

## **4. PLANT PATHOLOGY SECTION**

Research studies were carried out on the prevalence, management and control measures of cotton diseases viz., Cotton Leaf Curl Virus (CLCuV), Seedling Rot and Boll Rot. The experiment was conducted in glass house and field conditions. The promising strains tested under PCCC's National Coordinated Varietal Trial (NCVT) were also screened for their response against various diseases of cotton.

### **4.1. Survey of Cotton Diseases at CCRI- Sakrand Farm**

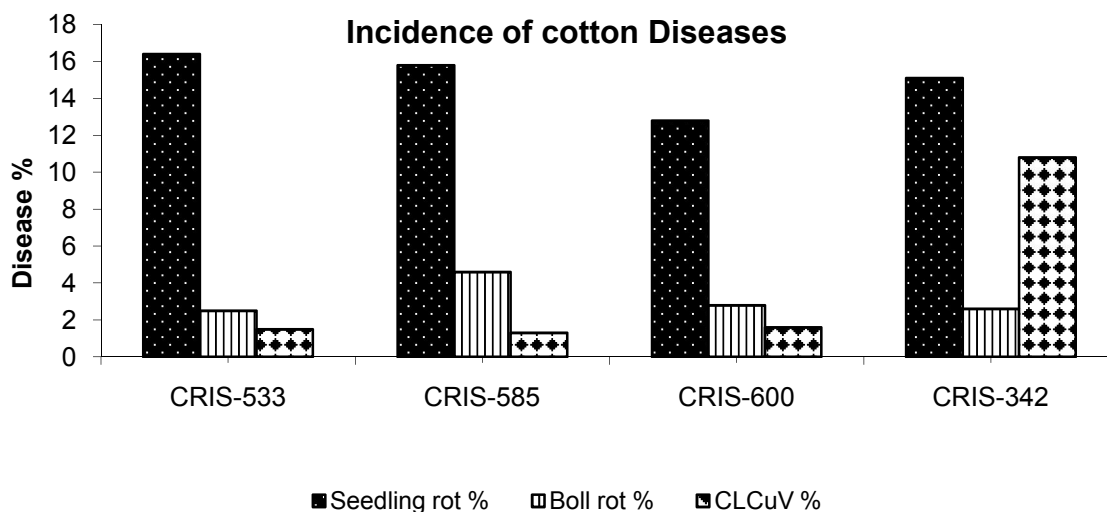
Survey was conducted to trace the incidence of different cotton diseases with special reference to Cotton Leaf Curl Virus (CLCuV) and boll rot diseases.

It was observed that the problem of seedling rot was occurred in whole field of CCRI-Sakrand farm and diseased trend was recorded more as compared to last year, with the range of 3-11%. However, the incidence of boll rot disease was decreased as compared to last year and ranged from 1.5-4.5%. Whereas Cotton Leaf Curl Virus was increased as compared to last year, it ranged from 3.5-10.5%. No any other cotton disease was appeared at CCRI- Sakrand Farm during the period under report.

### **4.2. Screening of Breeding Material under Field Conditions against Different Diseases of Cotton**

Three advanced strains viz., CRIS-533, CRIS-585 and Bt.CRIS-600 developed by CCRI-Sakrand were tested against various diseases of cotton under field conditions. The variety CRIS-342 was kept as control. The experiment was conducted in Randomized Complete Block Design (RCBD) with four replications and plot size was 20'x30'. The crop was sown on 22-5-2014. Observations were recorded on seedling rot, boll rot and CLCuV. The data presented in Table 4.1 illustrated that seedling rot, Boll rot and CLCuV diseases were recorded in all treatments. Maximum seedling rot (16.4%) in CRIS-533, boll rot (4.6%) in CRIS-585 and CLCuV (10.8%) was observed in CRIS-342 and minimum seedling rot (12.8) in Bt.CRIS-600, boll rot (2.5%) in CRIS-533 and CLCuV (1.3%) was noted in CRIS-585.

Maximum seed cotton yield (2735 kg ha<sup>-1</sup>) was obtained from CRIS-585 followed by CRIS-533 (2690 kg ha<sup>-1</sup>) and CRIS-342 (1793 kg ha<sup>-1</sup>) where as minimum seed cotton yield (1659 kg ha<sup>-1</sup>) was recorded from Bt.CRIS-600.



