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# Determinants for Frequency of Fungicide Applications against Chili Anthracnose (*Colletotrichum capsici* (Syd.) in Southern Ethiopia

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***Abstract***
*Chili anthracnose is posing a severe menace to chili production in southern Ethiopia. Study on fortnightly treatments of the fungicide Ridomil starting at different chili phonological stages was carried out so as to devise a strategy for appropriate frequency and timing for spraying against anthracnose diseases on chili. Two factor factorial arrangements with completely randomized block design had been employed. Variety, viz., MaraqoFana and OdaHaro, was assigned as factor A while fungicide frequency was assigned as factor B with four levels, viz., flushing, flowering, fruiting and control. The treatments were replicated four times. Data on incidences of anthracnose on leaves severity on fruits were collected. The financial impact and profitability of frequent spraying was computed. The economic implication of high frequency application of Ridomil in the current context of fungicide use on chili in Ethiopia was evaluated. A maximum of 7 applications starting from flushing successfully prevented the disease development and significantly reduced the incidence of leaf anthracnose. The best economic profit was obtainedwith7 applications of Ridomil for chili with potential yield of at least 29 kilograms per season per plot. In light of this research, small scale chili farmers will be able to lessen pesticide treadmill thereby escalating ecological safety and profitability.*

***Key Terms**: Chili Anthracnose, Financial Impacts, Frequency, Fungicide, Ridomil*

**Introduction**
Chili (*Capsicum frutescence* L.) is a crop of increasing importance in the economies of sub-Saharan Africa (Nsabiyera *et al.*, 2012). However, what is being produced has been below the potential that this area is capable of producing (Nsabiyera*et al.*, 2012; Lemma*et al.*, 2008). For instance, over the past many years, hot chili production in Ethiopia has stagnated at 0.4 tonnes per ha, with yields remaining lower than the average global production of 28 metric tons (Lemma *et al.*, 2008). Moreover, the quality of the produce realized does not meet the stringent standards of the international markets, where most countries face fierce competition from major producing countries such as India and China (Thampi, 2003). The poor quality of the produce is largely attributed to biotic and abiotic stresses in the field and the poor quality cultivars grown by farmers (Tusiime *et al.*,2010). Particularly, attack by different pest infestations or infections can cause significant losses in chili production (Ochoa-Alejo and Ramirez-Malagon, 2001). The most common diseases of most chili peppers are phytopathogenic fungi, bacteria, and viruses. By and large, from 50% (Pakdeevaraporn *et al.*,2005) to 100% loss had been was observed due to chili anthracnose (Melanie and Sally, 2004); causing severe defoliation of plants, resulting in reduced yield and loss of quality of harvested fruit when severe damage occurs on enlarging fruits(Melanie and Sally, 2004).

Control and/or prevention of these diseases and their vector populations are usually through use of chemical sprays on diseased plants and use of various cultural practices. In developing countries such as Uganda and Ethiopia, farmers largely use pesticides for disease and pest control on hot chili (Karungi*et al.*, 2010). Ever-increasing loads of disease management via chemicals accompanied by rising cost make pesticides non-affordable for small scale farmers(Lemma *et al.*, 2008).Application of pesticides arbitrarily over time has also resulted in a buildup of resistance among target pests and pathogens (Flint, 1999). Pests and diseases are best managed using host resistance, which is a cheap option for farmers (Duveiller*et al.*, 2007).

However, in cases where disease-resistant cultivars are not available, fungicide control would be the best control strategy. In some countries like Brazil, fungicides such as copper oxychloride, copper hydroxide, zinc + manganese, carbamate, captafol, benomyl, dithianon, anilazine, bitertanol, tridimenol and triforine, are used to control the disease (Freire*et al.*, 2002). However, the choice of fungicides depends on various factors such as biological efficiency, crop sensitivity (Uaciquete, 2013), economic feasibility(Freire*et al.*, 2002), environmental aspects (Sijaona, *et al.*, 2001), previous exposure to a certain fungicide or group (Siddiqui*et al.*, 2001)and local regulations for registration (Arauz, 2000). In general, there is no sufficient research information vis-à-vis the frequency of fungicides application in Ethiopia. Thus this paper was initiated with the aim to determine the efficacy of various fungicides rate and frequency against chili anthracnose in south western regions of the country.

