
1	2	3	4	5
	Yield trial 1			
1	58-57 x IT 81D 1137	253 N	47-17	mild symptoms
2	-If-	275 N	2-27	mild symptoms
3	-"-	279 N	33-53	
4	-"-	283 N	4-65	mild symptoms
5	-"-	299 N	4-12	
6	Mougnex IT 82D 713	369 N	0.00	
7	-"-	398 N	0.58	
8	-"-	399 N	0.57	mild symptoms
9	158-57 x Tvx 3236	400 N	3.98	
10	-"-	401 N	0.00	
11	-""-	402 N	4.00	
12	-"-	403 N	2.47	
13	-"-	404 N	4.60	
14	-"-	405 N	0.00	
15	-"-	406 N	0.57	mild symptoms
16	-"-	B 21	0.00	
17	-"-	58-57	36.47	
18	-"-	Tvx3236	0.00	
19	-"-	Ndiambour	8.52	

1	2	3	4	5
	Yield trial II			
1	58-57 x IT81E 1137	25 3 N	50-65	mild symptoms
2	-"-	275 N	3-41	mild symptoms
3	-"-	279 N	11-04	
4	-"-	283 N	8.00	mild symptoms
5	-"-	299 N	1.17	
6	Mougne x IT 82D 718	360 N	1.72	
7	-"-	363 N	0.57	mild symptoms
8	58-57 x Tvx 3236	407 N	0.00	
9	-"-	408 N	0.00	
10	-"-	409 N	0.57	
11	-"-	410 N	0.57	mild symptoms
12	-"-	411 N	0.00	
13	-"-	412 N	1.14	mild symptoms
14	-"-	413 N	0.57	
15	-"-	414 N	0.00	
16	-"-	415 N	0.00	
17		B 21	0.00	
18		58-57	23.57	
19		Tvx 3236	0.00	

1	2			
	Wild trial			
	58-57 x UT81D 1137	253 N	38.33	mild symptoms
2	-"-	275 N	7.39	mild symptoms
3	-"-	279 N	43.35	
4	-"-	283 N	6.34	mild symptoms
5	-"-	299 N	3.68	
6	Mougne x IT 82 D 713	356 N	0.57	mild symptoms
7		368 N	0.00	
8	58-57 x Tvx 3236	416 N	0.00	
9	-"-	417 N	5.70	
10	-"-	418 N	0.00	
11	-"-	420 N	1.70	mild symptoms
12	-"-	421 N	0.00	
13	-"-	422 N	0.00	
14	-"-	423 N	0.57	mild symptoms
15	-"-	424 N	0.57	mild symptoms
16	-"-	425 N	0.00	
17		B21	0.00	
18		58-57	32.92	
19		Tvx 3236	0.00	

1	2	3	4	5
	Yield trial IV			
	58-57 x IT 81D 1137	253 N	58-02	mi l d symptoms
2	-"-	275 N	1.14	mi d symptoms
	-"-	279 N	17.81	
4	-"-	283 N	3.75	mi Ld symptoms
5	-"-	299 N	0.00	
6	Mougne x IT 82D 713	365 N	0.00	
7	-"-	371 N	0.00	
8	58-57 x Tv x 3236	426 N	0.00	
9	-"-	427 N	2.00	
10	-"-	428 N	2.00	
11	-"-	429 N	0.00	
12	-"-	430 N	0.00	
13	-"-	431 N	0.00	
14	-"-	432 N	0.00	
15	-"-	433 N	0.00	
16	58-57 X IT81 D 1032	437 N	0.59	
17		B 21	0.00	
18		58-57	49.01	
19		Tvx 3236	0.00	

All the entries from the cross 58-57 x IT 81 D 1137, which were tested in all the trials developed virus infection in various degrees except one viz., 299 N which was free from virus in trial N°4. Amongst these entries 275 N, 283 N and 299 N had comparatively less virus infection. Moreover mild type of symptoms were observed on 275 N and 283 N.

Out of 43 breeding lines derived from the crosses Mougne x IT 82 D713, 58-57 x Tvx 3236 and 58-57 x IT81D 1032, 22 were free from virus infection while 21 were susceptible. Highest number of virus free lines (18) were obtained from the cross 58-57 x Tvx 3236. Mougne x IT82D 713 and 58-57 x IT 81D 1137 yielded 4 and 1 virus free lines respectively.

Amongst the varieties 521 and Tvx 3236 were free from virus infection while 58-57 and Ndiambocr were susceptible.

All these entries togetherwith some more breeding lines from the cross 58-57 x IT 81 D 1032 and few more varieties were screened in the screen house by artificial inoculation. Five seeds of each entry were sown in separate pots on 14.9.88. The virus inoculation was done on 21.9.88. The sap from the virus infected leaves was used for inoculation. The inoculum vas prepared by blending the infected leaves in a phosphate buffer. Carborundum powder was added to the inoculum to act as a abrasive. The inoculation was done by rubbing the fully grown well expanded primary leaves with a forefinger wetted with the inoculum.

The virus symptoms started appearing by the end of September. The observations were recorded on 13.10.88. The second observation, however could not be recorded as the plants were seriously attacked by aphids. Virus reactions noted in the first observation are given in table 2.

Table 2 : Virus reactions of some of the advanced breeding lines and parents.