**Fig. 1** Screening of Breeding Material against Different Diseases of Cotton at CCRI-Sakrand, during 2014-15.

**Table 4.1** Screening of Breeding Material against Different Diseases Incidence of Cotton at CCRI-Sakrand, during 2014-15

Sr. No.	Variety/Strain	Seedling rot (%)	Boll rot (%)	CLCuV (%)	Seedcotton yield (kg ha <sup>-1</sup> )
1.	CRIS-533	16.4	2.5	1.5	2690
2.	CRIS-585	15.8	4.6	1.3	2735
3.	Bt.CRIS-600	12.8	2.8	1.6	1659
4.	CRIS-342 (Std)	15.1	2.6	10.8	1793
<b>C.D (0.5%)</b>		<b>3.3</b>	<b>2.0</b>	<b>8.6</b>	<b>306.4</b>
<b>C.V %</b>		<b>13.6</b>	<b>39.6</b>	<b>141.3</b>	<b>8.6</b>

#### 4.3. Screening of Breeding Material against CLCuV Disease on Cotton through Side Grafting in Glass House

Fifteen strains were provided by Plant Breeding section of CCRI-Sakrand, which were sown in earthen pots under glass house conditions and tested against Cotton Leaf Curl Virus through side grafting technique. The observations were taken regularly after one week of grafting.

The results are precise in Table 4.2 which, indicates that Cotton Leaf Curl Virus (CLCuV) became visible in all strains/varieties and showed symptoms after the grafting within 22-28 days.

**Table 4.2 Transmission of CLCuV Disease on cotton through Side Grafting in glass house**

Sr. No.	Strain	No. of Plants Grafted	No. of plants showed disease symptoms	% of Plant Successful of disease	Days to disease appeared after grafting	Scale 0-4*
1.	CRIS- 537	10	4	40	22	1-2
2.	CRIS-538	10	6	60	26	1-3
3.	CRIS- 542	10	5	50	24	1-2
4.	CRIS- 543	10	6	60	28	1-3
5.	CRIS- 547	10	5	50	25	1-2
6.	CRIS- 550	10	4	40	27	1-3
7.	CRIS- 552	10	4	40	22	1-2
8.	CRIS- 553	10	6	60	28	1-3
9.	CRIS- 554	10	5	50	23	1-2
10.	CRIS- 558	10	6	60	27	1-2
11.	CRIS- 559	10	5	50	26	1-3
12.	CRIS- 560	10	4	40	24	1-2
13.	CRIS- 562	10	6	60	22	1-2
14.	CRIS- 567	10	5	50	23	1-3
15.	CRIS-569	10	6	60	25	1-2

\*Disease Rating Scale (Symptom Rating) for cotton against CLCuV.

Severity Grade	Proposed Symptoms	Remarks
0	Complete absence of symptoms	Resistant
1	Small scattered vein thickening	Highly Tolerant
2	Large groups of vein thickening and curling OR top of the plant affected	Tolerant
3	All vein thickening, enation and severe curling OR half of the plant affected	Susceptible
4	All vein thickening, severe curling, enation and stunted plant OR whole of the plant affected and stunting	Highly Susceptible

#### 4.4 Pathological Studies in National Coordinated Varietal Trial against different diseases at Central Cotton Research Institute, Sakrand during the Year 2014-15.

##### 4.4.1 National Coordinated Varietal Trial (Set-A)

To evaluate the incidence of various cotton diseases, thirteen coded strains of National Coordinated Varietal Trial were sown under field conditions by Plant Breeding section at CCRI-Sakrand. Table 4.3 shows that boll rot disease was observed in all candidate strains. Maximum boll rot disease was recorded in CRIS-585 (3.5%) and minimum in NIAB-414 (0.5%). Incidence of CLCuV disease was observed in 11 candidate strains out of 13. Maximum CLCuV incidence (18.3%) was observed in CRIS-342 (Std), whereas minimum (0.5%) was recorded in NIAB-414.

