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BY

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A disease nursery initiated during 1986 for multiple disease resistance screening was continued during this year also. There was heavy natural infection of ashy stem blight and web blight in the disease nursery. This opportunity was taken to score the test entries against these diseases. Screening for virus resistance in the field at Djibelor as well as at Bambey and in the screen house was also continued. Some work on transmission studies of virus through seed and by insects was initiated.

Similarly experiments for estimation of yield losses due to virus and bacterial blight diseases were conducted. In the laboratory studies, attempts were made to examine the pathogens associated with cowpea seed and seedling rots and their control through use of various seed dressers. The results of all these experiments are discussed in the following pages.

1. Resistance Screening for major diseases.

1.1. Screening for virus resistance.

133 individual plant selections made from 9 F₂ families during 1986 rainy season at Djibelor were grown at Bambey during off season (March-May). Natural virus infection was observed on some of the lines. Observations of virus incidence on these entries are presented in table 1. The available entries were also screened in the screen house by artificial inoculation. 4-5 seeds of each entry were sown on 2.3.87 in separate pot. The inoculation was done twice, first on 11.3.87 and the second on 13.3.87. The inoculum was prepared by blending the infected leaves collected from 58-57 plot at Bambey during off season in a buffer solution of sodium and potassium phosphates. Carborundum powder was dusted on the leaves before inoculation to act as an abrasive. The inoculation was done by rubbing the primary leaves with a forefinger wetted with the inoculum.

The virus symptoms started appearing in the second week after inoculation. Final observations were recorded one month after inoculation and are given in table 1.

Table 1 : Results of virus screening in the field and screen house during off season.

Cross and Entry N°		Incidence in the field	Screen house Reaction
Casa 16 x B 21	1	23.08	S
	2	14.29	S
	3	0.00	NA
	4	0.00	NA
	5	0.00	NA
	6	0.00	R
	7	33.33	S
	8	0.00	R
	9	0.00	NA
	10	17.65	S
	11	15.35	R
	12	20.00	R
	13	66.67	NA
	14	50.00	S
	15	0.00	S
	16	36.36	S
	17	50.00	NA
	18	0.00	NA
	19	0.00	NA
59-9 x 321	20	0.00	R
	21	0.00	NA
	22	0.00	NA
	23	0.00	NA
	24	0.00	R
59-9 x B 21	25	0.00	NA
	26	0.00	R
	27	0.00	NA
	28	0.00	NA
	29	0.00	R
	30	0.00	NA

Cross and Entry N°	% Incidence in the field	Screenhouse Reaction
Casa 3 x B21	31 0.00	NA
	32 0.00	R
	33 6.25	S
	34 0.00	NA
	35 0.00	S
	36 0.00	S
	37 0.00	R
	38 0.00	R
	39 0.00	NA
	40 0.00	NA
	41 0.00	R
	42 0.00	NA
	43 0.00	NA
	44 0.00	NA
	45 0.00	R
	46 0.00	R
	47 0.00	S
	48 0.00	R
	49 0.00	NA
	50 0.00	NA
Casa 3 x B21	51 0.00	S
	52 0.00	R
	53 0.00	NA
	54 0.00	R
	55 0.00	R
	56 0.00	R
	57 0.00	NA
	58 0.00	R
	59 0.00	NA
	60 0.00	R
	61 0.00	NA
	62 0.00	NA
	63 0.00	NA
	64 0.00	NA

Cross and Entry N°	Incidence in the field		Screenhouse Reaction
Casa 16 (B 21 x 1137)	65	5.56	R
	66	6.67	R
	67	38.46	S
	68	0.00	R
	69	0.00	R
	70	4.76	S
	71	0.00	S
	72	0.00	R
	73	0.00	S
	74	0.00	S
	75	0.00	R
Mougne (Mougne x 1032)	76	0.00	R
	77	6.25	R
	78	133.33	S
	79	26.67	R
	80	5.88	R
	81	11.76	R
	82	0.00	NA
	83	11.11	NA
	84	0.00	S
	85	0.00	R
	86	5.56	R
	87	0.00	S
	88	0.00	NA
	89	0.00	NA
	90	0.00	R
	91	0.00	R
	92	0.00	R
	93	0.00	R
VLP Casa 16 x B 21	94	6.67	R
	95	14.29	R
	96	123.08	R
	97	0.00	NA
	98	0.00	R
	99	0.00	NA
	100	0.00	R

Cross and Entry N°	% Incidence in the field	Screenhouse Reaction
VLP Casa 16 x B21	101	S
	102 133.33	S
	103 0.00	R
	104 ~80.00	S
	105 0.00	R
	106 10.00	S
	107 133.33	R
58-57 x TVU 1185	108 0.00	R
	109 0.00	R
	110 0.00	R
	111 0.00	R
	112 0.00	R
Casa 16 x CB5	113 0.00	S
	114 0.00	R
	115 0.00	R
	116 0.00	R
	117 0.00	NA
	118 0.00	R
	119 0.00	R
	120 0.00	R
	121 0.00	S
	122 0.00	R
	123 0.00	S
	124 0.00	S
	125 0.00	S
	126 0.00	R
	127 0.00	NA
Mougne x TVU 1185	128 0.00	R
	129 8.33	R
	130 110.53	R
	131 6.25	R
	132 0.00	R
	133 0.00	R

Notes :

R.. Résistant

S.. Susceptible

NA- Réaction not available

In the field observations 101 entries were observed to be free from virus infection. All the entries of the crosses 59-9 x B21(12), 58-57 x TVU 1185 (5) and Casa 16 x CB5 (15) did not show virus infection. However, the screen house reactions were partially confirming the field observations. In the screen house test 65 entries showed resistant reaction and 29 susceptible. In this test also no entry from the crosses 59-9 x B21 and 58-57 x TVU 1185 showed susceptible reaction. During 1986 screening at Djibelor, all the plants of the family 59-9 x B21 were also observed to be free from virus. In all 49 entries showed resistant reaction in the screen house test as well as no virus incidence in the field. From the material planted in the field, individual plant selections were made based on virus resistance and other desirable characters.