Sr.N°	Cross	Entry	Reaction
1	2	3	4
1	58-57 x IT 81D 1137	253 N	
2	-"-	275 N	R : S
3	-"-	279 N	S
4	-"-	283 N	R : S
5	-"-	299 N	R
6	Mougne x IT 82D 713	356 N	R
7	-"-	360 N	R
8	-"-	363 N	NG

Sr.N°	Cross	Entry	Reaction
1	2	3	4
9	Mougne x IT 82D 713	365 N	R
10	-"-	368 N	R
11	-"-	369 N	R
12	-"-	371 N	R
13	IT 81D 1137 x 58-57	384 N	S
14	Mocgne x IT 81D 1137	395 N	R
15	58-57 x Tvx 3236	398 N	S
16	-"-	399 N	R
17	-"-	400 N	S
18	-"-	401 N	S
19	-"-	402 N	S
20	-"-	403 N	R
21	-"-	404 N	S
22	-"-	405 N	R
23	-"-	406 N	R
24	-"-	407 N	S
25	-"-	408 N	R
26	-"-	409 N	S
27	-"-	410 N	R
28	-"-	411 N	R
29	-"-	412 N	R
30	-"-	413 N	S
31	-"-	414 N	R
32	-"-	415 N	R
33	-"-	416 N	R
34	-"-	417 N	R
35	-"-	418 N	S
36	-"-	419 N	S
37	-"-	420 N	R
38	-"-	421 N	R
39	-"-	422 N	R
40	-"-	423 N	R

Sr. N°	Cross	Entry	Reaction
1	2	3	4
41	58-57 x TVx 3236		R
42	-"-	425 N	S
43	-"-	426 N	S
44	-"-	427 N	R
455	-"-	428 N	R
46	-"-	429 N	R
47	-"-	430 N	R
48	-"-	431 N	S
49	-"-	432 N	R
50	-"-	433 N	S
51	58-57 x IT 81D 1032	437 N	R
52	-"-	438 N	R
53	-"-	444 N	R
54	-"-	445 N	R
55	-"-	447 N	R
56	-"-	449 N	R
57	-"-	454 N	S
58	-"-	455 N	R
5'3	-"-	B 21	R
60	-"-	58-57	S
61	-"-	Mougne	S
61	-"-	Ndiambour	S
63	-"-	CB5	R
64	-"-	TVx 3236	R
65	-"-	IT 84S2246-4	R

Notes :

R - Resistant S-Susceptible NC - Not germinated

R:S - Mixture of resistant and susceptible.

Out o f 58 breading lines 33 were resistant reac tior. hile 18 were susceptible. Two entries viz, 275N acd 283 N showecl he terogeneous reaction. All t h e entries from the cross Mougnex IT 82 D 713 showed resistant reactior:. Similarly as ir: the f ield test , i n thi s test also large number of entries were observed to be resistant in 58-57 x Tvx3236 cross. Amongst t he varieties, B 21, Tvx 3236, IT 84S 2246-4 and CB5 were found to be resistant while 58-57. Mougne and Ndiambour were susceptible. This year CB5 w a s also found to be virus free in the breeder's trials as well as minikit trials.

The following 15 breeding lines were observed to be free of' vi rus in the screechouse test as well as in the field test.

365 N, 368 N, 369 N, 371 N, 405 N, 408 N, 411 N, 414 N, 415 N, 416 N, 421 N , 422 N, 429 N, 430 N and 432 N.

1.2. Screening for bacterial blight resistance :

A set of 65 entries comprising of 58 breeding lines from advanced generations and 7 varieties were screened against bacterial blight in the screen house .Four seeds of' each were sown in each p o t separately on 14.9.88. The inoculation was done on 24.9.88 by stem stab method. The stems were stabbed with a arrow-head needle through a bac ter i al smear placed on the stem one centimeter below the primary leaves. Fresh inoculum multiplied on nutrient dextrose agar medium was used for inoculation. The observations were recorded for disease reaction thrice on 6.10.88, 13.10.88 and 21.10.88 and are given in table 3.

Table 3 : Bacterial blight reaction of some advanced breeding material and parents.

	Entry	Bacterial blight reaction		
		1st Observa- tior:	2nd Observa- tion	3rd Observat ion
	58-57 x IT 81 D 1137			
1	253 N	2 S	2 S	2 S
2	275 N	4 R	3 R 1 S	3 R 1 S
3	279 N	2 R 2 S	2 R 2 S	2 R 2 S
4	283 N	1 R 2 S	1 R 2 S	1 R 2 S
5	299 N	2 S	2 S	2 S

	Mougne x IT 82 D 713			
6	356 N	4 R	4 R	4 R
7	360 N	4 R	4 R	4 R
8	363 N	N G	-	-
9	365 N	2 R	2 R	2 R
10	368 N	3 R	3 R	3 R
11	369 N	3 R	3 R	3 R
12	371 N	1 R 2 S	1 R 2 S	1 R 2 S
	IT 81 D 1137 x 50-57			
13	384 N	2 R 1 S	1 R 2 S	1 R 2 S
	Mougne x IT 81 D 1137			
14	395 N	3 R	3 R	3 R
	58 - 57 x Tv x 3236			
15	398 N	4 R	4 R	4 R
16	399 N	3 R	3 R	3 S
17	400 N	3 R	3 R	3 R
18	401 N	2 R	2 R	2 R
19	402 N	4 R	4 R	4 R
20	403 N	1 R	1 R	1 R
21	404 N	2 R	3 R	1 R 1 S
22	405 N	3 R	3 R	3 R
23	406 N	4 R	4 R	4 R
24	407 N	2 R	2 R	2 R
25	408 N	2 R	2 R	2 R
26	409 N	4 R	4 R	4 R
27	410 N	2 R	2 R	2 R
28	411 N	2 R	2 R	2 R
29	412 N	4 R	4 R	3 R 1 M S
30	413 N	2 R	2 R	2 R
31	414 N	3 R	3 R	3 R
32	415 N	4 R	4 R	4 R
33	416 N	4 R	4 R	4 R
34	417 N	3 R	3 R	3 R