**Table 4.3 Average Boll rot and CLCuV Disease incidence in National Coordinated Varietal Trial (Set-A) at CCRI-Sakrand during 2014-15**

Sr. No.	Strain	Boll rot (%)	CLCuV (%)	Seed cotton yield (kg ha <sup>-1</sup> )
1.	CRIS-533	2.7	9.5	3319
2.	TH-112/05	2.3	1.2	2601
3.	BH-177	1.7	2.0	2691
4.	MPS-27	1.4	15.3	2691
5.	CRIS-585	3.5	2.7	3498
6.	NIAB-414	0.5	0.5	2691
7.	DNH-40	2.8	5.5	2247
8.	TH-120	2.7	14.3	2960
9.	IUB-75	2.6	1.1	1345
10.	CIM-620	3.3	0.0	1256
11.	AA-132	1.9	2.6	2063
12.	GS-433	0.7	0.0	807
13.	CRIS-342 (Std)	2.4	18.3	2889
<b>C.D (0.5%)</b>		0.20	4.5	

##### 4.4.2 National Coordinated Varietal Trial (Set-B)

To evaluate the incidence of various cotton diseases, twenty four coded strains of National Coordinated Varietal Trial (Set-B) were sown under field conditions by Plant Breeding section at CCRI-Sakrand. The observations on different cotton diseases were taken by Plant Pathology Section. Table 4.4 shows that boll rot disease was observed in 21 out of 24 candidate strains. Maximum boll rot disease was recorded in SLH-8 (4.0%) and minimum in IR-NIBGE-6 and TH-21/09 (0.5%). Incidence of CLCuV disease was observed in 11 candidate strains out of 24. Maximum CLCuV incidence was observed in VH-327 (1.7%) and minimum (0.1%) in SLH-8, CIM-622 and CIM-602 (Std-1).

**Table 4.4 Average Boll rot and CLCuV Disease incidence in National Coordinated Varietal Trial (Set-B) at CCRI-Sakrand, during 2014-15**

Sr. No.	Strain	Boll rot (%)	CLCuV (%)	Seed cotton yield (kg ha <sup>-1</sup> )
1.	IUB-13	1.7	0	1704
2.	IR-NIBGE-6	0.5	0	1884
3.	FH-Lalazar	0.8	0	3229
4.	Cyto-177	0.9	0.2	2691
5.	VH-305	2.2	0	1973
6.	SLH-8	4.0	0.1	2063
7.	BH-184	1.7	0	2422
8.	MNH-988	0.6	0.2	2512
9.	CIM-616	0.6	0	2512
10.	CEMB-66	0.7	0.2	2332
11.	CIM-622	0.0	0.1	2153
12.	CEMB-77	1.4	0	2960
13.	IR-NIBGE-7	0.7	0.4	2512
14.	Cyto-178	1.1	0	2781
15.	BH-185	2.3	0	2781
16.	FH-Noor	1.8	0	1884
17.	VH-327	0.0	1.7	2601
18.	NIAB-8748	2.7	0	2601
19.	Baghdadi	0.0	0	3139
20.	RH-647	2.3	0.2	2242
21.	TH-21/09	0.5	0.4	2422
22.	IUB-63	1.4	0	2512
23.	CIM-602 (Std-1)	2.6	0.1	2332
24.	FH-142 (Std-2)	0.7	0.2	2691
<b>C.D (0.5%)</b>		0.22	0.38	

#### 4.4.3. National Coordinated Varietal Trial (Set-C)

Eighteen coded strains of National coordinated Varietal Trial (Set-C) were tested against boll rot and Cotton Leaf Curl Virus (CLCuV) diseases at CCRI-Sakrand. The data presented in Table 4.5 illustrated that boll rot disease appeared in all strains ranged from 0.5 to 2.2%. Cotton Leaf Curl Virus disease was observed in 3 out of 18 strains. Maximum boll rot disease (2.2%) was recorded in Auriga-215 and minimum (0.5%) in SAHARA-150. Maximum CLCuV was observed in Auriga-215 (0.3%) and minimum in BS-70 (0.1%).