An experiment with 42 individual plant selections made from the above mentioned off season experiment together with 8 parents was laid out during rainy season of 1987 at Djibelor for confirming the virus resistance of these selections. The screening method was the same that was used during 1986 season. One line of a local susceptible variety (Spreader row) was planted after every two test entries for multiplying the inoculum. The spreader rows were sown on 15.07.1987. The test entries were sown on 11 and 12.08.87. By this time the virus had started appearing on the spreader rows. The test entries were inoculated on 26.08.87 and 27.08.87 with the sap from the infected leaves. Carborundum powder was added to the inoculum to act as an abrasive. The inoculation was done by rubbing the fully grown well expanded primary leaves with a forefinger wetted with the inoculum.

The virus symptoms on the test entries had started appearing in the first week of september. However, at the time of first observation which was taken on 8.09.87 the incidence was almost negligible. The second observation was recorded on 25.09.87 which revealed 5 entries having virus infection while the rest were still free of virus. In the final observations which were recorded on 23.10.87, 13 entries showed virus infection. The results of the final observations are summarised in table 2.

Table 2 : Virus incidence in the field at Djibelor
on selected material of F⁴ generation.

Cross & Entry n°		Virus incidence % (AV of 2 rep)	Other Diseases noticed	Cross & Entry N°		Virus incidence % (AV of 2 rep)	Other diseases noticed
Mougne x (MougnexIT 81D1032)				Casa 3 x B 21			
1	4-2	5.88		26	3	0.00	
2	1-1	3.85		27	15 -1	0.00	
3	1-4	0.00	WB	28	15 -1	0.00	WB
4	2-1	0.00		29	20	0.00	WB
5	2-3	0.00		30	23	0.00	WB
6	3-1	10.72		31	29-1	0.00	
7	3-3	0.00		32	29 -1	0.00	
8	5-2	2.94		33	33	0.00	
				59.9 x B21			
9	6-1	0.00		34	6	0.00	
				58-57 x TVU 1185			
10	8-2	0.00	WB	35	1 -1	0.00	
11	13-2	0.00	WB	36	1 -1	0.00	
12	13-4	0.00	WB	37	4 -1	5.00	WB
13	14-1	0.00		38	4 -1	4.55	WB
14	15-6	5.88		39	4 -1	1.00	
15	18-6	0.00		40	4 -1	0.00	
Casa 16 x CB5							
16	12-1	4.76		41	5-1	0.00	
17	12-2	0.00	WB	42	5-2	2.63	
				<u>Parents</u>			
18	7-1	0.00		43	Mougne	0.00	
19	7-2	0.00		44	58-57	5.88	
20	8	0.00		45	IT -81D1032	0.00	
21	14	0.00	WB	46	Casa 16	0.00	WB
Casa 16 x B21							
22	6	0.00		47	CB 5	0.00	
23	10	0.00		48	TVU1185	0.00	
Casa 16 X (B21x1137)							
24	1	0.00		49	Casa 3	6.25	
25	2	0.00		50	59-9	26.72	

Note : WB = WEB BLIGHT

From the results in table 2 it is seen that 5 parents viz ; Mougne, Casa 16, CB5, IT 81D 1032 and TVU 1185 are resistant while 58-57, Casa 3 and 59-9 are susceptible. Reactions of Casa 16 and 59-9 were contradictory to the reactions obtained last year. In the screen house test conducted during Nov.86-Jan.87 Casa 16 showed susceptible reaction while 59-9 was free of virus. Mougne and CB5 which are free of virus in this test were observed to be susceptible on farmers' fields during last year.

Another set of 38 entries were also screened alongwith the experiment described on the previous page. This set consisted of 30 entries from the cross B 21 x TVX3236, 4 entries from the cross 58-57 x IT 81D1137 (which were found resistant during 1986 screening) and 4 parents. The screening method was the same that was followed for the previous experiment.. The sowing was done on 11.08.87 and the inoculation on 26.08.87. At the time of first observation on 8.09.87 ; 2 entries and 1 parent (58-57) showed virus infection. The subsequent observations were noted on 25.09.87 and 23.10.87. The results of the final observations are presented in table 3.

Table 3 : Virus incidence in the field at Djibelor on advance generation material..

Cross & Entry N°			Virus Inci- dence (%Av of 2 Rep)	Other Disea- ses No- ticed	Cross & Entry N°			Virus Inci- dence (%Av of 2 Rep)	Other Diseases Noticed
<u>B21 x TVX. 3236</u>					<u>B21 x TVX. 3236</u>				
1	IS 86	60N	0.00	WB, ASB	24	IS 86	84N	0.00	
2	IS 86	62N	0.00		25	IS 86	85N	0.00	
3	IS 86	63N	0.00	WB	26	IS 84	86N	0.00	
4	IS 86	64N	0.00		27	IS 86	87N	0.00	
5	IS 86	65N	0.00		28	IS 86	88N	0.00	WB
6	IS 86	66N	0.00		29	IS 86	89N	0.00	
7	IS 86	67N	0.00		30	IS 86	90N	0.00	
8	IS 86	68N	0.00	WB	31	Bambey 21		0.00	
9	IS 86	69N	0.00		32	TVX 3236		0.00	
10	IS 86	70N	0.00		<u>58-57 x IT81D1137</u>				
					33	IS 86	282 N	0.68	
11	IS 86	71N	0.00	WB					
					34	IS 86	299N	0.00	WB
12	IS 86	72N	0.00						
					35	IS 86	240N	25.24	WB
13	IS 86	73N	0.00	ASB					
					36	IS 86	253N	0.00	WB
14	IS 86	74N	0.00						
					37	58-57		24.27	WB
15	IS 86	75N	0.00						
					38	IT 81D 1137		0.00	
16	IS 86	76N	0.00						
17	IS 86	77N	0.00	WB					
18	IS 86	78N	0.00		Note :				
19	IS 86	79N	0.00						
20	IS 86	80N	0.00	WB					WB = WEB BLIGHT
21	IS 86	81N	0.00	WB					ASB = ASHY STEM BLIGHT
22	IS 86	82N	0.00						
23	IS 86	83N	0.00	WB					

The results in table 3 revealed that all the 34 entries from the cross B21 x TVX 3236 and 2 entries (IS86 299N and IS86 253N) from the cross 58-57 x IT81D 1137 were resistant. IS86 282N, another entry from the same cross showed negligible infection (0.68%). Out of 4 parents, 3 were free from virus viz ; 321, TVX 3236 and IT81 D 1137. 58-57 showed the highest virus infection (24%).

A third set of 32 entries comprising of 17 breeding lines of our program and 15 IITA entries received from SAFGRAD were screened in the same manner as done in the previous experiments. The sowing was done on 12.08.87 and inoculation on 27.08.87. However, the disease development was poor in this trial which was evident from the poor infection on the spreader rows. All the test entries were free from virus.