35	418 N	3R		3 R	3 R
36	419 N	2 R		2 R	2 R
37	420 N	2 R		2 R	2 R
38	421 N	3R	1 S	3 R 1 S	3 R 1 S
39	422 N	2 R		2 R	2 R
40	423 N	2 R		1 R 1 S	1 R 1 S
41	424 N	3R		3 R	3 R
42	425 N	4 R		4 R	4 R
43	426 N	4 R		4 R	4 R
44	427 N	3R		3 R	3 R
45	428 N	4R		4 R	4 R
46	429 N	1 R		1 R	1R
47	430 N	2 R		2 R	2 R
48	431 N	3R		3 R	3R
49	432 N	4 R		4 R	4 R
50	433 N	3R		3 R	3R
	58-57 x IT 81 D 1032				
51	437 N	4 R		4 R	4 R
52	438 N	2 R		2 R	2 R
53	444 N	4 R		4 R	2 R 1MS 1 S
54	445 N	3R	1 S	3 R 1 S	2 R 2 S
55	447 N	4		4 R	4 R
56	449 N	2 R		2 R	2 R
57	454 N	2 R		2 R	2 S (Symptoms on the leaves!
58	455 N	3R		3 R	3R
	Varieties				
59	Tvx 3236	4 R		4 R	4 R
60	IT 84S 2246-4	4R		4 R	4 R
61	Mougne	4R		4 R	4 R
62	58-57	3R		3R	1 R 2MS
63	Ndiambour	2 R S		2 R 2 S	1 R 3 S
64	B 21	4 s		4 S	4 s
65	CB5	2 s		2 S	2 s

Note : R = Resistant MS = Moderately susceptible
S = Susceptible NC; = Not germinated

It is revealed from the final observation that 42 breeding lines were resistant to bacterial blight while 4 were susceptible. Eleven breeding lines showed heterogeneous reactions. One entry developed symptoms on the leaves through systemic infection. However, symptoms on the stem were of resistant type.

Amongst the 7 varieties Mougne, Tvx 32 36 and IT 84 S 2246-4 were resistant while B 21 and CB5 were susceptible. 58-57 and Ndiambour showed heterogeneous reaction. Bacterial blight is seen for the first time on 58-57. This year it was observed in the field also under natural infection.

Out of 15 entries which were found to be virus free in both field as well as screen house tests. 13 were also found to be resistant to bacterial blight. They are as under : 365 N, 368 N, 369 N, 405 N, 408 N, 411 N, 414 N, 415 N, 416 N, 422 N, 429 N, 430 N and 432 N.

It is suggested to do single plant selections in the breeding lines showing heterogeneous reactions.

Single plant selections made in some of the promising breeding lines were screened in the screen house by stem stab method. The sowing of 15 single plant selections from 275N was done on 28.10.88 and the inoculation on 9.11.88. Twenty single plant selections from 283 N were sown on 11.11.88 and inoculated on 23.11.88.

Out of 15 single plant selections from 275 N 9 were found resistant to bacterial blight while 2 single plant selections from 283 N were resistant to bacterial blight. The seed of these selections has been given to the breeder for further use.

1.3. Disease Nursery .

A disease nursery was initiated in the year 1986 with a view to screen the promising material against the principle cowpea diseases. This year in all 120 entries comprising of 79 varieties and 41 elite breeding lines were tested against virus, bacterial bligh-t , macrophomina blight and cercospora leaf spot. No entry was inoculated directly . However, varieties used in the spreader rows viz, 58-57 and B 21 were inoculated with virus and, bacterial blight respectively . Macrophomina blight pathogen is soil borne. The tiisease nursery is conducted in the same field every year. This has helped to build up this pathogen in the disease nursery plot. which was evident from the heavy infection of this disease on the spreader rows as well as the test. entries. However, it is not yet uniformly distributed in the nursery plot.

The disease nursery consisted of spreader rows, indicator rows and the test entries. Two varieties were used for spreader and indicator rows viz, 58-57 (virus susceptible) and B 21 (bacterial blight susceptible). Half line was sown to 58-57 and the remaing half to B 21. The spreader row was repreated every after 4 test entries. THE spreader rows were sown on 28.07.88 while the test entries were sown on 10.08.88. One line of indicator rows was sown on the same day alongwith the test entries every after test rows. Each entry hnd one row of 5m length The spacing used was 80 cm between the rows and 50 cm within the plants. Thus there were 10 pockets in each row of which 5 were sown to 58-57 and 5 to B 21. in case of spreader and indicator rows. Each test entry was repeated two times. A border of 4-6 lines of 13 21. and 58-57 was sown all around the experimental plot. A11 the plants of 58-5;' in: the spreader rows were inoculated with virus on 31.08.88. The inoculum was prepared by blending thc infected leaves in a buffer solution of sodium and potassium phosphate:;. Bacterial blight inoculation of B 21 plants in the spreader rows was done on 1.09.88 by infiltration technique. Inoculnm was prepared by making a water suspension of freshly multiplied bacterial culture on nutrient dextrose agar medium .

Virus development on the spreader rows was highly satisfactory. Its spread to the test entries was also very high. Some of the test entries were very severely infected. Out of 79 varieties tested, 46 were found to be virus resistant while 20 were susceptible. Seven varieties produced heterogeneous reaction. Amongst the breeding lines 11 were observed to be virus free while 14 were susceptible. Thirteen breeding lines had a mixture of resistant and susceptible plants. There was a mixture of resistant and susceptible plants in 275 N, a promising breeding line which is likely to go in the minikit trials. Individcal virus resistant plants of 275 N were selected and handed over to the breeder for further use.

