

## **CHAPTER-7**

### **Pot trial for evaluation of different botanicals**

#### **7.1 Information about the workplace**

##### **7.1.1. Experimental area**

The pot trial was conducted at "Yogikutir" Shree Swaminarayan Mahila Ashram, Rajkot, as well as the in vitro tests were carried out at Atmiya University Rajkot. The microscopic analysis was completed at the Plant Pathology Department of the Agriculture University, Junagadh in Gujarat, which is located at 21.510 Northeast Latitude and 70360 Southeast Longitude. Rajkot is located in the Gujarat state of India. Rajkot is situated at a latitude of 22.3 degrees north of the Equator and an east longitude of 70.78 degrees. The mean height is 127 meters (421 feet) on average. This town is situated along the bank of the Aji and Nyari rivers, both of which remain dry outside of the rainy season of August through October. The town is 170.00 km<sup>2</sup> in area.

##### **7.1.2 Climatic Condition**

Rajkot has a hot, semi-arid environment having summers that are hot and dry which go between mid-March to June, and an annual monsoon season which lasts between the middle of June to October. The city's median height is 660 mm or 27 mm. The winter months of November through February are pleasant, with 20°C on average and little humidity. Summertime highs are between 24 and 42 degrees Celsius (75.2 and 107.6 °F). In Rajkot, India, wintertime temperatures range from 50 to 71.6 Celsius (10 to 22 degrees C), yet they are usually pleasant.

#### **7.2 Methods**

##### **7.2.1 Antifungal activity of plant extract against cumin blight caused by *Alternaria burnsii* in the pot experiment**

## Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals

### 7.2.1.1 Details of the Experiment

Objective	Evaluate the effectiveness of different botanicals against cumin blight disease caused by <i>Alternaria burnsii</i>
Location	“Yogikutir” Shri Swaminarayan Mahila Ashram, Rajkot
Crop & Variety	Cumin (Tulsi, Akshay- seed)
Treatments	10
Design:	CRD (Complete Randomized Design)
No. of Replications	Three (10 plants/pot as one replicate)
Date of Sowing	30, November-2022
Date of germination:	1)Initiation 18, December-2022, 2) 50% gemination-22 December 2022, 3) Full germination- 27 December 2022
Date of application	1) 31, December 2022, (Initiation of disease) 2) 16, January 2023, 3)01, February,2023
No. of Applications	Five
Time interval of applications	15 Days
Date of Inoculation	18, January,2023

Table 7.1: Details of a pot experiment to evaluate the efficacy of plant extract against *Alternaria burnsii*

### 7.2.1.2 Method of pot preparation

For this experiment, 80 plastic containers (4-5 kg capacity) were purchased from the local market of Rajkot City. The soil was collected from the organic farm near Munjka village.

Pots were filled up with this organic soil and cow dung and irrigated. Cumin seeds were soaked in a water container for 4-5 hours. Each container contained 20–30 seeds, and additional water was added as needed. Each pot had a diameter of 7.5 inches and a pot depth of 6 inches.

## Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals



Figure 7.1: pot preparation for *Alternaria burnsii* & *Fusarium oxysporum*

### 7.2.1.3 Preparation of plant extracts

To investigate the effectiveness of plant extraction for the *Alternaria burnsii* caused blight of cumin, 10% plant extract was prepared using various solvents (water, acetone, and cow urine).



Figure 7.2: 10% plant extract prepared in water, acetone, and cow urine

### 7.2.1.4 Methods of Application

The first treatment of respective botanicals was made on 31<sup>st</sup> December 2022 and the second and third applications were given at 15 days intervals using a manually operated mini sprayer.

### 7.2.1.5 Methods of recording observation

Based on the percentage of diseased or blighted plants and the level of severity of the disease per plant, the efficacy of the botanicals was evaluated. For recording observations on *Alternaria* blight, 10 plants were selected randomly in each pot. The disease severity scale (0 to 4) of the plant (10/pot) observed was recorded every week (Rathore and Rathore, 1995 & Khunt et al., 2017). Data from the disease severity scale was converted into Percentile Disease Index (PDI)

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

Grade	Symptoms	Description	Result
0	Nil	Plant free from disease	Immune-Highly resistant (HR)
1	Symptoms on leaf tips and scattered on leaves only	1-25 % of plant areas infected	Moderately resistant (MR)
2	Symptoms on leaves, branches, and florets	26-50 % of plant areas infected	Moderately susceptible (MS)
3	Symptoms on leaves, branches, inflorescences, and sparse on the stem	51-75 % of plant areas infected	susceptible (S)
4	Symptoms on leaves stem, inflorescence including seeds, drying and blacking/ whitening of plants	76-100 % of plant areas infected	Highly susceptible (HS)

Table 7.2: Disease severity scale

**7.2.1.6 Following the formula, the percentage of the disease severity of Alternaria blight was calculated in this pot experiment (Wheeler, 1966).**

$$(PDI) = \frac{\text{Sum of total rating}}{\text{Total No. of plants obsered} \times \text{Maximum disease rating}} \times 100$$

**7.2.1.7 PDRC (Percent disease reduction over control) is calculated by by following the equation.**

$$PDRC = \frac{\text{Control} - \text{Treatment}}{\text{control}} \times 100$$

**7.2.1.8 Statistical Analysis**

The disease susceptibility assessment after rotational conversion was statistically examined using a one-way analysis of variance (ANOVA). The LSD test, which stands for least significant difference, was employed to evaluate the outcomes at  $p \leq 5\%$ .

**7.2.2 Evaluation of botanicals against wilt caused by *F. oxysporum* in cumin plants grown in pots.**

## **Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

### **7.2.2.1 Details of the Experiment**

Objective	Evaluate the effectiveness of several medicinal products in managing the <i>Fusarium oxysporum</i> -caused cumin wilt disease.
Location	Yogikutir, Shri Swaminarayan Mahila Ashram, Rajkot.
Crop & Variety	Cumin (Tulsi, Akshay- seed)
Design	CRD (Complete Randomized Design)
Treatments	10
No. of Replications	Three (20-30 plants/pot as one replication)
Date of Sowing	4, December -2022
Date of germination	1) Initiation 20, December-2022 2) 50% gemination-26, December-2022 3) Full germination-2, January-2023
Date of application	1) 4, January 2023, 2) 20, January, 2023 3) 4, February, 2023
No. of Applications	Three
Time interval of applications	15 Days
Date of Inoculation	11, January,2023

Table 7.3: Details of a pot experiment to evaluate the efficacy of plant extract against *Fusarium oxysporum*

### **7.2.2.2 Preparation for Plant Extraction**

A 10% plant extract was prepared in various solvents such as water, acetone, and cow urine to check the plant's efficacy against *Fusarium oxysporum*, the causative agent of cumin wilt.

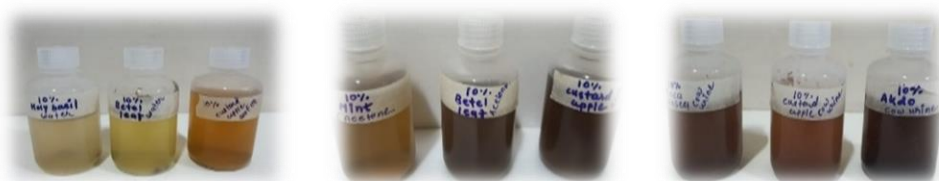


Figure 7.3: 10 % plant extract prepared in water, acetone, and cow urine

## **Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

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### **7.2.2.3 Techniques for recording observations.**

The number of cumin plants becoming infected or showing signs of wilting was used to evaluate the effectiveness of the botanicals. For recording observations on wilt, 15-20 plants were selected randomly in each pot. The percentage of wilt disease incidence will be measured from respective treatments using the given mathematical equation

$$\text{Disease incidence (\%)} = \frac{\text{Number of affected plants}}{\text{Total number of plants noticed}} \times 100$$

## **7.3. Results**

### **7.3.1 Impact of botanicals on control of Alternaria blight disease in cumin.**

Sixteen treatments were used for in vitro evaluation of different plants against *Alternaria burnsii*. Nine of these treatments were used in pot experiments to assess plant efficacy. More or less inhibition was observed in all plants. Good levels of inhibition were seen in plants such as Neem, Bullet wood, Betel leaf, and Adulsa.