Typically copper oxychloride is used to control chili anthracnose in many countries. Other fungicides such as 5% trifloxystrobin WG, 25% difeconazole EC and 25% azoxystrobin EC were proven also to be effective (Uaciquete, 2013). However, these fungicides have not been widely adopted due to similar constraints as described in Brazil, i.e. extensive area planted but low productivity and the high cost of these fungicides (Freire*et al.*, 2002). In Ethiopia, the cost is increased because other and timely asynchronized series of fungicide applications are required for anthracnose control.

In Ethiopia, chili fungicides are not subsidized by the government, including transportation up to farm gate. Farmers pay only for the spraying service. Because the incidence of anthracnose is higher in the Southern as compared to the other parts of Ethiopia, the recommended frequency of fungicide application has been four and three times respectively.

Copper fungicides are very old, have a residual build up in soils and were found to be detrimental to avocado phylloplane microorganisms with natural suppressive effect on *Colletotrichum spp*)(Freire*et al.*, 2002; Uaciquete, 2013; Sijaona, *et al.*, 2001). Alternatively, Ridomilis widely used in chili control but it has shown no significant reduction on anthracnose severity. The current study was conducted to determine the effectiveness of 5%RidomilSC against chili anthracnose through changes in timing and frequency of applications at different stages.

## Material and Methods

### Location, Plants and Experimental Design

The present experiment was conducted during 2013 and 2014 cropping seasons in a FTC farm in Shashogo District, which is located at 8.042378latitudes, 38.49944 longitudes, and with altitude of 1840.08**.** The farm is located just about 24 km avert from Addis-Hossana road which is about 200kms in from the capital. The experiments were carried out for two consecutive seasons starting from May/June till December each year. The sites were chosen on the basis of safety, disease confinement and focusing on absence of interlocking branches with adjacent shades, as recommended by Uaciquete (2013).

Two factor factorial experiments in randomized complete block design (RCBD) were adopted with 4 replications. Factor A was the genotypes (A1=Maraqofana and A2=OdaHaro) obtained from Melkassa Agricultural Research Center). Factor B was spray times at which Ridomil were initiated. The first treatment aimed at protecting the plants from the true leaf stage onwards(B1); the second treatment was aimed at protecting the plant from flowering production stage onwards(B2) and the third, from fruiting(B3) and then a fourth treatment that consisted of un-sprayed served as control(B4) (Table 1). Experimental plot consisted of five plants and the plot was separated from another by at least one row in each direction. The applied dose was 0.5 ml of active ingredient per plot(Uaciquete, 2013).Experimental site measured was measure as 674.4m$^2$ [length: - 1.4m x 10m x 8 =112.4 m and the width: - (0.3mx5) + (1m+4) = 6m].

### Spraying procedure

Spraying was carried out fortnightly using a hand held knapsack mist blower operated by a trained person. The rate of Ridomil application was determined based on the recommendations of Uaciquete (2013). Detailed procedures such as speed of the operator, wind challenge and rain coverage had been avoided for uniformity (Uaciquete, 2013; Sijaona, *et al.*, 2001).

### Data collection

Both anthracnose leaf incidence and severity on flowers were recorded fortnightlybasis (Table 2) in purposively selected ten young leaves per plot. A scale (0-6) developed by Siddiqui*et al*. 2008)for coverage on leaf surface were adopted. The area covered in the scale corresponds well with the necroticised area in the case of anthracnose infection and designated as Healthy (0); 1-5% of mature leaves with necrotic and chlorotic (*Colletotrichum* spp.) symptoms (1); 6–15% of mature leaves with necrotic and chlorotic symptoms (2); 16–50% of young shoots and stem with water soaked lesions and minor shoot die back (3); 51–95%water-soaked lesions with abundant mycelia growth and fructification, and extensive shoot dieback (4); Dead plant (5) (Siddiqui*et al*.(2008).Three to four observations were made in order to cover the peak of disease intensity as observed from the untreated.