A set of 5 varieties were also grown in the same field along with the above screening trials. Though these varieties were not artificially inoculated, some of them showed a very high incidence of virus infection, B21 and TVX 3236 were free of virus while amongst the susceptibles included Casa 3 (25%), 58-57 (60%) and 59-9 (83%).

42 entries comprising of 38 breeding lines from advance trials and 4 check varieties were screened in the screen house during Sept-Oct 1987. About 6 seeds of each entry were sown in separate pots. The inoculation was done on 26.09.87 and repeated on 28.09.87. The inoculum was prepared from the infected leaves of 58-57 collected from Bambey. The methods of preparing inoculum and inoculation were the same as used previously and described in the beginning of the report. The symptoms started appearing in the first week of october. The reactions noted on 17.10.87 are presented in table 4.

Tablee 4 : Screen house reactions of entries from Advance Trials

Entry		Reaction	Entry		Reaction
IS86	235 N	R	IS86	2NN	R
"	245 N	S	"	76 N	R
"	247 N	R	"	93 N	R
"	252 N	R	"	114 N	S
"	269 N	R	"	168 N	R
"	276 N	R	"	185 N	S
"	283 N	R	"	217 N	R
"	292 N	R	"	224 N	R
"	309 N	S	"	237 N	R
"	310 N	R	"	241 N	R
"	239 N	R	"	253 N	R
"	259 N	S	"	174 N	R
"	279 N	R	"	191 N	S
"	286 N	R	"	218 N	R
"	299 N	R	"	219 N	S
"	36 N	R	"	248 N	R
"	48 N	S	"	2' 75 N	R
"	63 N	R	"	58-57	S
"	121 N	R	TVX	32 36	R
"	140 N	R	Mougne		R
"	170 N	S	B 21		R

Notes : R = Resistant
S = Susceptible

The results indicated that quite a large number of entries did not show virus infection. Out of 38 breeding lines 29 were resistant and 9 susceptible. Amongst the check varieties 58-57 showed susceptible reaction while TVX 3236, Mougne and B21 were free of virus infection.

During the subsequent observation taken on 27.10.87 entry n°1886 239N was found susceptible. All other reactions remained the same.

1.2. Multiple disease screening nursery

Screening the germplasm varieties against principle cowpea diseases was continued at Bambey during this year also. In all 243 germplasm varieties comprising of mostly local collections and few varieties obtained from International Institute of Tropical Agriculture, Ibadan (Nigeria) were screened against major diseases such as bacterial blight, virus, choanephora pod rot, web blight, ashy stem blight and cercospora leaf spots. The disease nursery consisted of spreader rows, indicator rows and the test entries. Two varieties were used for spreader and indicator rows viz. Bambey 21 (bacterial blight susceptible) and 58-57 (virus susceptible). Half line was sown to B 21 and the remaining half to 58-57. One line of these susceptible varieties was sown on 20.07.87 as spreader row every after 4 test entries. The sowing of test entries was done on 28.07.87. One line of indicator rows was sown on the same day every after 2 test entries. One line of 4.5 m length was sown to each test entry. The spacing between 2 lines was 80 cm while between 2 plants was 50 cm. Thus there were 10 pockets in each line of which 5 were sown to B 21 and 5 to 58-57 in case of spreader and indicator rows. Each test entry was repeated twice. A border of 4-6 lines of B 21 and 58-57 was sown all around the experimental plot. A suspension prepared from bacterial blight infected leaves of 1986 rainy season was sprayed on the experimental plot on 27.08.87. 58-57 plants in the spreader rows were inoculated with virus on 31.08.87. The inoculum was prepared by blending the infected leaves collected from seed multiplication plot of 58-57 at Bambey during 1987 rainy season in a buffer solution of sodium and potassium phosphates.

The virus infection on the spreader rows was satisfactory. However, it did not spread to test entries. Only six test entries developed virus infection. Similarly bacterial blight incidence was also very low. Only 17 entries showed bacterial blight infection. This may be due to very high natural infection of web blight and ashy stem blight in the disease nursery plot which might have suppressed the bacterial blight and virus infections. Incidence of choanephora pod rot was also low. The cercospora leaf spot infection developed at late stage and was seen mostly on late entries. The observations on all the diseases are summarised in table 5.

Table 5 : Summary of results on infection of major diseases
(Average of 2 replications)

SrN°	Lieu	NP	WB		ASB	VR	BB		CR		CPR	
			INC	INT	INC	INC	INC	INT	INC	INT	INC	INT
1	58-57	10	0	0	0	11	0	0	0	0	0	0
2	58-39	22	10	3.0	0	0	10	3	0	0	0	0
3	58-24	9	100	100	50	0	25	7	0	0	0	0
4	59-12	32	17	17	9	0	0	0	8	2	0	0
5	~9-1-12-12	18	38	1.6	9	0	9	2	0	0	0	0
6	78-45	12	50	2	0	0	0	0	0	0	0	0
7	Dan Haoussa	7	55	52	0	0	0	0	0	0	0	0
8	66-71	32	34	34	34	0	0	0	0	0	0	0
9	58-161	14	20	15	20	0	0	0	0	0	0	0
10	60-2	29	13	11	9	0	0	0	0	0	0	0
11	78-1	17	64	60	59	0	0	0	0	0	0	0
12	58-152	7	62	39	36	0	0	0	0	0	7	1.5
13	78-44	29	35	30	25	0	0	0	0	0	0	0
14	59-32	29	50	50	50	0	0	0	0	0	0	0
15	84 E-1-108	30	40	40	40	0	9	1	0	0	0	0
16	ET 81D1032	1	0	0	0	0	0	0	0	0	0	0
17	59- 29	21	32	30	18	0	0	0	0	0	0	0
18	58-185	24	22	22	0	0	0	0	0	0	0	0
19	Kvu 69	16	60	34	25	0	0	0	0	0	0	0
20	78-7	11	13	13	0	0	0	0	0	0	0	0
21	66-68	7	17	8	0	0	17	4	17	4	0	0
22	Pop 735	14	75	67	65	0	0	0	0	0	0	0
23	CB 5	12	50	43	50	0	15	4	0	0	0	0
24	13 B24	13	92	92	75	0	0	0	0	0	0	0
25	IT82D713	6	100	54	50	0	0	0	0	0	0	0
26	78-9	14	73	73	73	0	0	0	0	0	0	0
27	casa 16	7	58	58	50	0	0	0	0	0	4	1
28	58-25	6	0	0	0	0	0	0	0	0	0	0
29	58-184	6	0	0	0	0	0	0	0	0	0	0
30	60-3	7	65	44	30	0	0	0	0	0	0	0
31	I8 31	11	100	75	50	0	0	0	0	0	0	0