#### **7.3.1.1 Impact of botanicals on control of Alternaria blight disease in cumin at first and Second week after application of treatments.**

Following the spray application of the treatment on cumin plants cultivated in pots throughout the Rabi season between 2022–2023 in Rajkot, the data of PDI were recorded at weekly intervals. The 10% plant extracts were sprayed on four different occasions throughout the duration of 15 days.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

No.	Treatment	PDI (%) Replication			Mean
		I	II	III	PDI
<b>Plant extract with water</b>					
1	<i>Millettia pinnata</i> (Indian beech)	0.00	0.00	0.00	0.00
2	<i>Mimuspos elengi</i> (Bullet wood)	0.00	0.00	0.00	0.00
3	<i>Azadirachta indica</i> (Neem)	0.00	0.00	0.00	0.00
<b>Plant extract with acetone</b>					
4	<i>Azadirachta indica</i> (Neem)	0.00	0.00	0.00	0.00
5	<i>Adhatoda vasica</i> (Adulsa)	0.00	0.00	0.00	0.00
6	<i>Aloe barbadensis miller</i> (Aloe vera)	0.00	0.00	0.00	0.00
<b>Plant extract with cow urine</b>					
7	<i>Millettia pinnata</i> (Indian beech)	0.00	0.00	0.00	0.00
8	<i>Mimuspos elengi</i> (Bullet wood)	0.00	0.00	0.00	0.00
9	<i>Azadirachta indica</i> (Neem)	0.00	0.00	0.00	0.00

Table 7.4: Impact of Various botanical treatments on disease development of cumin blight at 1<sup>st</sup> and 2<sup>nd</sup> week after application

### 7.3.1.2 One and Two weeks after the application of treatments

The information in Table 7.4 showed that during the first and second weeks after applying the treatments, the cumin blight disease did not appear.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and  
Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

Sr. No.	Treatment	PDI (%) Replication			Mean Replicates	Per cent disease reduction over control
		Replicate I	Replicate II	Replicate III		
1	Indian beech (with water)	21.13* (13.00)	22.38 (14.50)	20.70 (12.5)	21.40 (13.32)	40.79
2	Bullet wood (with water)	18.90 (10.500)	18.90 (10.50)	17.95 (9.5)	18.58 (10.16)	54.83
3	Neem (with water)	18.43 (10.00)	17.95 (9.50)	16.43 (8.00)	17.60 (9.15)	59.34
4	Neem (with acetone)	14.77 (6.500)	12.92 (5.00)	14.17 (6.00)	(13.95) (5.82)	74.14
5	Adulsa (with acetone)	14.17 (6.00)	14.77 (6.500)	15.89 (7.5)	(14.94) (6.65)	70.42
6	Bullet wood (with acetone)	15.34 (7.00)	16.43 (8.00)	15.89 (7.5)	(15.88) (7.49)	66.68
7	Indian beech (with cow urine)	17.95 (9.50)	18.90 (10.50)	18.43 (10.0)	(18.43) (10.00)	55.57
8	Vinca rosea (with cow urine)	18.43 (10.00)	16.43 (8.00)	15.89 (7.5)	(16.91) (8.47)	62.35
9	Neem (with cow urine)	15.89 (7.50)	15.34 (7.00)	16.95 (8.5)	(16.06) (7.66)	65.97
10	Control	28.65 (23.00)	27.97 (22.00)	28.31 (22.50)	(28.31) (22.50)	0.00
	S.Em. ±				0.47	
	C.D. at 5%				1.42	
	C.V. %				4.57	

Table 7.5: Impact of various botanical treatments on disease development of cumin blight at 3<sup>rd</sup> week after application.

Note: Data outside the parentheses are arcsine transformed, whereas inside are retransformed values.



**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

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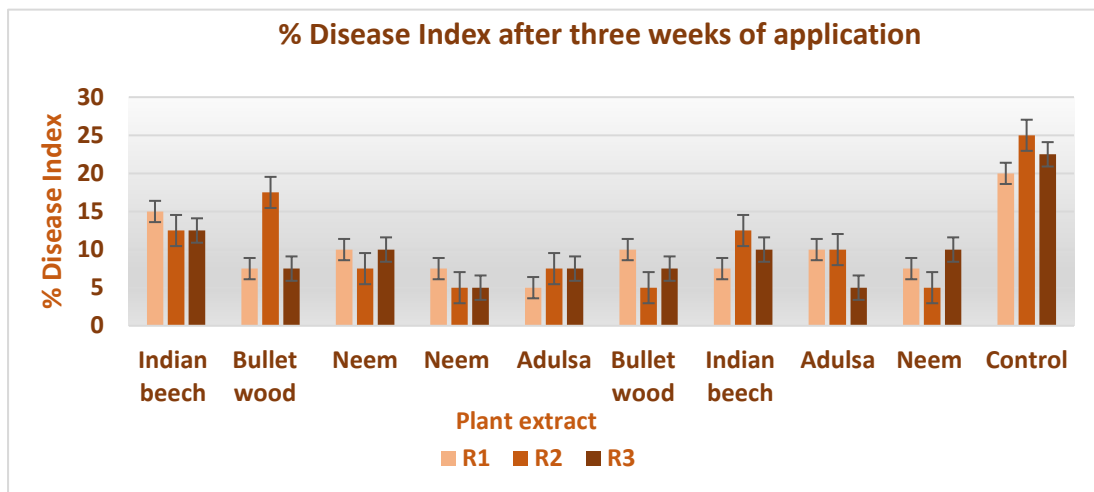


Figure 7.4: Graph of plant extracts on blight diseases development of cumin blight at 3<sup>rd</sup> week after application

**7.3.1.3 Three weeks after the application of the treatments.**

The information in Table 7.5 revealed that the symptoms associated with the blight disease first developed in some of the treated plants and in the control (just water) plants in the third week.

However, a significant minimum PDI of 5.82% (ranged 5 to 6.5%) was recorded in treatment with Neem with acetone. The data table additionally revealed that plants treated with Adulsa in acetone had cumin PDI readings of 6.65%, which was statistically comparable (statistically at par) to Neem. Further studies found that treatments using Bullet wood with acetone and Neem with cow urine were placed in second for efficacy against the disease, respectively, with 7.49% and 7.66% PDI records. The disease intensity (PDI) was 8.47%, 9.15%, 10.00%, and 10.16% for the treatments of Vinca rosea with cow urine, Neem with water, Indian beech with cow urine, and Bullet wood with water against the blight of cumin. The

data table indicated that the plan treatments with acetone and cow urine were most effective against the blight disease of cumin.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

**7.3.1.4 Impact of botanicals on control of Alternaria blight disease in cumin at four weeks after application of treatments.**

Sr. No.	Treatment	PDI (%) Replication			Mean Replicate	Percent disease reduction over control
		Replicate I	Replicate II	Replicate III		
1	Indian beech (with water)	28.31* (22.50)	28.65 (23.00)	29.66 (24.50)	28.88 (23.33)	46.14
2	Bullet wood (with water)	25.84 (19.00)	27.27 (21.00)	28.31 (22.50)	27.14 (20.81)	51.95
3	Neem (with water)	24.72 (17.50)	26.56 (20.00)	28.31 (22.50)	26.54 (19.96)	53.92
4	Neem (with acetone)	19.82 (11.50)	18.43 (10.00)	21.55 (13.50)	19.94 (11.63)	73.15
5	Adulsa (with acetone)	21.97 (14.00)	21.13 (13.00)	20.26 (12.00)	21.12 (12.99)	70.01
6	Bullet wood (with acetone)	22.78 (15.00)	23.96 (16.50)	21.55 (13.50)	22.77 (14.98)	65.42
7	Indian beech (with cow urine)	24.72 (17.50)	25.10 (18.00)	26.20 (19.50)	25.35 (18.33)	57.69
8	Vinca rosea (with cow urine)	24.72 (17.50)	24.35 (17.00)	23.96 (16.50)	24.35 (17.00)	60.76
9	Neem (with cow urine)	20.26 (12.00)	20.70 (12.50)	21.13 (13.00)	20.70 (12.50)	71.15
10	Control	40.68 (42.50)	43.56 (47.50)	39.23 (40.00)	41.16 (43.32)	
	S.Em. ±				0.72	
	C.D. at 5%				2.13	
	C.V. %				4.85	

Table 7.6: Impact of various botanical extracts on blight diseases development in cumin in 4<sup>th</sup> week after application

Note: Data outside the parentheses are arcsine transformed, whereas inside are retransformed values.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