Bacteriai blight development on B 21 plants in the spreader rows was quite satisfactory. However, it did not spread much to test entries. Only 7 entries developed susceptible reaction. Most of these entries developed stem canker symptoms. Rlight symptoms on the leaves were very rare. This may be due to heavy infection of macrophomina blight which might have suppressed bacterial blight infection.

Macrophomia blight infection was the first to appear in the nursery. The infection was seen both on the leaves as well as on the stems . In fact the infection first started on the leaves and gradually extended to the stems . In many cases all thc leaves on the plant were dropped down due to macrophomina infection finally resulting in complete death of the plants.

In some areas the infection was very severe killing all the plants in all the entries including spreader and indicator rows. In the whole nursery only 19 entries were found to be resistant of which 12 were varieties and 7 were breeding lines. However, the resistance of these entries needs to be confirmed. Probably they might have escaped infection because of lack of inoculum in some area of the nursery.

Cercospora leaf spots infection was developed late. It was quite severe on some of the entries. Twenty seven entries were rated as susceptible. Only 9 entries were observed to be almost free from cercospora leaf spots. All other entries showed intermediate reaction. Most of them were rated as moderately resistant.

This year there was no incidence of chonnephora pod rot. Similarly web blight infection was also not seen which might be due to heavy infection of macrophomina blight.

In case of 8 entries, all the plants were killed due to macrophominu blight in both Le replications. As such their performance against other diseases could not be seen. In other 47 entries, all the plants were killed due to macrophomina blight in one replication. The performance of these entries against other diseases is based on one replication only. These entries are marked by asterisk.

The results of all the entries for all the four diseases are summarised in table 4.

Table 4 : Reactions of principle diseases on some promising varieties and elite breeding lines in the diseasc nursery.

	Entry	Disease Reaction			
		Virus	Bacterial Blight	Macropho- Blight	Cercospora leaf spot
	2	3	4	5	6
1	58-57	S	R	S	MS
2	58-39 *	R	R	S	MR
3	78-45 *	R	R	S	MR
4	58-185*	S	R	S	S
5	78-7*	R	R	S	MR
6	66-68"	MS	R	S	MR
7	58-25	NA	NA	S	NA
8	58-184*	R	R	S	MR
9	66-86	Nil	NA	S	NA
10	58-79 D_2 A_2^*	R	R	S	MR
11	78-21*	R	R	S	MR
12	82-2 WL*	R	R	S	MR
13	66-37	NA	NA	S	NA
14	58-43"	R	R	S	MR
15	63-33	S	R	S	MR
16	66-149	R	R	S	MR
17	36-64	S	R	MR	MR
18	78-29	R	R	S	MR
19	66-64"	R	S	S	MR
20	76 B 27	R	R	S	MR
21	66-73*	R	MS	S	MR
22	58-95"	R	R	S	MR
23	82-6	R:S	R	S	S
24	60-6	R	R	S	MR
25	AS 6 *	R	R	S	S
26	AS 9	R	R	S	S
27	85 F 962-4*	R	R	S	MR
28	78-23"	R	R	S	MR
29	58-74 D1C2	R	R	S	MR
30	58-58	S	R	MR	S

31	78-46	R	R	S3	S
32	63-8"	R	R	S	?IR
33	66-56	R : MS	R	-	MR
34	59-21	R : MS	MR	MR	MR
35	58-221	Mi	R	MR	MR
36	58-79T	R ; MS	MS	R	MR
37	58-64	MS	R	MR	S
38	58-60	S	R	R	s
39	78-36	R	R	R	R
40	63-05	MS	R	MR	MR
41	59_20	R	R	R	MR
42	78-37	S	R	R	MR
43	67-32	R	R	S	S
44	66-A4	S	R	Fi	MR
45	78_10	MS	R	R	MR
46	66-17	R : S	R	S	S
47	IS B 26	S	R	R	S
48	Ndiambour	S	R	R	S
49	89-10 ML*	R	R	C	R
50	IT 81 D 1137	NA	NA	NA	NA
51	66-76	R : S	S	MR	MR
52	59-9 D1*	R	R	S	R
53	68-226	R	R	MR	S
54	78-26	R	R	MR	R
55	17 B 28*	R	R	S	MR
56	I22 Vita 5	R	R	MR	R
57	58-20*	R	R	S	MR
58	78-33	R	R	S	R
59	58-34	R : MS	R	R	S
60	66-40	R	R	MR	S
61	103-6	S	R	R	S
62	58-75	R	R	S	R
63	83D 328-4	R	R	MR	R
64	78-6	S	R	R	MR
65	TVx 3236*	R	R	S	R
66	78-32	R	R	S	MR
67	78-19	NA	NA	S	NA
68	84 D 371"	R	R	S	MR
69	58-95 D2	MS	R	S	MR