Table 5 : Summary of results on infection of major diseases
(Average of 2 replications)

SrN°	Entry	NP	WB		ASB	VR	BB		CR		CPR	
			INC	INT	INC	INC	INC	INT	INC	INT	INC	INT
32	AS 3	24	37	20	18	0	0	0	0	0	0	0
33	59-208	16	84	73	54	0	0	0	0	0	0	0
34	66-86	25	26	18	0	0	0	0	0	0	0	0
35	66-91	27	4	4	4	0	8	0	0	0	0	0
34	58-79D ₂ A ₂	15	20	10	0	0	22	11	0	0	0	0
37	78-21	24	0	0	0	0	0	0	0	0	0	0
38	63-1	26	25	21	9	0	4	1	7	2	0	0
39	AS 7	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
40	82-2WL	2	0	0	0	0	0	0	0	0	0	0
41	66-37	16	24	13	0	0	19	2	0	0	0	0
42	81D2814-4	9	17	17	17	0	17	4	0	0	0	0
43	82-7PRIMA	11	47	34	22	0	0	0	0	0	0	0
44	14 B25	16	88	50	59	0	0	0	21	7	0	0
45	66-54	18	84	67	50	0	0	0	0	0	9	2
46	60-9	20	50	41	32	0	0	0	0	0	0	0
47	78-35	18	45	28	10	0	10	3	0	0	0	0
48	AS-5	20	40	31	27	0	0	0	9	7	0	0
49	AS-2	13	15	15	15	0	0	0	0	0	0	0
50	58-43	23	0	0	0	0	0	0	6	2	4	1
51	67-30	19	50	50	50	0	0	0	6	2	0	0
52	63-33	12	0	0	0	0	0	0	25	5	0	0
53	66-1	28	71	52	39	0	0	0	12	7	0	0
54	66-149	22	50	50	0	0	0	0	9	6	0	0
55	58-80	16	76	73	70	0	0	0	0	0	0	0
56	66-61	7	88	88	88	0	0	0	0	0	0	0
57	58-79	19	35	35	25	0	0	0	0	0	0	0
58	36-64	23	6	3	0	0	0	0	0	0	0	0
59	78-29	23	0	0	0	0	0	0	0	0	0	0
60	68-24'	21	28	16	11	0	0	0	0	0	0	0
61	66-21	19	17	17	17	0	0	0	25	7	0	0
42	TN88-63	23	66	58	25	0	0	0	8	2	0	0

Table 5 : Summary of results on infection of major diseases
(Average of 2 replications)

SrN°	PY	NP	WB		ASB	VR	BB		CR		CPR	
			INC	INT	INC	INC	INC	INT	INC	INT	INC	INT
63	1 44	11	39	34	22	0	0	0	0	0	25	7
64	110 B 33	12	69	32	13	0	0	0	0	0	25	13
65	78-17	23	10	10	10	0	5	2	8	2	0	0
66	66-64	24	29	9	0	0	4	1	0	0	13	3
67	16 B27	8	0	0	0	0	0	0	0	0	0	0
68	66- 73	14	0	0	0	0	0	0	0	0	0	0
69	58-95	23	0	0	0	0	5	3	8	2	0	0
70	82-6	25	23	18	0	0	5	1	5	1	5	1
71	I 47	14	60	49	15	0	0	0	0	0	0	0
72	12 B 22	16	50	22	20	0	0	0	42	11	0	0
73	58-37	20	22	14	11	0	0	0	0	0	0	0
74	58-16T	29	29	27	22	0	0	0	0	0	0	0
75	58-146	3	100	100	100	0	0	0	0	0	0	0
76	66-58	28	69	62	40	0	0	0	0	0	29	5
77	78-25	17	76	72	50	0	0	0	0	0	0	0
78	66-74	15	55	36	10	0	0	0	0	0	0	0
79	B 21	2	100	100	100	0	50	10	0	0	0	0
80	60-6	6	0	0	0	0	0	0	0	0	25	6
81	A S 6	25	17	11	0	0	0	0	0	0	0	0
82	81D 832	16	34	25	0	0	0	0	0	0	0	0
83	AS 9	16	14	9	0	0	0	0	0	0	0	0
84	85 F 962-4	27	4	4	0	0	0	0	0	0	4	1
85	78-23	28	25	13	0	0	0	0	0	0	0	0
86	59-24 D1	28	58	55	40	0	0	0	0	0	0	0
87	66-14	29	31	28	17	0	0	0	0	0	4	1
88	58-153	22	18	11	9	0	0	0	0	0	13	3
89	60-1	23	38	34	27	0	0	0	0	0	13	3
90	83-D-328-4	22	4	4	0	0	0	0	0	0	0	0
91	I 94	31	54	41	30	0	0	0	0	0	0	0
92	58-74 D1 C2	26	15	12	0	0	0	0	4	1	4	1

Table 5 : Summary of results on infection of major diseases
(Average of 2 replications)

[illegible]

Table 5 : Summary of results on infection of major diseases
(Average of 2 replications)