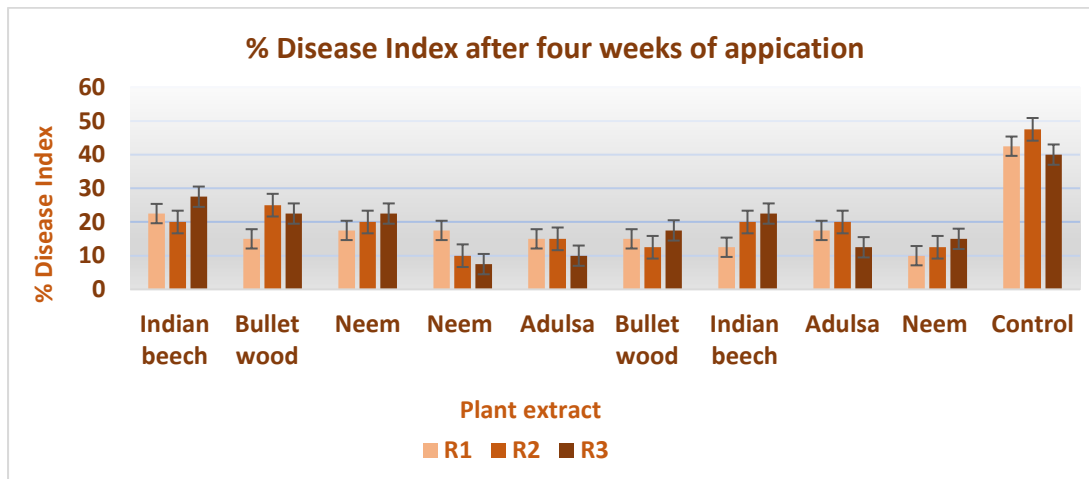


Figure 7.5: Graph of the antifungal activity of plant extracts on cumin blight diseases development in cumin at 4<sup>th</sup> week after application

**7.3.1.5 Four-week application of the treatments**

One week after the third application, the disease severity (measured using scales) was recorded for all treatments. The findings in Data Table 4.114 to 4.124 showed that the plant treated with neem with acetone had a considerably minimum mean PDI of cumin blight of 11.63% (10.00% to 13.50%). Adulsa with acetone (12.99%) and Neem with cow urine (12.50%) treatments both exhibited PDI readings that were statistically equivalent to Neem in acetone. Therefore, it was clear that Neem and Adulsa were the most effective treatments for cumin blight.

Plants treated with Bullet wood and acetone showed a 14.98% PDI of blight, ranking it as the second most effective treatment for the disease. The PDI (17.00% to 20.81%) obtained while treating Vinca rosea with cow urine, Neem, and bullet wood with water were comparable to one another and evaluated third among the effective treatments for cumin blight.

Bullet Wood with water recorded a PDI of 23.33% and reached the conclusion that it was not more effective than other approaches. The data table 6.6 also showed that the control circumstance, in which just water was sprayed, recorded the highest 43.32% PDI.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and  
Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

**7.3.1.6 Impact of botanicals on control of Alternaria blight disease in cumin at five weeks after application of treatments.**

Sr. No.	Treatment	PDI (%) Replication			Mean Replicate	Percent disease reduction over control
		Replicate I	Replicate II	Replicate III		
1	Indian beech (with water)	47.29* (54.00)	47.87 (55.00)	49.31 (57.00)	48.16 (55.50)	19.62
2	Bullet wood (with water)	41.84 (44.50)	42.13 (45.00)	42.42 (45.50)	42.13 (45.00)	34.83
3	Neem (with water)	35.97 (34.50)	36.27 (35.00)	36.57 (35.50)	36.27 (35.00)	49.31
4	Neem (with acetone)	30.00 (25.00)	28.32 (22.50)	31.63 (27.50)	29.98 (24.97)	63.83
5	Adulsa (with acetone)	31.63 (27.50)	33.21 (30.00)	33.21 (30.00)	32.68 (29.16)	57.77
6	Bullet wood (with acetone)	30.00 (25.00)	36.27 (35.00)	33.21 (30.00)	33.16 (29.92)	56.67
7	Indian beech (with cow urine)	40.69 (42.50)	47.87 (55.00)	43.57 (47.50)	44.04 (48.33)	30.00
8	Vinca rosea (with cow urine)	39.23 (40.00)	40.69 (42.500)	34.76 (32.50)	38.23 (38.29)	44.55
9	Neem (with cow urine)	34.76 (32.50)	28.32 (22.50)	31.63 (27.50)	31.57 (27.41)	60.30
10	Control	53.43 (64.50)	58.37 (72.50)	56.79 (70.00)	56.20 (69.05)	
	S.Em. ±				1.34	
	C.D. at 5%				3.95	
	C.V. %				5.92	

Table 7.7: Impact of only water on disease development of cumin blight at 5<sup>th</sup> week after application

Note: The values inside the brackets have undergone retransformation, whereas the data outside is arcsine transformed.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

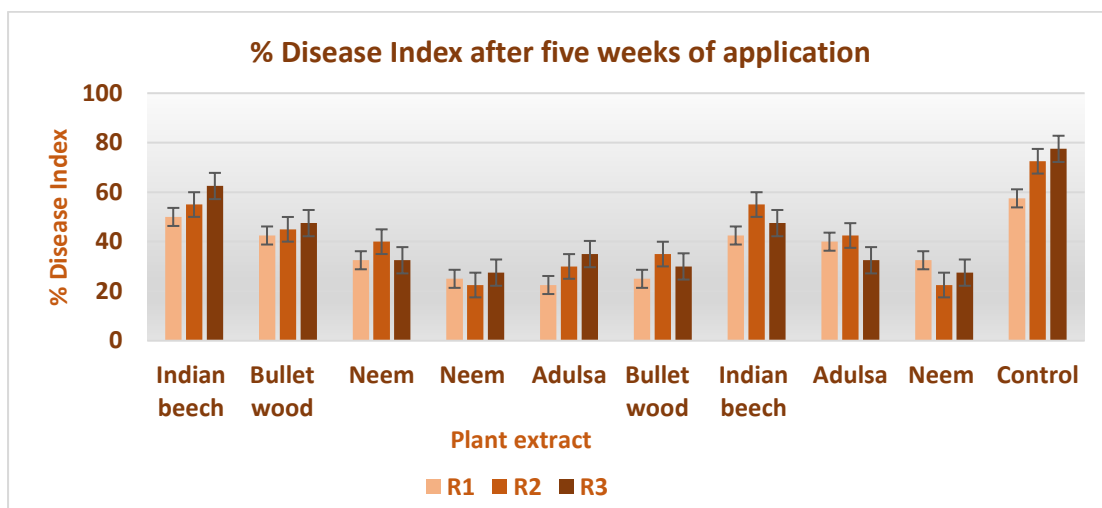


Figure 7.6: Graph of the efficacy of various botanical extracts on blight diseases development in cumin at 5<sup>th</sup> week after application

**7.3.1.7. Five weeks after the application of the treatments**

At the end of the fourth application, the disease severity (scales) were recorded for all treatments. According to the findings in (Table 7.7), the plant treated with neem in acetone showed the lowest mean PDI of blight across all treatments, which was 24.97% (22.50% to 27.50%). The plants treated with Neem with cow urine exhibited a 27.41% PDI of blight (statistically at par), making it the second-most effective treatment for disease prevention. The treatment of Adulsa and Bullet wood with acetone at equality with one another stood in third place, with the PDI of 29.16% and 29.92% reported.