**Table 4.5 Average Boll Rot and CLCuV Disease incidence in National Coordinated Varietal Trial (Set-C) at CCRI-Sakrand during 2014-15**

Sr. No.	Strain	Boll rot (%)	CLCuV (%)	Seed cotton yield (kg ha <sup>-1</sup> )
1.	SAHARA-120	0.8	0	2242
2.	Leader-3	0.8	0	1884
3.	Eagle-1	1.6	0	2153
4.	Tarzan-4	1.7	0	1525
5.	AGC-999	0.7	0	1345
6.	Sitara-13	0.8	0.2	1615
7.	CA-926	0.7	0	1525
8.	Leader-5	0.8	0	1794
9.	JS-733	0.8	0	1884
11.	BS-70	1.0	0.1	1973
12.	CRYSTAL-1	1.5	0	2063
13.	Tahafuz-3	1.7	0	1525
14.	SAHARA-150	0.5	0	1615
15.	AGC-NAZEER-1	1.6	0	1525
16.	Sitara-14	1.2	0	1794
17.	Auriga-215	2.2	0.3	1525
18.	CIM-602 (Std-1)	0.6	0	1435
19.	FH-142 (Std-2)	0.7	0	2332
<b>C.D (0.5%)</b>		0.28	0.40	

#### 4.4.4. National Coordinated Varietal Trial (Set-D)

In National Coordinated Varietal Trial (Set-D), four coded strains were tested against different diseases under field conditions at CCRI-Sakrand. The data in Table 4.6 revealed that boll rot disease appeared in all four strains. Maximum damage of disease was observed in CIM-602 (Std-1) (3.3%) and minimum (1.7%) in Bt.Hybrid-53 and AL-Seemi-HBt. 209. CLCuV disease was appeared in only one strain out of 4. That was (0.5%) in Bt.Hybrid-53.

**Table 4.6 Average Boll Rot and CLCuV Disease Incidence in National Coordinated Varietal Trial (Set-D) at CCRI-Sakrand, during 2014-15**

Sr. No.	Strain	Boll rot (%)	CLCuV (%)	Seed cotton yield (kg ha <sup>-1</sup> )
1.	AL-Seemi-HBt. 209	1.7	0	2332
2.	Bt.Hybrid-53	1.7	0.5	2601
3.	CIM-602 (Std-1)	3.3	0	2242
4.	FH-142 (Std-2)	2.1	0	2601
<b>C.D (0.5%)</b>		0.34	0.34	

## 4.5. Epidemiological Studies on Cotton Diseases

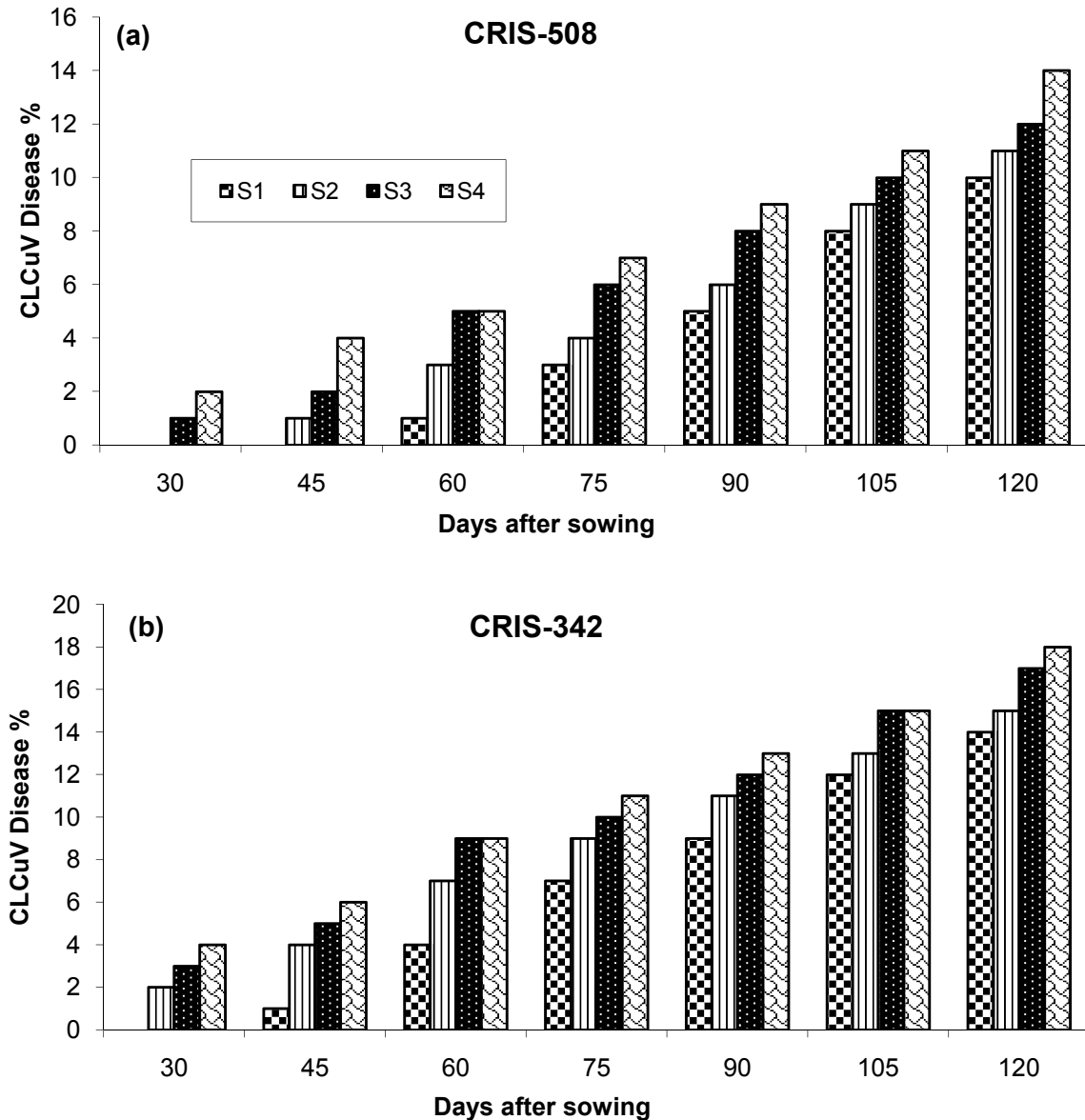
### 4.5.1 Response of Sowing Date against CLCuV and boll rot diseases.