### Statistical analysis

Data on disease incidence and severity (D-S) were transformed using the square root function (S=√ (X+1) so as to normalize variability. The transformed data were subjected to analysis of variance using GenStat computer package (GenStat 9.2) to examine variations among frequencies. For both anthracnoses, individual plant score means for shoots and fruits were annually calculated in the field forms as detailed before (Sijaona, *et al.*, 2001). Then, plant means, over the years, were used to run the statistical analysis for both anthracnose incidence and severity. Analysis of variance (ANOVA) was used to determine differences between the treatment effects on means. The data was acceptably normally distributed with heterogeneous treatment variances. Means were therefore separated using Fisher's protected t-test least significant difference (LSD) at 5% level of significance (Petersen, 1994; Gomez and Gomez, 1984).

## Results

### Effect of Frequency Application of Ridomil on Anthracnose Incidence and Severity on different chili Genotypes and Plant Parts Affected

The finding of this study indicated that fungicide applications aimed at protecting emerging seedlings from flushing stage, in which total number of 7 sprays were made, had shown minimum incidence and severity of anthracnose on fruits of MaraqoFana variety, with 2.5 and 2.53; and 2.17 and 1.83 in 2013 and 2014 seasons; and respectively (Table 2). On Odaharo variety, the minimum incidence and severity of anthracnose on fruits was 2.43 and 1.37; and 1.8 and 3.37 in 2013 and 2014, respectively. Overall, the severity of anthracnose on leaves of Maraqofana was lower than Odaharo variety in Ridomil treated plots in 2013. On the contrary, the percent severity on fruits was higher in Odaharo than Maraqofana variety in untreated check the same season. The severity on leaves and fruits had been lower in variety Maraqofana than OdaHaro in Ridomil treated plots in 2014. Regardless of when the sprayings started, severity mean scores for two consecutive seasons were significantly lower on Ridomil treated compared to untreated controls (Table 2). Furthermore, the percent incidence and severity on parts of chili plant had been compared. In fact, no symptoms developed on flowers in all plots. However, high disease incidence were observed on leaves than fruits in 2013 season while percent severity was higher on fruits than leaves in 2014 (Table 2).

**Table 1**. Date of Application ofRidomilper treatment, during 2013 and 2014pepper crop,Shashogo District, SNNP

| **Date of application (2013)** | **Treatments at:** | **16-Jun** | **23-Jun** | **30-Jun** | **7-Jul** | **18-Jul** | **25-Jul** | **1-Aug** | **8-Aug** | **15-Aug** | **23-Aug** | **23-Aug** | **29-Aug** | **7-Sep** | **15-Sep** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Maraqofana& Odaharo** | Flushing | * | - | * | - | * | - | * | - | * | - | * | - | * | - |
| | Flowering | - | - | - | * | - | * | - | * | - | * | - | * | - | * |
| | Fruiting | - | - | - | - | - | - | - | - | - | - | - | * | * | * |
| | Untreated | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Date of application (2014)** | Treatments at: | 10-Jun | 17-Jun | 25-Jun | 2-Jul | 9-Jul | 16-Jul | 23-Aug | 30-Aug | 1-Aug | 23-Aug | 30-Aug | 8-Aug | 16-Sep | 1-Sep |
| **Maraqofana& Odaharo** | Flushing | - | * | - | * | - | * | - | * | - | * | - | * | - | * |
| | Flowering | - | - | - | - | * | - | * | - | * | - | * | - | * | - |
| | Fruiting | - | - | - | - | - | - | - | - | - | - | | * | * | * |
| | Untreated | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

*= Application of Ridomil, - = No application

**Table 2.** Effect of Fortnightly application of Ridomil for the control of anthracnose during 2013 and 2014 cropping season in Shashogo, Ethiopia

| Genotype | First Application at: | 2013 | | | | 2014 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **Severity (%) on:** | | **Incidence (%) on:** | | **Severity (%) on:** | | **Incidence (%) on:** | |
| | | **Leaves** | **Fruits** | **Leaves** | **Fruits** | **Leaves** | **Fruits** | **Leaves** | **Fruits** |
| **Maraqo Fana** | Flushing | 1.23a* | 2.17a | 2.3a | 2.50a | 3.20a | 1.83a | 5.97a | 2.53b |
| | Flowering | 1.3a | 1.43a | 2.5a | 2.33ab | 9.63d | 3.77b | 5.90a | 3.67c |
| | Fruiting | 1.3a | 1.53a | 1.67a | 2.33ab | 10.63e | 5.87c | 6.00a | 6.00c |
| | control | 2.9b | 2.90ab | 5.35d | 5.43d | 12.90f | 8.90d | 8.70c | 9.63f |
| **OdaHaro** | Flushing | 1.57a | 1.37a | 2.57ab | 2.43b | 6.27c | 3.37b | 5.83a | 1.80a |
| | Flowering | 1.53a | 1.80a | 2.3a | 2.60b | 5.00b | 9.80d | 5.63a | 2.30b |
| | Fruiting | 1.57a | 1.47a | 2.23a | 1.93a | 6.00c | 9.47d | 8.93c | 6.93d |
| | control | 3.83c | 4.27c | 4.31cd | 5.10c | 10.63e | 12.93e | 7.63b | 8.43e |
| | CV (%) | 16.75 | 11.5 | 13.6 | 15.2 | 14.1 | 17.6 | 16.6 | 14.77 |
| | LSD | 1.22 | 0.96 | 1.37 | 0.53 | 0.85 | 1.11 | 0.78 | 0.55 |