Bullet wood and Indian beech with water both showed PDI values of 45.00% and 55.50% in the (44.50% to 57%) range. The statistics also showed that spraying simple water resulted in a maximum PDI of 69.05%. Therefore, it was determined that treating Indian beech and Bullet wood with water did not effectively decrease cumin blight.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

**7.3.1.8 Impact of botanicals on control of Alternaria blight disease in cumin at six weeks after application of treatments**

Sr. No.	Treatment	PDI (%) Replication			Mean Replicate	Percent disease reduction over control
		Replicate I	Replicate II	Replicate III		
1	Indian beech (with water)	47.87 (55.00)	50.76 (60.00)	56.78 (70.00)	51.81 (61.77)	37.20
2	Bullet wood (with water)	45.00 (50.00)	46.43 (52.50)	50.76 (60.00)	47.40 (54.18)	44.91
3	Neem (with water)	39.23 (40.00)	47.87 (55.00)	46.43 (52.50)	44.51 (49.15)	50.03
4	Neem (with acetone)	36.27 (35.00)	34.75 (32.50)	37.76 (37.50)	36.26 (34.99)	64.43
5	Adulsa (with acetone)	41.84 (44.50)	45.28 (50.50)	43.56 (47.50)	43.57 (47.50)	51.71
6	Bullet wood (with acetone)	45.28 (50.50)	47.58 (54.50)	46.43 (52.50)	46.43 (52.50)	46.62
7	Indian beech (with cow urine)	48.73 (56.50)	49.02 (57.00)	49.89 (58.50)	49.22 (57.33)	41.71
8	Vinca rosea (with cow urine)	40.97 (43.00)	41.84 (44.50)	40.10 (41.50)	40.97 (43.00)	56.28
9	Neem (with cow urine)	41.55 (44.00)	40.39 (42.00)	40.10 (41.50)	40.69 (42.50)	56.79
10	Control	77.07 (95.00)	80.90 (97.50)	90.00 (100.00)	82.66 (98.37)	
	S.Em. ±				1.85	
	C.D. at 5%				5.47	
	C.V. %				6.66	

Table 7.8: Impact of various botanical extracts on blight diseases development in cumin in 6<sup>th</sup> week after application

Note: Data outside the parentheses are arcsine transformed, whereas inside are retransformed values.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

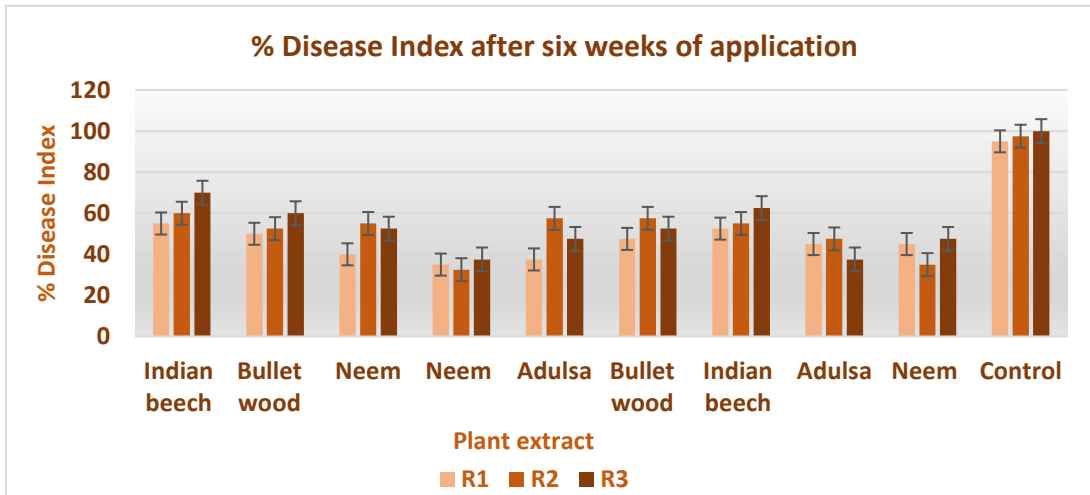


Figure 7.7: Comparative effects of 10% plant extracts on cumin blight diseases development in cumin in the 6<sup>th</sup> week after application

**7.3.1.9 Six weeks after the application of the treatments**

In all of the treatments, the final disease severity (scales) was reported six weeks after the final application. The findings in (Table 7.8) revealed that, among all the treatments, the plant treated with neem in acetone had a significant minimum mean of 34.99% PDI of blight. Neem-treated plants showed PDI of 42.50% and 43.000%, while vinca rosea with cow urine was classified as the second-most successful treatment for disease management. Neem was treated with water and placed third, with a 49.15% PDI reported.

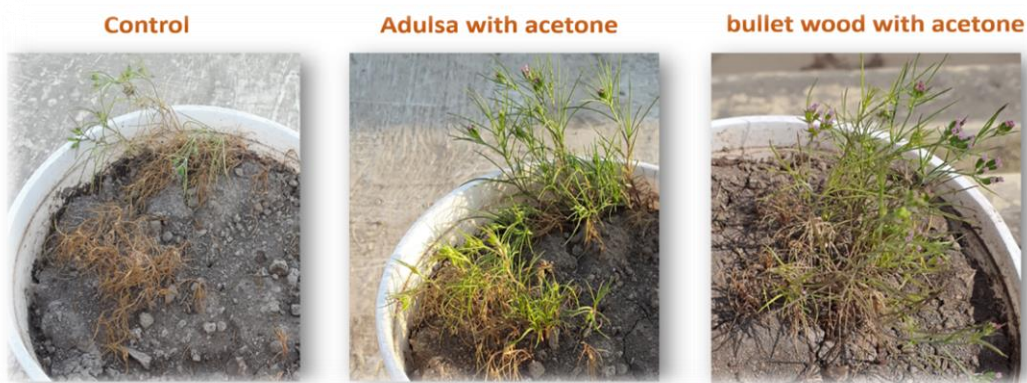
The PDI in the range of 54.18 % to 61.77 % was recorded by Bullet wood with water and Indian beech with water and cow urine. The data also showed that only water was sprayed in those situations where the maximum PDI of 98.37% was observed. Therefore, it was determined that treating Indian beech and Bullet wood with water did not effectively decrease cumin blight.



**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**



**Figure 7.8: Pots treated with various extracts of Neem**



**Figure 7.9: Diseased symptoms of blight in potted cumin plant**



**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

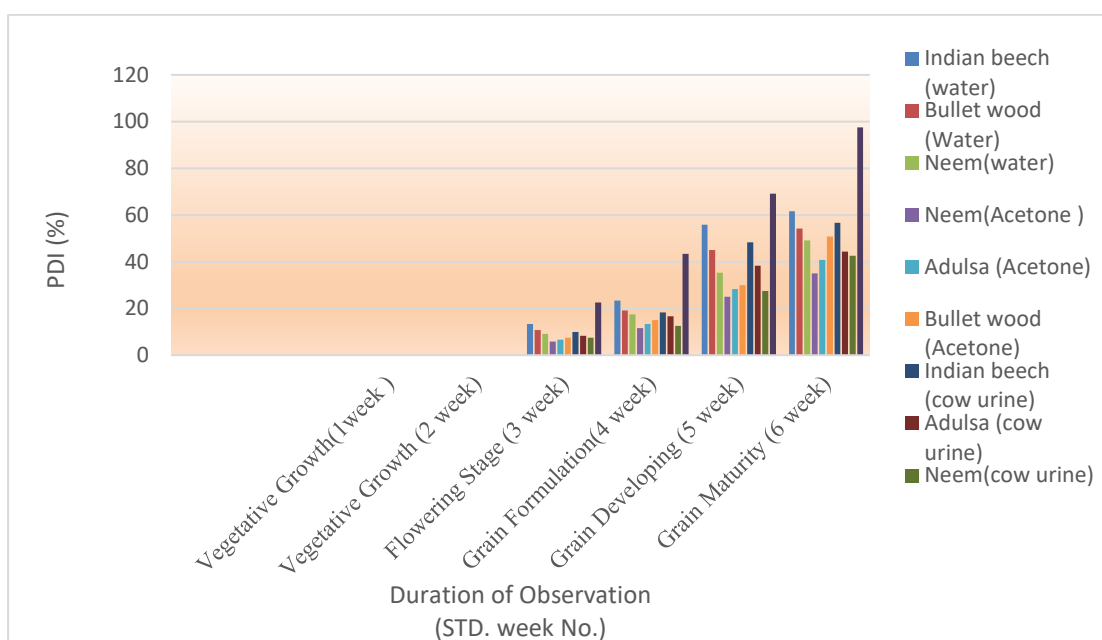
**7.3.1.10 Impact of treatments on the development of Alternaria blight disease of cumin at a different week**

No.	Treatments	PDI (%) of cumin blight at a different week				
		1 & 2	3	4	5	6
T1	Indian beech Water	0.00	13.33	23.33	55.83	61.66
T2	Bullet wood Water	0.00	10.83	19.16	45	54.16
T3	Neem Water	0.00	9.16	17.5	35.33	49.16
T4	Neem Acetone	0.00	5.83	11.66	25	35
T5	Adulsa Acetone	0.00	6.66	13.33	28.33	40.83
T6	Bullet wood Acetone	0.00	7.5	15	30	50.83
T7	Indian beech Cow urine	0.00	10	18.33	48.33	56.66
T8	Adulsa Cow urine	0.00	8.33	16.66	38.33	44.33
T9	Neem Cow urine	0.00	7.5	12.5	27.5	42.5
T10	Control	0.00	22.5	43.33	69.16	97.5
	S. Em±	0.00	0.48	0.72	1.34	1.85
	C.D. at 5%	0.00	1.41	2.13	3.95	5.47
	C.V.	0.00	4.57	4.85	5.92	6.65

Table 7.9: Efficacy of different botanicals on the growth of the blight disease in cumin at differed application intervals.