The most promising cotton strains of CCRI-Sakrand were studied to observe the effect of sowing dates against boll rot and CLCuV diseases. Two strains/varieties were sown by Agronomy Section on 15<sup>th</sup> April, 1<sup>st</sup> May, 15<sup>th</sup> May and 1<sup>st</sup> June 2014 at 15 days interval. Data on incidence of CLCuV disease was recorded from each sowing date during the season. The results precised in Table 4.7 revealed that no CLCuV appeared in 15<sup>th</sup> April sowing at 30 and 45 days after planting and also no CLCuV was recorded on 1<sup>st</sup> May sowing at 30 days after planting. Maximum CLCuV was recorded on both genotypes planted on 1<sup>st</sup> June followed by 15<sup>th</sup> May. The minimum disease was recorded on 15<sup>th</sup> April planted crop as compared with other planting dates.

Lowest incidence of CLCuV disease (3.8 and 4.8) was recorded from Bt.CRIS-508 in comparison to CRIS-342 (6.7 and 8.7) in 15<sup>th</sup> April and 1<sup>st</sup> May planting respectively. All the genotypes planted after 15<sup>th</sup> April and 1<sup>st</sup> May were more susceptible to CLCuV disease.

**Table 4.7 Incidence of CLCuV disease% on different strains/varieties planted on different sowing dates at CCRI-Sakrand, during 2014-15.**

Cultivar	Days after planting	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>
		15 <sup>th</sup> April	1 <sup>st</sup> May	15 <sup>th</sup> May	1 <sup>st</sup> June
Bt.CRIS-508	30	-	-	1.0	2.0
	45	-	1.0	2.0	4.0
	60	1.0	3.0	5.0	5.0
	75	3.0	4.0	6.0	7.0
	90	5.0	6.0	8.0	9.0
	105	8.0	9.0	10.0	11.0
	120	10.0	11.0	12.0	14.0
<b>Average</b>		<b>3.8</b>	<b>4.8</b>	<b>6.3</b>	<b>7.4</b>
CRIS-342	30	-	2.0	3.0	4.0
	45	1.0	4.0	5.0	6.0
	60	4.0	7.0	9.0	9.0
	75	7.0	9.0	10.0	11.0
	90	9.0	11.0	12.0	13.0
	105	12.0	13.0	15.0	15.0
	120	14.0	15.0	17.0	18.0
<b>Average</b>		<b>6.7</b>	<b>8.7</b>	<b>10.1</b>	<b>10.8</b>
<b>C.D (0.5%)</b>		0.72			