70	78-20*	R	R	S	MR
71	83-122*	R	S	S	MR
72	Mougne	S	R	S	MR
73	78-3*	R	R	S	MR
74	58-44*	R	R	S	MR
75	78-5	R	ii	S	MR
76	82-9*	R	FIS	S	MR
77	dan Haoussa	S	R	S	MR
78	IT 81 D 1032	NA	NA	S	NA
79	IT 84S-2246-4	R	R	S	MR
80	2N	R : S	R	S	MR
81	36 *	MS	R	S	MR
82	48N *	R : s	R	S	MR
83	63N *	R :	R	S	MR
84	76N *	R	R	S	MR
85	93N *	R	R	S	S
86	114N	NA	NA	S	NA
87	121N *	S	R	S	MR
88	140N *	S	R	S	MR
89	168N *	R	R	S	MR
90	170N	NA	NA	S	NA
91	174N	NA	NA	S	NA
92	185N	S	R	S	S
93	191N *	PIS	R	S	MR
94	217 N *	MS	R	S	MR
95	218 N *	MS	R	S	S
96	219 N *	MS	MS	S	S
97	224 N *	S	R	S	S
98	235 N	R	R	MR	MR
99	237 N	R	R	S	MR
100	239 N *	R	R	S	MR
101	241 N	S	R	S	MR
102	245 N *	R : S	R	S	MR
103	247 N *	MS	R	S	MS
104	248 N *	S	R	MR	MR
105	252 N *	R	R	S	MR
106	253 N	R : MS	R	MR	MR

107	259 N	R	R	MR	MR
108	269 N	R : S	R	R	S
109	275 N	R : S	R	S	MS
110	276 N	R : s	R	MR	MR
111	279 N	S	R	MR	MR
112	283 N	MS : S	R	R	S
113	286 N	R : S	R	R	MR
114	292 N	R : MS	R	R	S
115	299 N	R : S	R	MR	S
196	309 N	R : s	R	R	MS
117	310 N	R	R	MR	MR
118	375 N	R	R	MS	S
119	279 N	S	R	R	MR
120	283 N	MR : MS	R	R	S

Noi;es :

R - Resistant MR - Moderately resistant

MS- Moderately susceptible S-Susceptible

R:S-Mixture of resistant and susceptible

NA- Results not available.

* Observations for virus, bacterial blight and cercospora leaf spots based on one replication only.

I. Virus Transmission studies :

The studies on virus transmission through seed as well as by vectors were initiated in 1987. The same were continued this year in order to confirm the results obtained in 1987. However ,the trial was slightly modified. In addition to station seed farmers' seed was also used in the trial conducted at Bambey while at Djibelor only the farmers' seed was used instead of station seed. This will help to know the extent of contamination already exists in the farmers ' seed.

2.1. Transmission through seed

The trial was conducted at 2 locations viz, Bambey and Djibelor. At Bambey 58-57 was used for this trial. There were 3 treatments depending on the source of seed. The first treatment. consisted of our own seed which was harvested from the virus infected plot (Infected seedj. For the second treatment seed obtained from seed production service (healthy seed) was used while the third treatment comprised of the farmers' seed procured from the market. The sowing was done on 28 .07 .88 in 3 separate plots with a spacing of' 50 x 50 cm2 . . One seed was sown in each pocket. The observations on virus incidence were recorded on 11 . 8. The data on number of seed sown and germinated and the number of virus infected plants is furnished below.

Treatmer, t	Number of seeds sown	germinated	% ger.	N° of virus infected plants 11.08	% disease
Infected seed	480	337	70.2	17	5.04
Healthy seed	470	379	80.6		1.06
Farmers ' seed	960	650	67.7	16	2.46

From the germination percentage it is seen that the quality of farmers ' seed as well as infected seed was not satisfactory while that of healthy seed was just fulfilling the minimum requirement. The observntions recorded 14 days after sowing showed 5.04% virus incidence in the plot sown with infected seed while i.t was 2.46% in the farmers ' seed. Healthy seed also recorded 1.06% virus incidence. The first appearance of aphids was noticed on 19.08 which means the virus infection occured was through seed In 1987, 17.5 % infection was recorded through seed. It was quite high as compared to this year probably because the seed used during 1987 was exclusively obtained from the infected plants while this year it was Prom the harvest of an infected plot.

2,46% infection in the farmers' seed indicates that farmers' seed is also substantially contaminated with virus while the 1.06% infection in the healthy seed reveals that the seed of seed production service is not totally free from virus and emphasizes the need of monitoring and exercising rigorous rouging of infected plants in the seed multiplication plots.

The trial conducted at Djibelor consisted of only the farmers' seed of 1.0ca variety procured from market. The trial was sown in small plots at different sites in the same field. The sowing was done on 6.08.88 with 50 x 50 cm2 spacing. The observations on virus incidence were recorded on 31.08.88. No beetles were observed in the trial plot, till 31.08.88. The data on number of seeds sown in each plot with number of seeds germinated and number of plants infected with virus is furnished below.

plot. N°	N° of sown	Seeds germinated	% germ.	N° of virus infected plants	% disease
1	1520	1406	92.5	97	6.9
II	392	371	94.6	23	6.2
III	492	458	93.1	20	4.37
IV	400	375	93.7	11	2.93
Total	2804	2610	93.1	151	5.79

The average icfection (5.79%) occurred through seed at Djibelor is higher than the infection noticed at Bambey (2.46%). This shows that the farmers' seed in Casamance is more coctaminated by virus than Hambey.

2.2. : Transmission by insects.

The trial for virus transmision through seed was further continued to see whether there is virus transmission by insects. The occurrence of aphids was noticed at Bambey on 19/08.

Aphids were allowed to develop in the trial .However, they disappeared after a heavy rain of 127mm on 28/08. There was considerable increase in the virus incidence in the first week of September which indicates that aphids had already transmitted the virus to the healthy plants. The observations recorded on 8.09 are presented below .

Plot		Total plants	Virus Infected plants	Disease %	Disease % before the appearance of aphids
Infected	Seed	337	79	23.44	5.04
Healthy	Seed	379	66	17.41	1.06
Farmers'	Seed	650	124	19.08	2.46

All the plots have shown iccrease in virus incidence af ter the occurence of aphids. This indicates that aphids were responsible for transrnitting the virus infection to the healthy plants.