Note: The values inside the brackets have undergone retransformation, whereas the data outside is arcsine transformed.

## Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals



**Figure 7.9: Comparative effect of various botanical treatments on cumin blight**

The graph shows the hat intensity of blight disease on cumin increased with time. In the seven standard weeks disease was in starting phase. The severity of the disease is affected differentially by different treatments. Three treatments, namely Adulsa with acetone, Neem with acetone, and cow urine, were found to have the lowest level of disease incidence. The medium intensity of disease was observed in Neem with water, Bullet wood with acetone, Indian beech, and Adulsa with cow urine in the range of 44.33% to 50.83. The maximum intensity of disease was observed in Bullet wood and Indian beech with water in the range of 54.16% to 61.66%. So Indian beech and Bullet wood were not more effective as compared to other treatments.

### 7.3.2 Impact of botanicals on control of Fusarium wilt disease in cumin.

#### 7.3.2.1 Impact of botanicals on control of Fusarium wilt disease in cumin at first week after application of treatments.

Plant disease indices were recorded at weekly intervals after spray application of treatments to potted cumin plants during the 2022-2023 rabbi season in Rajkot. 10% plant extracts were applied four times at intervals of every 15 days.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

No.	Treatment	PDI (%) Replication			Mean
		I	II	III	PDI
<b>Plant extract with water</b>					
1	<i>Millettia pinnata</i> (Indian beech)	0.00	0.00	0.00	0.00
2	<i>Mimuspos elengi</i> (Bullet wood)	0.00	0.00	0.00	0.00
3	<i>Azadirachta indica</i> (Neem)	0.00	0.00	0.00	0.00
<b>Plant extract with acetone</b>					
4	<i>Azadirachta indica</i> (Neem)	0.00	0.00	0.00	0.00
5	<i>Adhatoda vasica</i> (Adulsa)	0.00	0.00	0.00	0.00
6	<i>Aloe barbadensis miller</i> (Aleo vera)	0.00	0.00	0.00	0.00
<b>Plant extract with cow urine</b>					
7	<i>Millettia pinnata</i> (Indian beech)	0.00	0.00	0.00	0.00
8	<i>Mimuspos elengi</i> (Bullet wood)	0.00	0.00	0.00	0.00
9	<i>Azadirachta indica</i> (Neem)	0.00	0.00	0.00	0.00

Table 7.10: Impact of Various botanical treatments on disease development of cumin wilt in 1<sup>st</sup> week after application

**7.3.2.2 One week after the application of treatments**

Based on the data presented in Table 6.10, the disease that causes cumin wilt was not affecting cumin plants for a week when the treatments were applied.

**7.3.2.3 Impact of botanicals on control of wilt disease in cumin the 2<sup>nd</sup> week after application of treatments.**

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

Sr. No.	Treatment	PDI (%) Replication			Mean Replicates	Percent disease reduction over control
		Replicate I	Replicate II	Replicate III		
1	Holy basil (with water)	20.70 (12.50)	19.47 (11.11)	20.05 (11.76)	20.08 (11.78)	8.15
2	custard apple (with water)	19.96 (11.60)	18.92 (10.52)	19.47 (11.11)	19.45 (11.09)	13.54
3	Piper betle (with water)	14.47 (6.25)	13.62 (5.55)	14.47 (6.25)	14.19 (6.01)	54.09
4	Mint (with acetone)	19.47 (11.11)	18.92 (10.25)	19.47 (11.11)	19.29 (10.91)	14.95
5	custard apple (with acetone)	18.92 (10.52)	14.47 (6.25)	18.43 (10.00)	17.28 (8.82)	31.23
6	Piper betle (with acetone)	14.03 (5.8)	14.47 (6.25)	13.62 (5.55)	14.05 (5.89)	53.21
7	Vinca rosea (with cow urine)	20.05 (11.76)	20.92 (12.75)	19.47 (11.11)	20.15 (11.87)	0.01
8	Aak (with cow urine)	19.47 (11.11)	20.05 (11.76)	20.70 (12.5)	20.08 (11.78)	8.15
9	Piper betle (with cow urine)	14.03 (5.88)	14.47 (6.25)	14.03 (5.88)	14.18 (6.00)	53.13
10	Control	19.47 (11.11)	22.78 (15.00)	20.70 (12.5)	20.99 (12.83)	7.52
	S.Em. ±				0.60	
	C.D. at 5%				1.77	
	C.V. %				5.81	

Table 7.11: Impact of Various botanical treatments on disease development of cumin wilt in 2<sup>nd</sup> week after application

Note: The values inside the brackets have undergone retransformation, whereas the data outside is arcsine transformed.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

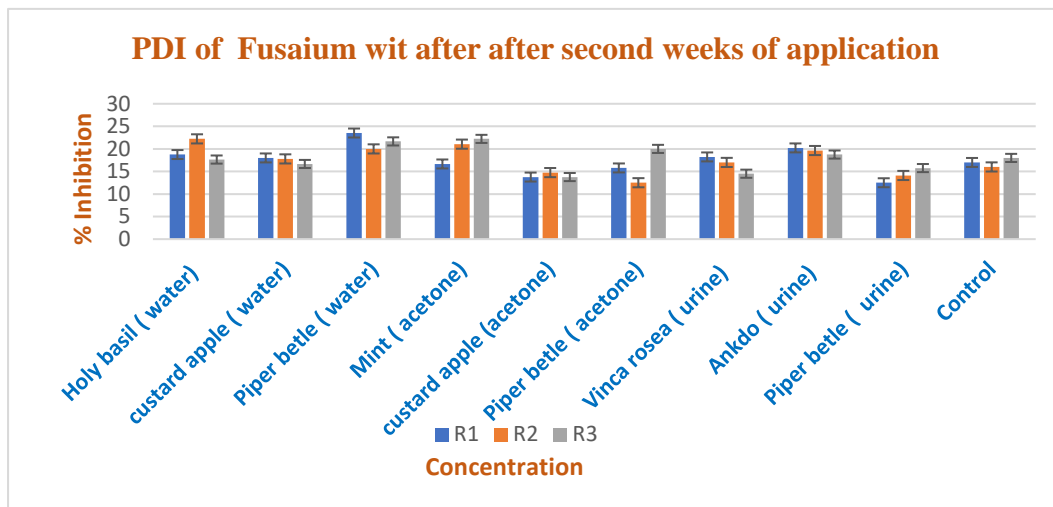


Figure 7.10: Efficacy of various botanical extracts on wilt diseases development in cumin at 2<sup>nd</sup> week after application

**7.3.2.4 Two weeks after the application of the treatments.**

The Data (Table 7.11) presented in the table revealed that the wilt disease incidence appeared on the treated plants along with the control (without treatment).

However significant minimum wilt (5.89% 6.00% and 6.01%) was recorded in the treatment with Betel leaf extracted in acetone, cow urine and water respectively. The data also indicate that the 8.82 % intensity of cumin wilt was on plants treated with custard apple extracted in acetone, which was statistically at par with Betel leaf. 10.91% incidence of wilt was recorded in the plant treated with mint extracted in acetone and it stood at second-ranked effective for control of the disease. Further, it was found that 11.9% to 11.87% of plant disease observed in Holy basil and Custard apple extracted in water and Aak extracted in cow urine was at par with control (12.83%) indicating an effect.

The data (Table 7.11) indicated that the treatments with Betel leaf and Custard apple and Mint were found most effective against the cumin wilt in the second week after the application of the treatment.