**Fig. 2 Incidence of CLCuV disease% on different strains/varieties (a) CRIS-508 (b) CRIS-342 planted on different dates at CCRI-Sakrand, during 2014-15.**

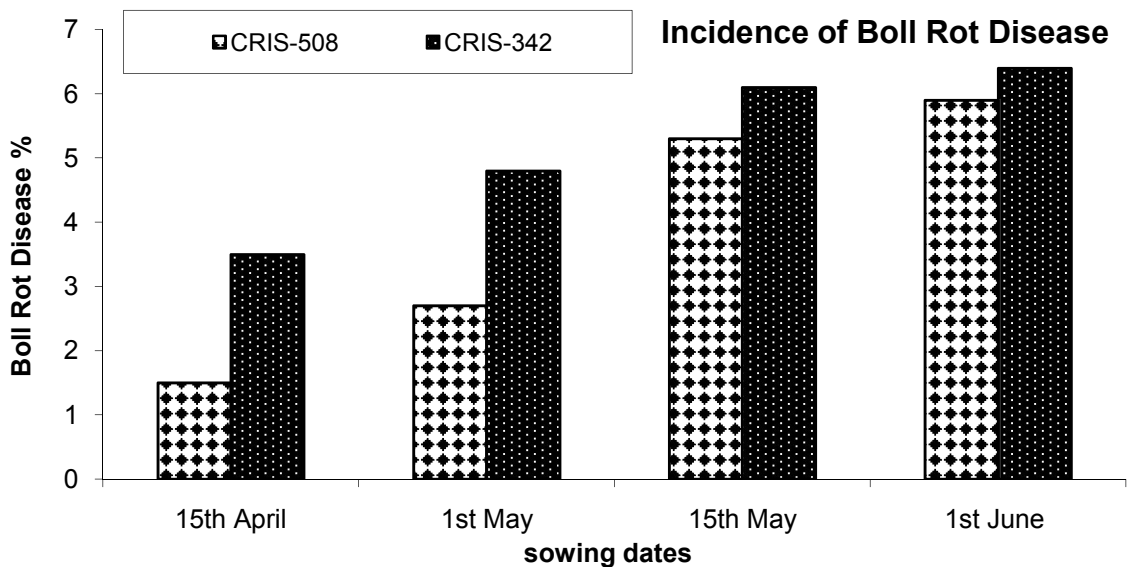
**4.5.2. Effect of Different Sowing Dates on Occurrence of Boll Rot Disease in different Cultivars.**

In same experiment the incidence of boll rot disease was also computed in different strains sown at different sowing dates. Table 4.8 shows that maximum incidence of boll rot disease was recorded in CRIS-342 (6.4%) crop planted on 1<sup>st</sup> June whereas, minimum incidence of boll rot was recorded in Bt.CRIS-508 (1.5%) in 15<sup>th</sup> April sown crop.



**Table 4.8 Incidence of Boll Rot Disease% in crop planted at different sowing dates at CCRI Sakrand, during 2014-15.**

Cultivar	Sowing dates				Mean
	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>	
	15 <sup>th</sup> April	1 <sup>st</sup> May	15 <sup>th</sup> May	1 <sup>st</sup> June	
Bt.CRIS-508	1.5	2.7	5.3	5.9	3.8
CRIS-342	3.5	4.8	6.1	6.4	5.2
<b>Mean</b>	<b>2.5</b>	<b>3.7</b>	<b>5.7</b>	<b>6.1</b>	
<b>C.D (0.5%)</b>	<b>1.30</b>				