III. ESTIMATION OF LOSS IN YIELD DUE TO VIRUS.

A filler trial conducted at Bambey during 1987 revealed that there was 17.41% loss in yield due to virus. This year a statistically Laid out triat was conducted at Bambey to find out the yield loss due to virus. The experiment consisted of two treatments viz, (1) plots with minimal virus infection through use of healthy seed and control of vector and (2) plots with maximum virus infection through use of infected seed and artificial inoculation of plants. The variety used for the experiment was 58-57. The experiment was sown on 28.07.88 in a randomised complete block design. Each treatment was replicated 12 times. Plot size was 5 x 5m2 and the spacing 50 x 50cm2. The protected plots were sprnyed periodically with thiodan at the rate of 800g a.i/ha for arrestingthe vector nctivity. Unprotected plants were inoculated with the sap collected from the infected leaves. The inoculation was done on 31.08.88 by rubbing the young leaves with a fore finger wetted with the inoculum. Carborundum powder was added to ttie inoculum to act as an abrasive.

The observations were recorded for the virus incidence and the yield. The data was statistically analysed. The summary of results is presented in table 5.

Table 5 : Estimation of loss in yield due to virus : summary of results .

Treatment	Virus incidence		Yield
	%	arcsin	(Kg/ha)
Protected plots	15.99	23.53	1140
unprotected plots	24.37	29.32	897
CV%	27.74	14.14	7.72
Prob.	0.003	**0.002**	**0.000**
LSD	7.09	**4.74**	**100**

In case of both the disease incidence and the yield data, the differences between the two treatments were highly significant. There was significantly higher virus incidence in the unprotected plots than protected plots which resulted in significantly decreasing the yield in unprotected plots. There was 30% (343 Kg/ha) yield loss due to more virus incidence in the unprotected plots.

In the disease and yield correlation analysis a negative but significant correlation was observed (-0.557). This shows that with the increase in the virus incidence there is significant reduction in the yield.

IV. CHEMICAL CONTROL OF ASHY STEM BLIGHT.

Ashy stem blight caused by Macrophomina phaseolina was a serious disease on cowpea during 1987 rainy season. It was seen through out the cowpea area at the research stations as well as farmers' fields .Some of the fields were very badly affected resulting in heavy yield losses. Since the ashy stem blight pathogen is predominantly soil borne, seed treatment was thought to be more effective for combating this disease. Hence a field experiment was conducted with some new seed dressers together with the old ones which are available and in use in Senegal. The experiment was conducted in a randomised complete block design with 8 treatments and 4 replications. Other details of the experiment were as follows :

Treatments : EIGHT

1	Rizolex	2g/Kg seed
2	Rizolex	3g /Kg "
3	Granox	2g /Kg "
4	Sumi 8	1g/Kg "
5	Sumi 8	2g/Kg "
6	Granox	4g/Kg "
7	Thiram	3g/Kg "
8	Control (No Seed treatment)	

Plot size : 6 x 5m
Spacing : 50 x 50 cm
variety : B 2 3
Fertilizens: 6 : 20 : 10 at the rate of 50 Kg/ ha
Date of sowing : 28.07.88
Date of harest : 6. 10.88

One seed was sown at each pocket:. Refore sowing furadan was applied in each pocket to protect the seed from damage due to other pests particularly millipeds. Infected stems collected during 1987 crop season was crushed into powder and used as inoculum. This inoculum was put in each pocket along with the seed.

The observations were recorded for germination, disease incidence, disease intensity and the yield. Disease intensity and incidence observations were recorded three times. All the data were statistically analysed. The summary of results is given in table 6 .Duncan's multiple Range test was applied to test the efficacy of various seed dressers where the treatment effectswere observed to be significant i.e. in case of germination percentage and first observations on disease incidence and intensity recorded on 26.08.88. Theresults are summarised in table 7.

Table 6 : Chemical control of ashy stem blight :
Summary of results
(Figures in the brackets denote Arcsin values)

Treatment	Germination %	Disease Incidence %			Disease Intensity			Grain yield (Kg/ha)
		1st obs 26/08	2nd obs 7/09	3rd obs 23/09	1st obs 26/08	2nd obs 7/09	3rd obs 23/09	
Rizolex 2g/Kg	56.11 (48.53)	(49.59)	(70.56)	(90.00)	--	(63.25)	(84.39)	13.21
Rizolex 3g/Kg	62.50 (52.40)	51.67 (45.97)	88.61 (70.44)	100.00 (90.00)	45.28 (42.26)	79.03 (62.75)	98.61 (84.45)	12.94
Granox 2g/Kg	73.61 (59.20)	48.05 (43.87)	87.50 (69.87)	100.00 (90.00)	40.14 (39.31)	72.71 (58.63)	98.13 (82.27)	8.34
[illegible] g/Kg	51.67 (45.96)	64.72 (53.58)	93.89 (76.08)	100.00 (90.00)	60.69 (51.18)	85.56 (67.77)	99.38 (85.70)	3.98
[illegible] 2g/Kg	55.00 (47.87)	61.39 I(51.86)	90.00 (73.51)	100.00 (90.00)	55.07 (48.01)	82.71 (66.27)	98.47 (84.04)	4.88
Granox 4g/Kg	74.72 (59.83)	47.50 (43.56)	86.67 (68.63)	100.00 (90.00)	42.64 (40.72)	78.47 (62.49)	98.06 (81.94)	4.00
Bavistin 3/Kg	52.50 (46.44)	63.61 (52.94)	91.39 (73.86)	100.00 (90.00)	60.14 (50.88)	82.23 ((65.25)	99.17 (84.90)	1.26
Control	48.06 (43.89)	65.28 (53.89)	95.59 (77.86)	100.00 (90.00)	60.97 (51.34)	88.53 (70.26)	99.58 (87.90)	LI.67
C.V.%	8.16 (5.84)	12.65 (8.80)	6.12 (7.34)	0.00 (0.00)	16.05 (10.64)	6.86 (6.37)	1.17 (4.05)	116.03 ,
Prob.	.000** (.000)	.032* (.037)	-NS (.402)	000NS (000)	034" (038)	093NS. (.087)	NS -	,392[NS]
LSD	8.47 (5.17)	12.75 (7.62)			14.62 (8.64)			