SrN°	Entry	NP	WB		ASB	VR	BB	CR		CPR		
			INC	INT	INC	INC	INC	INT	INC	INT	INC	INT
123	TVX 32-36	14	0	0	0	0	0	0	0	0	0	0
124	78-32	26	0	0	0	0	0	0	0	0	10	3
125	9-19	24	0	0	0	0	0	0	0	0	0	0
126	58-47	10	10	10	10	0	0	0	0	0	0	0
127	63-8	29	0	0	0	0	0	0	0	0	5	1
128	66-56	28	0	0	0	0	0	0	0	0	9	3
129	58-21	19	10	3	0	0	0	0	0	0	0	0
130	58-221	14	17	17	0	0	0	0	0	0	0	0
131	66-46	24	12	8	12	0	0	0	0	0	0	0
132	58-79T	18	90	85	0	0	0	0	0	0	14	4
133	B 32 ID	14	57	50	54	0	0	0	0	0	0	0
134	59-95	21	90	86	61	0	0	0	0	0	0	0
135	VE 78-42	19	67	66	69	0	0	0	0	0	0	0
136	66-77	22	50	50	50	0	0	0	0	0	4	1
137	58-19	29	19	14	10	0	0	0	0	0	0	0
138	58-64	23	7	4	0	0	0	0	0	0	0	0
139	58-17	29	85	77	47	0	0	0	0	0	0	0
140	58-50	18	89	74	62	0	0	0	0	0	0	0
141	58-60	19	13	13	0	0	0	0	22	7	0	0
142	78-42	16	15	15	15	6	0	0	0	0	17	4
143	78-36	2	0	0	0	50	0	0	50	13	0	0
144	63-5	21	0	0	0	0	0	0	0	0	0	0
145	78-5'	13	0	0	0	0	0	0	0	0	0	0
146	66-39	18	88	78	75	0	0	0	0	0	0	0
147	59-20	26	17	17	0	0	0	0	0	0	11	3
148	66-67	23	29	29	15	0	0	0	0	0	0	0
149	82-9	3	0	0	0	0	0	0	0	0	0	0
150	IAR-48	8	50	50	50	0	0	0	22	6	0	0
151	58-16 D1	100	0	72	0	0	0	0	0	0	0	0
152	84 D 371	30	16	16	0	0	0	0	0	0	0	0
153	58-15	24	53	50	31	0	0	0	0	0	0	0

Table 5 : Summary of results on infection of major diseases
(Average of 2 replications)

SrN°		NP	WB		ASB	VR	BB		CR		CPR	
			INC	INT	INC	INC	INC	INT	INC	INT	INC	INT
154	66-62	8	17	17	17	0	0	0	0	0	0	0
155	67-95	24	63	60	32	0	0	0	0	0	0	0
156	58-52	21	72	57	28	0	0	0	0	0	0	0
157	I 31	20	7	7	7	0	0	0	0	0	0	0
158	58-55	26	43	25	14	0	0	0	9	2	9	2
159	78-22	30	29	29	29	0	0	0	0	0	0	0
160	78-39	24	31	31	29	0	0	0	0	0	0	0
161	66-52	28	97	95	68	0	0	0	0	0	0	0
162	58-107	28	53	49	34	0	0	0	0	0	0	0
163	60-8	13	93	93	93	0	0	0	0	0	0	0
164	67-167	21	50	50	50	0	0	0	0	0	4	2
1.65	66-45	27	50	50	50	0	0	0	0	0	0	0
1.66	66- 89	13	86	84	79	0	0	0	0	0	0	0
167	59-30	28	75	69	48	0	0	0	0	0	0	0
168	84S 2231-1	26	47	44	44	0	0	0	0	0	0	0
169	58-5	24	35	35	34	0	0	0	0	0	0	0
1.70	78-37	23	17	34	0	0	0	0	0	0	0	0
371	58-79D ₂ B	24	87	70	60	0	0	0	0	0	0	0
172	66-12	25	74	65	58	0	0	0	0	0	0	0
173	78-26	27	50	50	50	0	0	0	0	0	0	0
174	58-185 D	28	50	46	35	0	0	0	0	0	0	0
175	58-12	24	40	35	30	0	0	0	0	0	0	0
176	66-59	17	43	27	22	0	0	0	0	0	0	0
177	67-166	18	39	32	34	0	0	0	0	0	0	0
178	58-74T	19	79	75	64	0	0	0	0	0	0	0
179	66-63	11	70	63	52	0	0	0	0	0	0	0
1.80	I 67	25	15	10	5	0	0	0	0	0	0	0
181	66-50	24	50	50	50	0	0	0	0	0	0	0
182	58-41		47	46	41	0	0	0	0	0	0	0
183	78-18		85	79	70	0	0	0	0	0	0	0

Table 5 : Summary of results on infection of major diseases
(Average of 2 replications)

SrN°	Disease	NP	WB		ASB	VR	BB		CR		CPR	
			INC	INT	INC	INC	INC	INT	INC	INT	INC	INT
184	78-2	21	29	22	29	0	0	0	0	0	0	0
185	67-32	3	00	00	00	0	0	0	0	0	0	0
186	59-26	24	69	61	42	0	0	0	0	0	0	0
187	58-151	13	54	40	16	0	0	0	9	2	0	0
188	66-36	26	84	84	75	0	0	0	0	0	0	0
189	59-13	25	43	38	19	0	0	0	0	0	0	0
190	66-A4	30	22	13	00	0	0	0	0	0	0	0
191	78-10	30	0	0	0	0	0	0	0	0	0	0
192	66-17	18	0	0	0	0	0	0	7	2	0	0
193	15 B 26	8	0	0	0	22	0	0	0	0	0	0
194	66-22	30	32	32	32	7	0	0	16	4	0	0
195	Ndiambour	7	0	0	0	17	0	0	0	0	17	4
196	58-95 D ₂	25	0	0	0	0	0	0	0	0	0	0
197	82-10 ML	11	46	23	0	0	0	0	0	0	0	0
198	78-40	21	22	18	15	0	0	0	0	0	7	2
199	IT81D1137	21	0	0	0	0	0	0	0	0	0	0
200	66-76	15	0	0	0	0	0	0	0	0	0	0
201	58-40	9	48	31	25	0	0	0	40	20	0	10
202	78-20	19	17	4	0	0	0	0	0	0	0	0
203	78-16	16	50	50	50	0	0	0	0	0	0	0
204	59-9-D1	31	17	4	0	0	0	0	0	0	0	0
205	68-226	32	11	3	0	0	0	0	0	0	0	0
206	78-26	35	0	0	0	0	0	0	0	0	10	2.5
207	VLP Casa 16	28	4	4	4	0	0	0	0	0	0	0
208	58-28	22	7	7	7	0	0	0	0	0	0	0
209	TVU-662	23	55	42	43	0	0	0	0	0	0	0
210	I7 328	4	25	13	0	0	0	0	0	0	0	0
211	I82 VITA5	27	0	0	0	0	0	0	0	0	10	1
212	58-74D1AR	18	20	20	20	0	0	0	0	0	8	2
213	78-8	19	22	22	2	0	0	0	0	0	5	2
214	58-2	16	15	9	7	0	0	0	0	0	0	0

Table 5 : Summary of results on infection of maize diseases
(Average of 2 replications)