**Fig. 3 Incidence of Boll Rot Disease% in crop planted at different sowing dates at CCRI-Sakrand, during 2014-15.**

#### 4.6. Studies on seedling rot disease.

##### 4.6.1 Screening of Seed Dressing Fungicide.

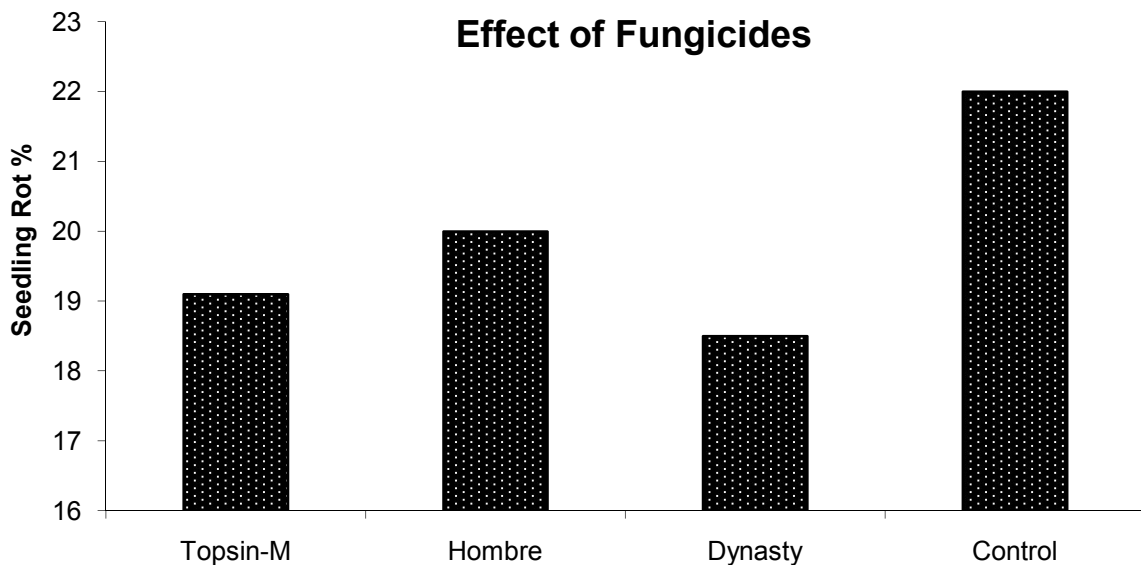
The experiment was accomplished to study the efficacy of fungicides against seedling rot disease. Bt.CRIS-508 was sown in Randomized Complete Block Design with four replications and plot size 30'x30'. The crop was sown on 22-05-2014. Seedling rot disease incidence was recorded after 20 days of sowing. The details of treatment are given below:

T1 = Topsin M @ 2.5 gm/kg of cotton seed.

T2 = Hombre @ 20 ml/kg of cotton seed.

T3 = Dynasty @ 3 ml/kg of cotton seed.

T4 = Control



**Fig. 4** Effect of different Fungicides on Seedling Rot Disease of Cotton at CCRI-Sakrand, during 2014-15.

Table-4.9 shows that, the difference between treatments was non significant. Maximum seedling rot incidence (22.0%) was observed in control and minimum (18.5%) in the treatment treated by Dynasty fungicide. The maximum seed cotton yield of 2197 kg ha<sup>-1</sup> was also obtained from this treatment.

**Table 4.9** Effect of Fungicide on Seedling Rot Disease of Cotton

Sr. No.	Treatment	Seedling rot (%)	Seed cotton yield (kg ha <sup>-1</sup> )
1.	Topsin M @ 2.5 gm/kg	19.1	1973
2.	Hombre @ 20 ml/kg	20.0	1883
3.	Dynasty @ 3 ml/kg	18.5	2197
4.	Control	22.0	1704
<b>C.D (0.5%)</b>		<b>5.20</b>	<b>741.8</b>

#### 4.6.2 Isolation and identification of causal organisms.

Isolation of rotted seedlings was made on PDA medium poured test tubes in the laboratory. 50 test tubes were isolated from each treatment. The frequency of fungi isolated is presented in table 4.10.

**Table-4.10 Organisms associated with seedlings.**

Sr. No.	Treatments	Organisms	Percentage
1.	Topsin-M	Fusarium sp Rhizopus sp Rhizoctonia sp No growth	25 13 12 50
2.	Hombre	Fusarium sp Rhizopus sp Aspergillus sp No growth	20 18 12 50
3.	Dynasty	Rhizopus sp Aspergillus niger Fusarium sp Un identified No growth	15 5 5 5 70
4.	Control	Fusarium sp Rhizopus sp Rhizoctonia sp Aspergillus flavus Penicillium sp Helminthosporium sp Un identified	30 14 20 16 10 5 5 5

It was observed from Table 4.10 that maximum test tubes showed no growth of any fungus, which were treated with fungicides, where as all the test tubes were contaminated with associated organisms in control.

Dynasty showed more effect to control the organisms associated with cotton seedlings than the other fungicides. Maximum growth of fungi was recorded from control in which no any fungicide was applied.