** - Significant at 1% level

* - Significant at 5% level

NS -Non significant

Table 7 : Chemical control of ashy stem blight :
Results of Duncan's Multiple Range Test.

Treatment	Germination	Disease Incidence 1st obs	Disease Intensity 1st obs
Rizolex	BC	AB	AB
Rizolex 3g	B	AB	AB
Granox 2g	A	B	B
Sumi 8 1g	C	A	A
Sumi 8 2g	BC	AB	AB
Granox 3g	A	B	B
Thiram 3g	C	A	A
Control (No treatment)	C	A	A

Treatments with the same letters do not differ significantly.

The results presented in table 6 revealed that there was highly significant differences in the germination percentage due to the treatment of different seed dressers. The germination percentage obtained in the seed treatment with granox (both doses-2p and 4g/Kg seed) was significantly more than not only the control (no seed treatment) but also the other seed dressers. The next best treatment observed was Rizolex 3g dose. It has given significantly more seed germination over control as well as Thiram and Sumi 8 1g dose. However, it was on par with Rizolex 2g dose and Sumi 8 2g dose. These results indicate that seed treatment with granox before sowing gives the highest seed germination followed by seed treatment with rizolex at the rate of 3g per Kilo seed.

The results of first observations recorded on disease incidence as well as intensity on 26.08.88 indicated that there was significant variation in the efficaccy of various seed treatments used in this experiment. Here also Granox at both the doses was found significantly superior over control as well as thiram and Sumi 8 at 1g dose. However, it was on par with other seed treatments viz, Rizolex at both 2g and 3g doses and Sumi 8 at 2g dose.

The results of the disease incidence and intensity observations recorded on 7.09.88 and on 23.09.88 did not show significant variation. In the third observation recorded on 23.09.88 , all the treatments have shown 100% disease incidence. The dieease intensity also was very high in all the treatments. Lt ranged in between 98 .06 (Granox 4g dose) and '99.58 (control). These results clearly show that

1. Seed treatment with granox gives satisfactory seed germination even though the seed is contaminated with Macrophomina pathogen.

2. New seed dressers viz., Rizolex and Sumi 8 do not give satisfactory seed germination if Macrophomina contamination is high.

3. Granox holds its efficacy to some extent in the early crop growth stage against Dlacrophomina infection. But subsequently it also looses its hold and the crop succumbs to the Macrophomina infection.

4. If the disease pressure is very high, seed treatment alone evenwith Granox cannot save the crop. For controlling the Macrophomina infection on the leaves, fungicidal sprays with some new systemic fungicides rnay be worth trying .

These seed dressers were also tested in vitro by rolled towel method. Same treatments were used in this test also.ie, Rizolex 2g/Kg, Rizolex 3g/Kg, Granox 2g/Kg Sumi 8 1g/Kg, Sumi 8 2g/Kg, Granox 4g/Kg and Thiram 3g/Kg. One set of untreated seed served as control.

Seeds were treatcd with respective seed dressers and then were put on sets of 3 blotter sheets previously moistened with water. The sheets were rolled and kept at room temperature, They were moistened regularly. The sheets were opened after 10 days and the observations were recorded for seed rot. and root/seedling infection. The microflora associated with seed rot and root rot/seedling infection was examined under the microscope. The results are presented in table 8.

Table 8 : Chemical control of ashy stem blight.

Results of laboratory test.

Seed treatment	Seed rot (ungermi nated) %	Healthy seed. germinated %	Root rot seedling infection %	Organisms associated with seed rot, root rot/seedling infection:
Rizolex 2g/Kg seed	15	67	18	Macrophomina phaseolina Aspergillus sp. Rhizopus sp. Erwinia sp.
Rizolex 3g/Kg seed	15	71	14	Macrophomina phaseolina Aspergillus sp. Rhizopus sp. Erwinia sp.
Granox 2g/Kg seed	6	90	4	Macrophomina phaseolina Erwinia sp.
Sumi 8 1g/kg seed	12	62	26	Macrophomina phaseolina Aspergillus sp. Rhizopus sp. Erwinia sp.
Sumi 8 2g/Kg seed	10	64	26	Macrophanina phaseolina Rhizopus sp. Erwinia sp.
Granox 4g/Kg seed	2	97	1	Erwinia sp.
Thiram 3g/Kg seed	5	79	16	Macrophomina phaseolina Aspergillus sp. Erwinia sp
Control (UC seed) (treatment)	18	28	54	Macrophomina phaseolina Aspergillus sp. Rhizopus sp. Aspergillus sp. Rhizopus sp. Erwinia sp.

As was seen in case of field experiment, granox at 4g dose was the best in this study also. Granox at 2g dose was the next best treatment followed by thiram 3g /Kg seed. Macrophomina phaseolina was the most common organism encountered almost in all the treatments except granox at 4g dose.