**7.3.2.5 Impact of botanicals on control of wilt disease of cumin at the 3<sup>rd</sup> week after application of treatments.**

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and  
Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

Sr. No.	Treatment	PDI (%) Replication			Mean Replicates	Percent disease reduction over control
		Replicate I	Replicate II	Replicate III		
1	Holy basil (with water)	25.66 (18.75)	28.12 (22.22)	24.83 (17.64)	26.20 (19.50)	10.17
2	custard apple (with water)	25.10 (18.00)	24.94 (17.78)	24.09 (16.66)	24.71 (17.47)	19.53
3	Piper betle (with water)	24.35 (17.00)	23.58 (16.00)	25.10 (18.00)	24.34 (16.99)	21.74
4	Mint (with acetone)	24.09 (16.66)	27.31 (21.05)	28.12 (22.22)	26.51 (19.92)	8.24
5	custard apple (with acetone)	23.41 (15.78)	20.70 (12.50)	26.57 (20.00)	23.56 (15.98)	26.53
6	Piper betle (with acetone)	21.77 (13.76)	22.59 (14.75)	21.77 (13.76)	22.04 (14.09)	35.09
7	Vinca rosea (with cow urine)	25.27 (18.22)	24.35 (17.00)	22.38 (14.50)	24.00 (16.54)	23.81
8	Aak (with cow urine)	26.72 (20.22)	26.31 (19.64)	25.66 (20.20)	26.23 (20.53)	5.43
9	Piper betle (with cow urine)	20.70 (12.50)	22.06 (14.11)	23.38 (15.75)	22.05 (14.09)	35.09
10	Control	29.01 (23.52)	26.57 (20.00)	27.74 (21.66)	27.77 (21.71)	0.00
	S.Em. ±				0.87	
	C.D. at 5%				2.58	
	C.V. %				6.12	

Table 7.12 Impact of Various botanical treatments on disease development of cumin wilt in 3<sup>rd</sup> week after application

Note: Data outside the parentheses are arcsine transformed, whereas inside are retransformed values.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

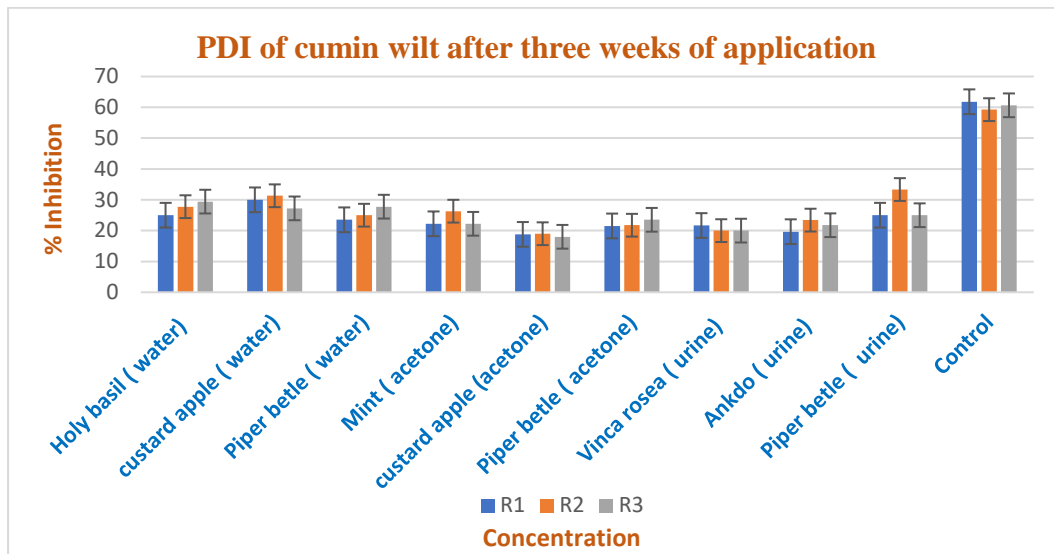


Figure 7.11: Efficacy of various botanical extracts on wilt diseases development in cumin in 3<sup>rd</sup> week after application

**7.3.2.6 Three weeks after the treatments were applied.**

The data given the Table 7.12 revealed that a minimum 14.09 % incidence of Fusarium wilt was recorded in the plant treated with piper betle extracted in acetone and cow urine. Thus, it could be clearly concluded that the treatment of Piper betle was more effective against cumin wilt. The data also indicate that the PDI of 15.98% was recorded by the treatment of Custard apple extracted in acetone statistically as per Piper betle.

16.54% and 16.99% PDI was recorded by Vinca rosea extracted in cow urine and Piper betle extracted in the water stood in the second position to control the Fusarium wilt.

The data was 17.47% to 19.53% also the incidence of wilt was recorded in the plants treated with custard apple and Holy basil extracted in water and Mint extracted in acetone were the next effective treatments for control of the disease.

The wilt of 20.53% recorded in the treatment of Aak was at par with the control (21.71), which was not more effective as others.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

**7.3.2.7 Impact of botanicals on control of Fusarium wilt disease in cumin at four weeks after application of treatments.**

Sr. No.	Treatment	PDI (%) Replication			Mean Replicate	Percent disease reduction over control
		Replicate I	Replicate II	Replicate III		
1	Holy basil (with water)	30.0 (25.00)	31.80 (27.77)	32.84 (29.41)	31.55 (27.37)	54.82
2	custard apple (with water)	33.11 (30.00)	34.02 (31.31)	31.48 (27.22)	32.89 (29.50)	51.30
3	Piper betle (with water)	29.01 (23.52)	30.00 (25.00)	31.80 (27.77)	30.27 (25.41)	58.05
4	Mint (with acetone)	28.12 (35.22)	30.85 (36.31)	28.12 (34.22)	29.04 (35.25)	41.81
5	custard apple (with acetone)	27.63 (21.52)	27.79 (21.75)	29.01 (23.52)	28.15 (22.26)	63.25
6	Piper betle (with acetone)	25.68 (18.78)	25.84 (19.00)	25.10 (18.00)	25.54 (18.59)	69.31
7	Vinca rosea (with cow urine)	30.00 (19.66)	35.26 (33.33)	30.00 (25.00)	31.75 (27.70)	54.27
8	Aak (with cow urine)	26.32 (35.00)	28.93 (33.41)	27.79 (31.75)	27.69 (33.38)	44.89
9	Piper betle (with cow urine)	27.73 (21.66)	26.56 (20.00)	26.56 (20.00)	26.96 (20.55)	66.07
10	Control	51.83 (61.82)	50.33 (59.25)	51.15 (60.66)	51.11 (60.58)	0.00
	S.Em. ±				0.84	
	C.D. at 5%				2.47	
	C.V. %				6.60	

Table 7.13: Impact of various botanical extracts on wilt diseases development in cumin in 4<sup>th</sup> week after application

Note: The values inside the brackets have undergone retransformation, whereas the data outside is arcsine transformed.



**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and *Alternaria* blight (*Alternaria burnsii*) diseases through different botanicals**

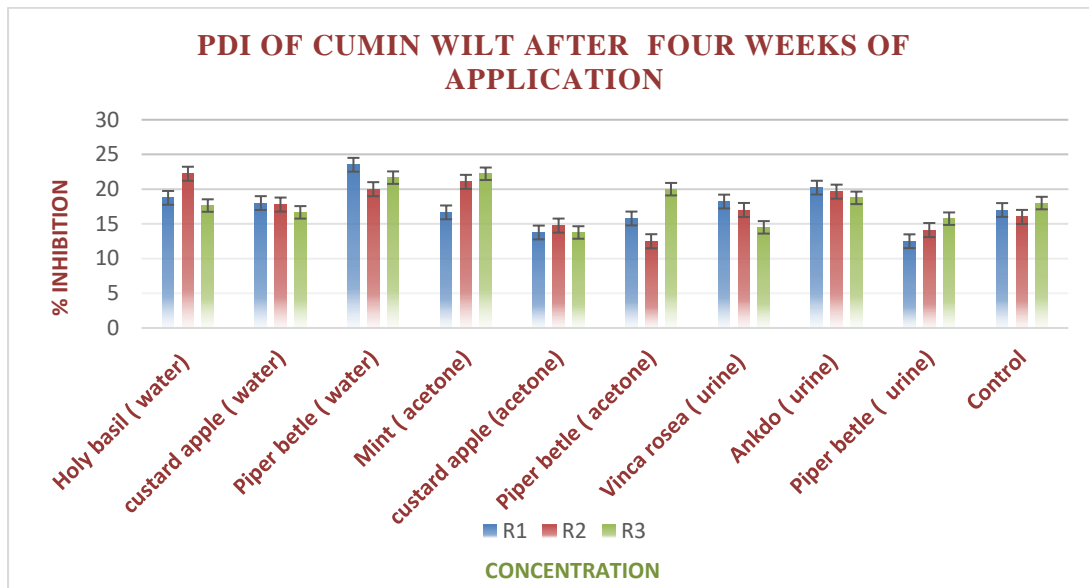


Figure 7.12: Efficacy of various botanical extracts on wilt diseases development in cumin in 4<sup>th</sup> week after application

**7.3.2.8 Four-week application of the treatments**

The Data (Table 7.13) presented in Table revealed that a significant minimum mean of 18.59% PDI was recorded by piper betle extracted with acetone and stood in the first position. Thus, it could be clearly concluded that the treatment of Piper betle was more effective against cumin wilt. The data also indicated that the treatment of piper betle extracted in cow urine (20.55%) was statistically compared to the par treatment of Piper betle extracted in cow urine. Thus, it could be clearly concluded that the treatment of Piper betle extracted in acetone and cow urine was equally effective.