SrN°	Cultivar	NP	WB		ASB	VR	BB		CR		CPR	
			INC	INT	INC	INC	INC	INT	INC	INT	INC	INT
215	66-55		75	66	63	0	0	0	0	0	0	0
213	58-20		29	25	0	0	0	0	0	0	0	0
217	78-33		36	31	0	0	0	0	0	0	0	0
218	83-122		50	44	0	0	0	0	0	0	34	9
219	58-34	2	50	13	0	0	0	0	0	0	0	0
220	Mougne	10	40	35	0	0	0	0	0	0	0	0
211	78-46	24	19	14	10	0	0	0	19	5	0	0
222	78-3	26	0	0	0	0	0	0	0	0	0	0
223	66-40	22	0	0	0	0	0	0	0	0	0	0
224	59-24T	17	58	43	37	0	0	0	0	0	0	0
225	103-6	24	13	3	0	0	0	0	21	5	0	0
226	58-75	22	42	7.5	0	0	0	0	0	0	0	0
227	66-129	25	92	84	30	0	0	0	0	0	0	0
228	78-31	25	00	43	100	0	0	0	0	0	0	0
229	78-24	24	50	14	45	0	0	0	12	3	0	0
230	67-159	17	00	92	66	0	0	0	0	0	0	0
231	66TVU 3629	31	66	60	39	0	0	0	0	0	0	0
232	IT 82D 716	8	50	42	17	0	0	0	0	0	0	0
233	85F 898- 5	35	28	23	20	0	0	0	0	0	0	0
234	78-30	29	42	36	18	0	0	0	0	0	0	0
235	66-48	24	19	19	16	0	0	0	0	0	0	0
236	78-15	21	18	18	18	0	0	0	0	0	0	0
237	58-42	12	38	38	38	0	0	0	0	0	0	0
238	I 21	21	17	15	9	0	0	0	0	0	0	0
239	58-53	19	1 4	6	4	0	0	0	4	1	0	0
240	I 22	24	26	22	16	0	0	0	0	0	0	0
241	78-43	21	45	43	39	0	0	0	0	0	0	0
242	82-8Magnolia	19	00	89	62	0	0	0	0	0	0	0
243	Casa 3	27	69	52	48	0	0	0	0	0	0	0

NOTE WB -- Web blight ; ASB - Ashy stem blight
 VR -- Virus ; BB - Bacterial blight
 CR -- Cercosporiose ,CPR-Choanephora pod rot
 INC - Incidence : INT - Intensity
 NA -- Data not available
 NP -- Number of plants observed

From the results of table 5 it is seen that only **37** entries were free from web blight infection while 204 entries were observed to be susceptible.

Seven entries including B 21 which was used in the spreader rows exhibited 100% infection. This indicates the high level of disease pressure in the nursery plot. Ashy stem blight infection was observed on **162** entries while **79** were free. The infection of this disease also was very severe. Many B 21 plants in the spreader and indicator rows were completely killed by ashy stem blight. Due to very high pressure of both web blight and ashy stem blight, the development of other diseases was poor. Only 6 entries showed virus infection while **17** entries exhibited bacterial blight infection. Infection of cercospora leaf spot appeared late and was developed on **34** entries. Choanephora pod rot was also comparatively poor and was seen on **31** entries only. In the whole nursery 23 entries were observed to be free from all diseases. However, 9 entries had very poor plant stand (less than 10 plants). As such the final list of the remaining 14 varieties which did not show any disease infection is as under.

78-21, 78-29, 66-73, 78-46, 78-6, TV x 3236, 79-19, 63-5, 78-5, 78-10, 58-95 D2, 66-76, 78-3 and 60-40.

1.3. Screening for bacterial blight resistance.

A set of **55** entries comprising of **51** breeding lines and four parents were screened against bacterial blight in the screen house. Four to five seeds of each entry were sown in each pot separately on 21.10.87. The inoculation was carried out on 30.10.87 by the stem stab method described in 1985 report. The observations for the bacterial blight score were recorded on 20.11.87, 11-12-87 and **28.12.87** in 1 to 10 scale as described in 1986 report. The results of this screening are presented in table 6.

Table 6 : Bacterial blight reactions of some breeding lines and parents in the screen house.

Entry	Score	Entry	Score	Entry	Score	Entry	Score	Entry	Score
<u>Primary Trial 1.</u>									
<u>TVX3236 x B21 F6</u>									
IS 87 313 N	1	314 N	1	315 N	1	316 N	1	317 N	1
318 N	1	319 N	10	320 N	3/10, 1/4	323 N	1	324 N	1
325 N	NC	326 N	1	327 N	3	328 N	3	329 N	2
<u>B21 x IT 81D 1137 F5</u>									
335 N	1/6, 1/2, 1	336 N	10	332 N	1	333 N	5	334 N	1
340 N	1	341 N	3/10, 1/8	337 N	1	338 N	1	339 N	NG
345 N	1	342 N	1	343 N	1	344 N	1		
<u>TVX 3236 x VCS 14 F6</u>									
434 N	NG	435 N	NC						
<u>TVX 3236 x TVU 1174 F6</u>									
350 N	1	351 N		352 N	1	353 N	7	354 N	1
355 N	NG								
<u>Advance Trial II</u>									
<u>Mougne x TVU 1174 F7</u>									
2 N	1								
<u>58-57 x TVU 1174 F6</u>									
185 N	1	168 N	1	217 N	1	224 N	1		

Advance Trial III

B 21 x TVX 3236 F6

63 N 1

58 - 57 x TVJ 1174 F6

170 N 1 174 N 1 191 N NA 218 N 1 219 N 7

58 - 57 x IT81 D 1137 F6

1586275 N 1

Parents

B 21 10 Mougne 1 58-57 1 TV x 3236 1

Note : NC = No germination

NA = Reaction not available

The results in table 6 indicated that many breeding lines possess resistance to bacterial blight. Out of 51 breeding lines, 34 remained free from bacterial blight infection, 3 showed resistant reaction, 1 was moderately resistant, 2 moderately susceptible, 1 susceptible, 2 highly susceptible and 2 exhibited heterogenous reaction. Amongst the varieties B 21 was highly susceptible while Mougne, 58-57 and TVX 3236 remained free.

II. Virus transmission studies

The literature shows that some of the **viruses** are transmitted through seed. The **common viruses** prevailing in Senegal such as aphid-borne mosaic virus and southern bean mosaic virus are reported to be perpetuated through seed. Similarly there are reports indicating transmission of virus by insects. Aphid-borne mosaic virus is reported to be transmitted by aphids, Aphis craccivora while beetles Ootheca mutabilis are reported to be responsible for transmission of southern bean mosaic virus. In order to find out the extent of virus transmission through seed as well as by insects some field trials were conducted during 1987 crop season, the results of which may help to determine the gravity of the problem and to take suitable measures to check this transmission.