V. SURVEY OF COWPEA DISEASES

The disease situation during 1988 crop season was serious in respect of mosaic diseases while it was comparatively much satisfactory in case of other diseases. A very high incidence of virus infection was observed througout the cowpea area. At Bambey virus infection was noticed during the second week after sowing. Subsequently it was spread very rapidly. Some of the 58-57 plots showed a very high virus incidence (around 80%) within 4 weeks after sowing. This year there was a very early out break of aphids on cowpea. This might have helped to spread the virus rapidly.

Amongst the other diseases bacterial blight was important particularly on B 21. Some of the ii 21 fields, at the station as well as in the minikits were badly affected. 58-57, which was holding resistance to bacterial blight so far, showeti some bacterial biight infection at Louga station. Few farmers' fields sown with CB5 and B 21 at Keur Boumi were badly affected by bacterial blight.

Macrophomina blight which was very serious during 1987 season was mostly confined to pathology field at Bambey. Lt was very serious in the chemical control experiment and the disease nursery. However, other fields in Bambey and other stations also had a ceglegible incidence . Some of the minikit trials showed mild attack of macrophomina blight.

Incidence of web blight was also very low as compared to last year. Similarly choanephora pod rot was also neglegible. Cercospora leaf spots incidence was slightly more than 1987 season. But it appeared late and as such had no much effect on the yield. Brown blotch was noticed on CB 5 at bambey. Bacterial pustule was seen in some of the minikit trials particularly on CB 5, Ndiambour, B 23. and at 2 Locations (Sagatta and ndatt fall) on 58-57 also.

Stationwise report of various diseases encountered in the experimental plots at the research stations as well as minikit trials on the farmers' fields is furished in table 9.

Table 9: Cowpea diseases encountered during 1988

Crop season :

Bambey :

58-57 - virus, cercosporiose, choanephora pod rot

Ndiambour - Virus, cercosporiose

Mougne - Virus, cercosporiose

B 21 - Bacterial blight, web blight, choanephora pod rot Ashy stem blight

CB5 - web blight, brown blotch

Virus and cercosporiose were seen on many breeding lines in the breeders field. Ashy stem blight (Macrophomina blight) was very serious in the disease nursery and many entries succumbed to this disease (see table 4 of this report).

Nioro :

58-57 - virus , Cercosporiose

Djibelor :

58-57 - virus , cercosporiose
Local - virus, cercosporiose, web blight
B 21 - web blight;

Thilmakha :

B 21 - Bacterial blight, web blight, ashy stem blight

58-57 - virus, ccrcosporios e
CB5 - choanephora pod rot
Mougne - virus
Some of the breeding lines in the advanced yield trials showed virus and bacterial blight infection. (virus - 279, 283 and 417, bacterial blight - 283 and 417).

Louga :

B 21 - Racterial blight
CB5 - Bacterial blight, web bligh , cercosporiose, choanephora pod rot, bacterial pustule

Ndiambour - Virus
58-57 - virus cercosporiose bacterial blight
(It was the first time 58-57 has shown bacterial bligh infection)
Some of the breeding lines (191 N , 279 N, 283 N) showed virus infection.

Minikits :

Sapatta :

B 21 - bacterial blight, cercosporiose
CB 5 - bacterial blight, bacterial pustule, ashy stem bligh t , cercosporiose
58-57 - virus, bactérial pustule, cercosporiose
Ndiambour - bacterial pustule, virus , cercosporiose

Sine Dieng :

58-57 - virus, cercosporiose

B 21 - Cercosporiose, bacterial blight, bacterial pustule

CB 5 - cercosporiose, bacterial blight, bacterial pustule, ashy stem blight

Ndiambour - Bacterial pustule, cercosporiose, choanephora, pod rot, virus

Cocki :

58-57 - virus, cercosporiose

Ndiambour - bacterial pustule

B 21 - Bacterial blight, cercosporiose

CB 5 - Ashy stem blight, cercosporiose

Sakal :

B - 21 - Bacterial blight, ashy stem blight., cercosporiose

CB5 - Bacterial blight, ashy stem blight cercosporiose web blight, choanephora pod rot;

Ndiambour - Virus, web blight

58-57 - Virus, cercosporiose

Ndatt Fall

CB _ 5 - Bacterial blight, bacterial pustule, ashy stem blight, cercosporiose, web blight

B21 - Bacterial blight, cercosporiose, ashy stem blight, bacterial pustule, web blight.

Ndiambour - bacterial pustule, bacterial blight, cercosporiose, web blight

58-57 - Virus, cercosporiose, bacterial pustule

Keur galo :

58-57 - Virus, cercosporiose

Mougne - virus, cercosporiose

B 21 - Cercosporiose, web blight

Tvx 3236 - No disease

Keur Boumi :

CB-5 - Bacterial pustule, cercosporiose, bacterial blight.

B 21 - Bacterial blight, bacterial pustule, cercosporiose

Ndiambour - Bacterial pustule, cercosporiose

58-57 - Virus, cercosporiose

Local - cercosporiose

(Regular minikits have been discontinual at Keur boumi from this year. However, farmers have continued to grow the minikit varieties.)

Striga was seen at Ndatt Fall for last 2 seasons. This year in addition to Ndatt Fall it was also seen at Sine Dieng and Keur Boumi. The intensity was also much more as compared to previous years. At Ndatt Fall and Sine Dieng purple flower sp. was observed while at Keur Boumi a white flower sp. was noticed. Striga was also noticed in the pathology field at Bambey. It was seen in the experiment where farmers' seed was used. This seed was procured from Bambey market. This indicates that striga is prevailing in the fields around Bambey.