The Data (table 7.14) also indicates that 22.26% PDI was recorded in the treatment of custard apple extracted in acetone and stood in the second position. Piper betle extracted in water (25.41%) stood in the third rank to control *Fusarium* wilt.

In the range of 27.37% to 29.50% PDI was recorded by the extract of Holy basil extracted in water, Holy basil extracted in water, and Vinca rosea extracted in cow urine.

The data table also indicated that the maximum 60.58% intensity was recorded in the control where only water was used.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and  
Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

**7.3.2.9 Impact of botanicals on control of wilt disease in cumin at five weeks after application of treatments.**

Sr. No.	Treatment	PDI (%) Replication			Mean Replicate	Percent disease reduction over control
		Replicate I	Replicate II	Replicate III		
1	Holy basil (with water)	39.91 (41.17)	38.58 (38.88)	39.91 (41.17)	39.47 (40.41)	43.14
2	custard apple (with water)	35.26 (33.33)	37.37 (36.84)	35.26 (33.33)	35.97 (34.49)	51.47
3	Piper betle (with water)	35.26 (33.33)	37.76 (37.50)	35.26 (27.77)	36.10 (34.71)	51.16
4	Mint (with acetone)	36.80 (27.77)	35.19 (31.57)	37.80 (30.00)	32.60 (36.26)	48.98
5	custard apple (with acetone)	33.76 (30.00)	31.80 (31.25)	32.76 (23.52)	35.78 (32.77)	53.89
6	Piper betle (with acetone)	29.01 (23.52)	30.00 (25.00)	29.01 (23.52)	29.34 (24.02)	66.17
7	Vinca rosea (with cow urine)	37.76 (37.50)	36.21 (30.00)	37.76 (37.50)	36.24 (36.96)	48.00
8	Aak (with cow urine)	39.98 (31.25)	37.44 (35.29)	38.98 (31.25)	34.81 (38.08)	46.62
9	Piper betle (with cow urine)	33.21 (37.50)	33.98 (27.77)	33.21 (37.50)	33.47 (30.41)	57.21
10	Control	58.19 (72.22)	56.01 (68.75)	58.19 (72.22)	57.47 (71.08)	0.00
	S.Em. ±				0.98	
	C.D. at 5%				2.90	
	C.V. %				4.58	

Table 7.14: Impact of only water on disease development of cumin wilt in 5<sup>th</sup> week after application

Note: The values inside the brackets have undergone retransformation, whereas the data outside is arcsine transformed.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

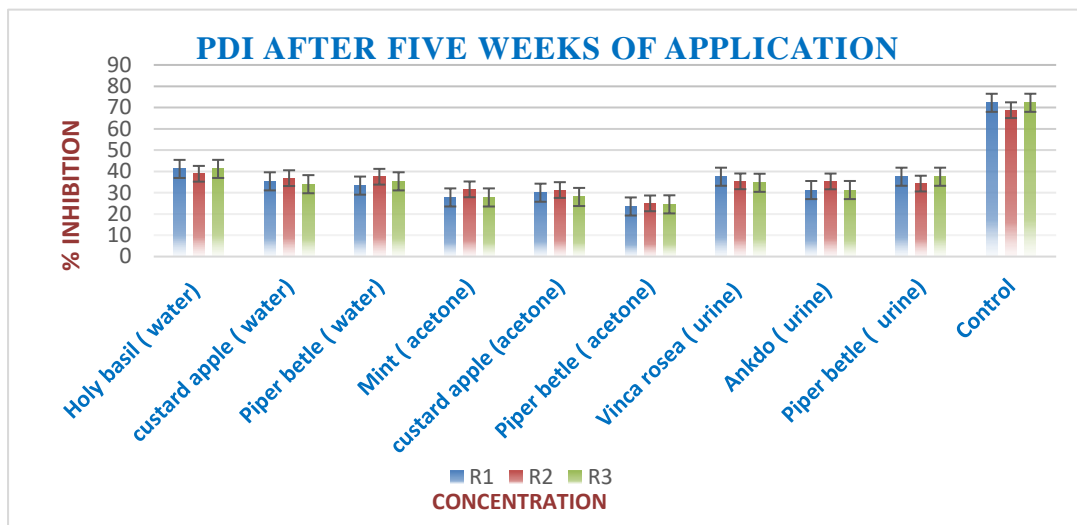


Figure 7.13: Efficacy of various botanical extracts on wilt diseases development in cumin in 5<sup>th</sup> week after application

**7.3.2.10 Five weeks after the application of the treatments**

At the end of the fourth application, the disease severity (scales) were recorded for all treatments. According to the findings in Table-7.14, the plant-treated Betel leaf showed the lowest mean PDI of wilt across all treatments, which was 24.02% (23.52% to 25.00%).

The plants treated with Custard apple extracted in cow urine exhibited a 32.37% PDI of blight (statistically at par), making it the second-most effective treatment for disease prevention. The treatment of Custard apple and Betel leaf extracted in water at equality with one another stood in third place, with the PDI of 34.49% and 34.71% reported.

Mint extracted in acetone and Akdo with cow urine both showed PDI values of 36.26% and 38.8 %. The statistics also showed that spraying simple water resulted in a maximum PDI of 71.08 %. Therefore, it was determined that the treatment of Mint and Akdo was not more effective as others to control the cumin wilt.

**7.3.2.11 Impact of botanicals on control of Fusarium wilt disease in cumin at six weeks after application of treatments**

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and  
Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

Sr. No.	Treatment	PDI (%) Replication			Mean Replicate	Percent disease reduction over control
		Replicate I	Replicate II	Replicate III		
1	Holy basil (with water)	48.59 (56.25)	48.19 (55.55)	46.68 (52.94)	47.82 (54.92)	44.70
2	custard apple (with water)	43.09 (46.66)	40.48 (42.10)	41.81 (44.44)	41.79 (44.40)	55.30
3	Piper betle (with water)	40.45 (42.10)	41.41 (43.75)	39.23 (40.00)	40.37 (41.95)	57.76
4	Mint (with acetone)	51.40 (61.11)	52.62 (63.15)	51.42 (61.11)	51.82 (61.80)	37.78
5	custard apple (with acetone)	36.48 (35.94)	41.41 (43.75)	38.58 (38.88)	38.81 (39.28)	60.45
6	Piper betle (with acetone)	36.48 (35.29)	33.98 (31.25)	36.44 (35.29)	35.63 (33.93)	65.84
7	Vinca rosea (with cow urine)	45.00 (50.00)	45.00 (50.00)	48.59 (56.25)	46.20 (52.09)	47.55
8	Aak (with cow urine)	54.73 (66.66)	53.55 (64.70)	52.23 (62.50)	53.51 (64.63)	34.93
9	Piper betle (with cow urine)	37.76 (37.50)	38.58 (38.88)	37.76 (37.50)	38.03 (37.96)	61.78
10	Control	75.96 (94.11)	90.00 (100.00)	90.00 (100.00)	85.32 (99.33)	0.00
	S.Em. $\pm$				1.87	
	C.D. at 5%				4.95	
	C.V. %				4.94	

Table 7.15: Impact of various botanical extracts on wilt diseases development in cumin in 6<sup>th</sup> week after application

Note: Data outside the parentheses are arcsine transformed, whereas inside are retransformed values.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