2.1. Transmission through seed.

This trial was conducted at Bambey on 58-57 variety. There were two treatments. In the first treatment seeds collected from the virus infected plants were used while the second treatment consisted of healthy seeds collected from virus free plants.

Each treatment was sown in 5 x 2 m² plot (4 lines of 5m length) with a spacing of 50 x 50 cm². Each treatment was repeated 4 times. The sowing was done on 20.07.87. The observations were recorded on 4.08.87 for the number of virus infected plants. All the plots sown with healthy seed did not show any virus infected plant, while the plots sown with infected seeds showed 10 to 22% virus infected plants. The average was 17.5% which is quite high. This shows the seriousness of the problem and emphasizes the need of healthy seed production.

2.2. Transmission by insects :

This trial was conducted at two locations viz ; Bambey and Djibelor on 58-57. The trial consisted of two treatments : 1) Protection of plants from insects using appropriate insecticide. 2) No protection. Thimul 35 800g ai/ha was used for protecting the plants against insects. The incidence of aphids was noticed at Bambey which is a vector for aphid borne mosaic virus. At Djibelor cowpea beetles were observed which serve as vector for southern bean mosaic virus.

The trial at Bambey was sown on 20.07.87. Observations were recorded twice in both protected and unprotected plots for virus incidence. In the first observation noted at Bambey on 4.08.87 it was revealed that there was no virus in the protected plots while the unprotected plots showed 9.64% virus incidence (Mean of 4 replications). There was considerable increase in the virus incidence at the time of second observation which was taken on 25.09.87. Unprotected plots showed 20% virus incidence (Average of 4 replications). Protected plots also showed 4.37% virus incidence. This increase in the virus incidence indicated that the aphids prevailing in the trial plot were responsible for transmitting the virus infection to the healthy plants. The virus incidence in the protected plots may be because the insects had already transmitted the virus before they were killed by the insecticide. Similar trend of results was noticed at Djibelor also. The trial was sown on 12.08.87. First observation on virus incidence was taken on 27.08.87 which revealed very negligible infection in the unprotected plots. The protected plots did not show any virus infection. The second observation which was taken on 25.09.87 revealed that the mean virus incidence in the protected plots was 16.5% while it was 27.1% in unprotected plots.

The first observation taken 2 weeks after sowing showed little virus infection at both the locations which might have been transmitted through seed.

But the subsequent increase observed in the second observation was due to transmission of virus by vectors. The high incidence in the second observation indicates that insects play an active role in the spread of virus.

III. Estimation of losses in yield due to major diseases.

3.1. Due to bacterial blight :

A filler trial was conducted at Bambey to estimate the probable loss in yield caused due to bacterial blight. The trial was conducted on B 21 and consisted of two treatments. 1) plots with minimal disease infection by use of healthy seed and 2) plots with maximum disease infection by use of infected seed and inoculation of plants. The sowing was done on 20.07.87 in 5 x 2m² plot (4 lines of 5m length) for each treatment with 4 replications. The inoculation for maximising the disease infection was done on 27.08.87 by injecting the bacterial suspension in the leaves by infiltration technique. The observations were recorded for disease infection and the yield data.

The disease intensity in the minimal disease infection treatment (uninoculated plots) ranged from 1.47 to 10.71 with an average of 5.61. While the disease intensity in the maximum disease treatment (inoculated plots) varied from **13.75** to **27.38** with an average of 21.22.

The yield data showed that there was reduction in yield in the inoculated plots than the yield in uninoculated plots. The yield figures in the inoculated plots ranged from 308 to **565** Kg/ha with an average of 440 Kg/ha, while the yields of uninoculated plots were in between **490** to 912 with a mean of **713** Kg/ha. Thus there was 38.29% (273 Kg/ha) reduction in yield due to more bacterial blight infection in the inoculated plots.

3.2. Due to virus.

Another filler trial was conducted at Bambey and Djibelor to estimate probable loss in yield caused due to virus. The trial was conducted on **58-57** at both the locations.

There were two treatments 1) plots with minimal virus infection through use of healthy seed and control of vectors and 2) plots with maximum virus infection through use of infected seed and **artificial** inoculation of plants.

The Bambey trial was sown 20.07.87 in 5x 2m² plot for each treatment replicated 4 times. The inoculation for maximising the virus infection was **done** on 31.08.87 with the sap collected from the infected plants. Same inoculation method as described in 1.1 was adopted. Observations were recorded for virus incidence and the yield.

The final observation recorded on 25.09.87 showed 10% virus incidence in the uninoculated plots while 38.75% in the inoculated plots. The average yield obtained in uninoculated plots was 603 Kg/ha while inoculated plots gave average yield of 498 Kg/ha. Thus there was 17.41% (105 Kg/ha) loss in yield due to more virus infection in the inoculated plots.

The Djibelor trial also showed the similar trend of results. The trial was sown on 12.08.87 with the **same** plot size and replications as that of Bambey **trial**. Virus inoculation in the inoculated plots for maximising infection was **done** on 27.08.87 with the sap collected from infected leaves as per the **procedure** described in 1.1. Observations were recorded for virus incidence and the yield.

Uninoculated plots showed 17.78% average virus incidence in the final observation taken on 25.09.87 while the inoculated plots showed 38.13%. Very low yields were obtained in both the plots. However, the trend was the **same**.

IV. Identification of seed microflora and their control ;

Some of the pathogens on the seed cause seed rot or root rot resulting in very poor stand of the crop. This is observed invariably in B 21 variety. Hence studies were under taken to identify the pathogens attacking seed which resulted in seed rot / root rot and their control.

Seeds of 3 varieties viz B 21, 58-57 and Mougne were used for these studies. The seeds were treated with Granox (4g/Kg), Benomyl (1g/Kg), and Thiram (2g/Kg). One set of untreated served as control. Seed microflora was detected by rolled towel method. Seeds were put on sets of three blotter sheets previously moistened with water. The sheets were rolled and kept at room temperature. The sheets were opened after 10 days and the observations were recorded for seed rot and root rot/ seedling infection. The microflora associated with seed rot and root rot/ seedling infection was examined under the microscope. The results are presented in table 7.