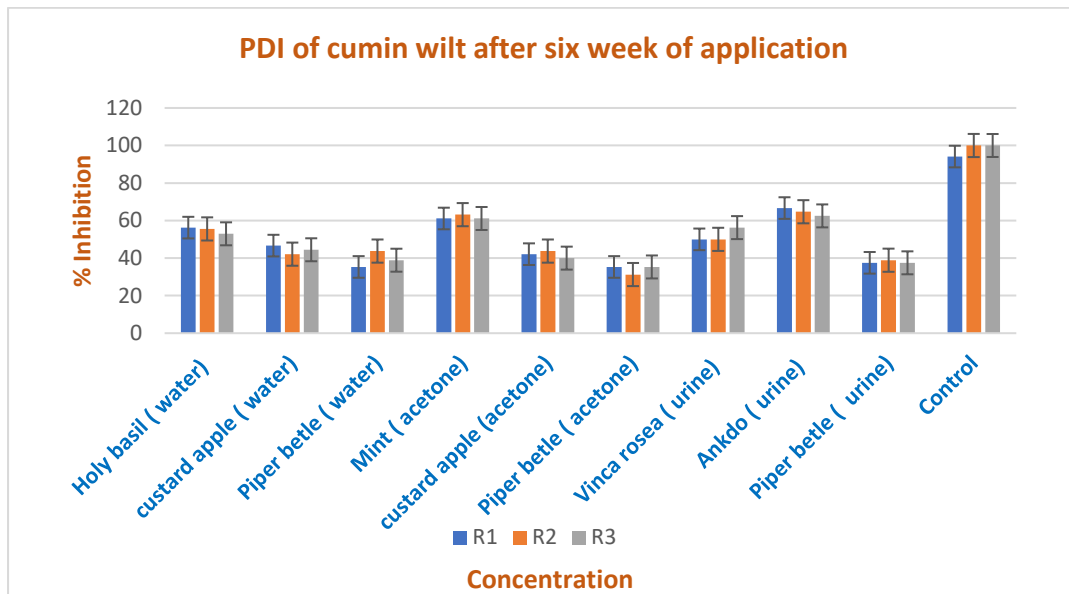


Figure 7.14: Efficacy of various botanical extracts on wilt diseases development in cumin at 6<sup>th</sup> week after application

**7.3.2.12 Six weeks after the application of the treatments**

In all of the treatments, the final disease severity (scales) was reported six weeks after the final application. The findings in the data (Table 6.15) revealed that, among all the treatments, the plant treated with Piper betle and Custard apple extracted in acetone and cow urine had a significant minimum mean of 33.93 % and 37.96% PDI of wilt respectively. 39.27% intensity of wilt was recorded in the treatment of Custard apple extracted in acetone and was classified as the second-most successful treatment for disease management. Treatment of Piper betle extracted in water (41.95%) was placed in third position to control the wilt of cumin.

The intensity of wilt in the range of 44.40 % to 54.92 % was recorded by Holy basil extracted in water, Custard apple extracted in water and Vinca rosea extracted in cow urine. The data table also indicated that 61.80% and 64.93% intensity was recorded by treatment of Mint extracted in acetone and Akdo extracted in cow urine were not more effective as other treatments. The data also showed that only water was sprayed in those situations where the maximum PDI of 99.33. % was observed.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and  
Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

**7.3.2.13 Impact of various botanical plant extracts on control of cumin wilt at different weeks after seed germination.**

No.	Treatments	Wilt intensity (%)					
		STD. Week no.					
		1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
1	Holy basil (with water)	0.00 (0.00)	20.08 (11.78)	26.20 (19.50)	31.55 (27.37)	39.47 (40.41)	47.82 (54.92)
2	custard apple (with water)	0.00 (0.00)	19.45 (11.09)	24.71 (17.47)	32.89 (29.50)	35.97 (34.49)	41.79 (44.40)
3	Piper betle (with water)	0.00 (0.00)	14.19 (6.01)	24.34 (16.99)	30.27 (25.41)	36.10 (34.71)	40.37 (41.95)
4	Mint (with acetone)	0.00 (0.00)	19.29 (10.91)	26.51 (19.92)	29.04 (35.25)	32.60 (36.26)	51.82 (61.80)
5	custard apple (with acetone)	0.00 (0.00)	17.28 (8.82)	23.56 (15.98)	28.15 (22.26)	35.78 (32.77)	38.81 (39.28)
6	Piper betle (with acetone)	0.00 (0.00)	14.05 (5.89)	22.04 (14.09)	25.54 (18.59)	29.34 (24.02)	35.63 (33.93)
7	Vinca rosea (with cow urine)	0.00 (0.00)	20.15 (11.87)	24.00 (16.54)	31.75 (27.70)	36.24 (36.96)	46.20 (52.09)
8	Aak (with cow urine)	0.00 (0.00)	20.08 (11.78)	26.23 (20.53)	27.69 (33.38)	34.81 (38.08)	53.51 (64.63)
9	Piper betle (with cow urine)	0.00 (0.00)	14.18 (6.00)	22.05 (14.09)	26.96 (20.55)	33.47 (30.41)	38.03 (37.96)
10	Control	0.00 (0.00)	20.99 (12.83)	27.77 (21.71)	51.11 (60.58)	57.47 (71.08)	85.32 (99.33)
	S.Em. ±	0.00	0.60	0.84	0.98	1.87	
	C.D. at 5%	0.00	1.77	2.47	2.90	4.95	
	C.V. %	0.00	5.81	6.60	4.58	4.94	

Table 7.16: Impact of various botanicals on wilt disease development in cumin at different weeks after application.

Note: The values inside the brackets have undergone retransformation, whereas the data outside is arcsine transformed.

**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

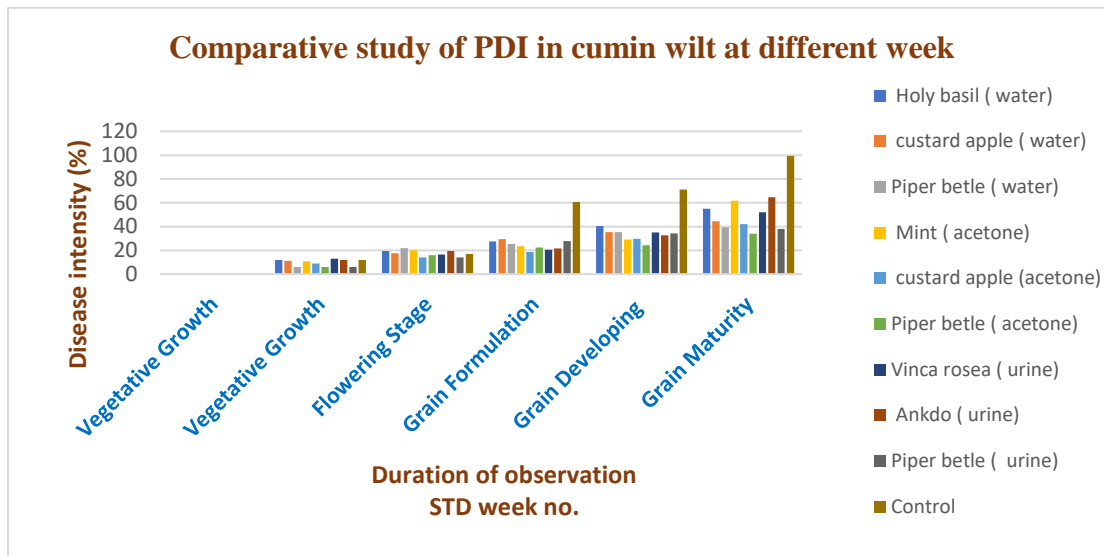


Figure 7.15: Comparative study of different botanical treatments on cumin wilt at different weeks.

Graph (Figure 7.17) shows that infection of wilt disease on cumin increased with time. In the second std. week disease was in starting phase. Various treatments give different effects on the seriousness of the problem. The least amount of the disease was observed in 10% plant extract of Piper betle extracted in acetone (33.93%), Piper betle extracted in cow urine (37.96%) and Custard apple extracted in acetone (39.28%)

The medium disease intensity was recorded in the range of 41.95% to 54.92 by the treatment of Holy basil, Custard apple and Betel leaf extracted in water as well as Vinca rosea extracted in cow urine.

The maximum intensity of disease was observed in the treatment of Mint extracted in cow urine and Akdo with acetone 61.80% to 64.93% respectively.



**Management of Cumin (*Cuminum cyminum* L) Wilt (*Fusarium oxysporum*) and Alternaria blight (*Alternaria burnsii*) diseases through different botanicals**

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**Figure 7.16: Cumin pots were treated with extract of betel leaf extracted in acetone**



**Figure 7.17: Cumin pots were treated with extract of custard apple extracted in acetone**



**Figure 7.18: Cumin pots were treated with extract of betel leaf extracted in cow urine**