Table 7 : Seed rot and root rot in seed of 3 cowpea varieties.

Variety	Seed treatment	seed rot (ungerminated) %	Healthy seed germinated %	root rot %	Organisms isolated from seed rot/root rot
B 21	Control	61	23	16	<u>Macrophomina phaseolina</u> (= <u>Rhizoctonia bataticola</u>) <u>Fusarium</u> <u>equiseti</u> , <u>Fusarium</u> <u>sp</u> ; <u>Penicillium</u> <u>sp</u> , <u>Rhizopus</u> <u>sp</u> <u>Erwinia</u> <u>sp</u> .
	Granox	16	84	0	
	Benomyl	24	76	0	
58-57	Thiram	35	50	15	<u>Macrophomina phaseolina</u>
	Control	11	89	0	<u>Penicillium</u> <u>sp</u> , <u>colletotrichum</u> <u>capsici</u> , <u>Curvularia</u> <u>sp</u> and <u>Erwinia</u> <u>sp</u>
	Granox	0	100	0	
Mougne	Benomyl	0	100	0	
	Thiram	0	100	0	
	Control	5	72	23	<u>Rhizopus</u> <u>sp</u> , <u>Aspergillus</u> <u>sp</u> , <u>Macrophomina phaseolina</u>
	Benomyl	5	93	2	<u>Rhizopus</u> <u>sp</u> , <u>Macrophomina phaseolina</u> , <u>Erwinia</u>
	Thiram	5	91	4	<u>Rhizopus</u> <u>sp</u> , <u>Penicillium</u> <u>sp</u> , <u>Macrophomina phaseolina</u>

The results in table 7 indicate that B 21 was more prone to infection of fungi causing seed rot/root rot than 58-57 and Mougne. In B 21 seed dressing with Granox and Benomyl reduced these diseases more effectively than Thiram. In case of 58-57 all three fungicides showed equal efficacy probably due to the fact that this variety seed was less infected, while in case of Mougne, Granox was most effective with no seed or root rot followed by Benomyl.

V. Survey of cowpea Diseases :

During 1987 rainy season, natural infection of ashy stem blight and web blight was very severe. Both the diseases were seen at all the locations and in almost all the trials. On Farmers' fields also these two were the main diseases encountered. Incidence of bacterial blight and virus was as usual on B 21 and 58-57 respectively. Incidence of bacterial blight was quite high on B 21 at Nioro. Choanephora pod rot was minor. Cercosporiose was noticed mostly on midlate and late varieties at the end of crop cycle. The striga incidence at Kebemer was comparatively more, 58-57, which is reported to be resistant, was also found to be attacked by striga. Stationwise report of various diseases encountered in the experimental plots at the research stations as well as minikit trials on the farmers' fields is furnished in table 8.

Table 8: Cowpea diseases encountered during 1987 rainy season

Research Stations :

Bambev

Ashy stem blight : - B 21, 58-57, CB 5, TVX 3236 and many breeding lines

Rhizoctoniose : B 21, CB 5, 58-57 and some breeding lines

Virus : : 58-57, Ndiambour

Bacterial blight: B 21, CB 5

Choanephora pod rot : B 21, CB 5, 58-57

Cercosporiose : B 21, 58-57

These diseases were also noticed on some of the germplasm entries in the disease nursery (see table 5 of this report).

Ndiémane :

Ashy stem blight : B 21, 58-57, TV x 3236,

Mougne and some breeding lines

Rhizoctoniose : B 21

Nioro

Rhizoctoniose : B 21

Bacterial Blight : B 21

Virus : 58-57

Djibelor

Virus : 58-57 ; 59-9 ; Casa 3

Web blight & ashy stem blight was seen on some of the breeding lines.

Thilmakha

Ashy stem blight : B 21 ; 58-57;TVX 3236

Mougne and some breeding lines

Rhizoctoniose - B 21, Mougne, 58-57,TVX 3236 and some breeding lines

Cercosporiose - 58-57 and few late breeding lines

Choanephora pod rot : B 21, 58-57, Mougne and few breeding lines

Choanephora pod rot incidence at Thilmakha was comparatively more than Bambey.

Louga

Ashy stem blight - B 21, CB 5,58-57,TVX 3236

Rhizoctoniose-B 21, CB 5

Virus - 58-57

Bacterial blight-B 21, CB 5

MinikitsSam Thialle

B 21 - bacterial blight, ashy stem blight, web blight, choanephora pod rot

Mougne - Ashy stem blight, web blight,choanephora pod rot, cercosporiose

58-57 - Virus,Cercosporiose,choanephora pod rot, web blight, ashy stem blights.

TVX 3236 - choanephora pod rot, web blight, ashy stem blight

Sagatta :

B 21 - Rhizoctoniose, bacterial blight, ashy stem blight

CB 5 - bacterial blight, Rhizoctoniose

58-57 - Virus,cercosporiose

Ndiambour-choanephora pod rot

Thilmakha

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

TVX 3236 - Ashy stem blight, web blight

58-57 - Virus, cercosporiose, web blight, ashy stem blight,choanephora pod rot

Mougne- Web blight, ashy stem blight, cercosporiose, choanephora pod rot.

Keur 3oumi

GB 5- Rhizoctoniose, bacterial blight, ashy stem blight

B 21 - Bacterial blight, Rhizoctoniose, ashy stem blight

58-57 - Virus, cercosporiose, ashy stem blight

Ndiambour - Ashy stem blight

Ngatt

58-57 - Cercosporiose, virus, web blight

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

Mougne - web blight, cercosporiose, ashy stem blight, choanephora pod rot

Mougne - web blight, cercosporiose, ashy stem blight, choanephora pod rot

TVX 3236 - web blight, ashy stem blight, cercosporiose

Ndatt Fall

B 21 - Rhizoctoniose, ashy stem blight, bacterial blight

CE 5 - Web blight, ashy stem blight, bacterial blight

58-57 - Virus, cercosporiose

Ndiambour - Rhizoctoniose

Keur galo

58-57 - Virus, cercosporiose, ashy stem blight

TV: 3236 - Web blight, ashy stem blight

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

Mougne - Ashy stem blight.

VI. Seed Production

During 1987 rainy season, seed multiplication plots of different varieties were inspected periodically. B 21 and CB 5 plots were observed to be infected by Rhizoctoniose while 58-57 plot showed some virus infected plants. In all the plots the virus as well as rhizoctoniose infected plants were removed to obtain disease free seed.