*Values with same letter are not significantly different (P<0.05)

**Effect of Frequency of Ridomil on Incidence and severity of chili anthracnose**

As indicated in Table 2, there is a significant variation in incidence and severity of chili anthracnose among genotypes and frequency of applications across seasons. In 2013 cropping season, leaf severity and incidence of anthracnose on both MaraqoFana and OdaHaro genotypes ranged between 1.23 and 3.83 and 1.67 and 4.31percents, respectively; whereas fruit severity and incidence of anthracnose on MaraqoFana and OdaHaro genotypes ranged between 1.23 and 3.83; and 1.67 and 4.31 percents. In 2014 cropping season, leaf severity and incidence of anthracnose on both MaraqoFana and OdaHaro genotypes ranged between 3.2 and 10.63; and 5.63 and 8.93 percents, respectively; whereas fruit severity and incidence of anthracnose on MaraqoFana and OdaHaro genotypes ranged between 1.83 and 12.93; and 1.8 and 8.43percents, respectively. In each season, variety and plant parts, the maximum incidence and severity were observed on untreated control (no application at all) while the minimum incidence and severity of anthracnose on leaves and fruits was observed when application is started at flushing.

**Effect of Frequency of Ridomil on chili Yield**

As indicated in Table 3, there is a variation among frequency of applications in yield/plot/season during 2013 cropping season. At poor performance-per-plot scenario, the minimum and maximum yield/plot/season was observed in untreated control (zero application) and flushing (7 times application) with 0.25 and 10, respectively. At average performance-per-plot scenario, the minimum and maximum yield/plot/season was observed in untreated control (zero application) and flushing (7 times application) with 1.00 and 19.5, respectively. At best performance-per-plot scenario, the minimum and maximum yield/plot/season was observed in untreated control (zero application) and flushing (7 times application) with 1.5 and 29, respectively (Table 3). Equivalent findings had been obtained in 2014 cropping season at poor, average and best yield-per-plot scenarios with a slight variations in price of the product (Table 4).

**Table 3:** Economic impact of increased frequency of application ofRidomilfor the control of anthracnose in Shashogo Ethiopia, 2013

| Options | First application at: | Price (appl/pl) (A) | Frequency of appl(B) | Price/plot/season (A*B) | Yield/plot /season Kg (C) | Price/ Kg(D) | Total gain/ plot/season (C*D) | Profit/ plot/season (C*D-A*B) |
|---|---|---|---|---|---|---|---|---|
| Farmers' practices | Flushing | 6.50 | 2 | 13.60 | 4 | 85 | 340.00 | 326.40 |
| | Flowering | 6.80 | 1 | 6.80 | 4 | 85 | 340.00 | 333.20 |
| Suggested by this study At minimum yield/plot | Flushing | 6.50 | 7 | 45.50 | 10 | 85 | 850.00 | 804.50 |
| | Flowering | 6.80 | 5 | 34.00 | 8 | 85 | 680.00 | 646.00 |
| | Fruiting | 6.50 | 3 | 19.50 | 6 | 85 | 510.00 | 490.50 |
| | Control | - | - | | 0.25 | 85 | 21.25 | 21.00 |
| Suggested by this study At average yield/plot | Flushing | 6.50 | 7 | 45.50 | 19.5 | 85 | 1657.50 | 1612.00 |
| | Flowering | 6.80 | 5 | 34.00 | 19 | 85 | 1615.00 | 1581.00 |
| | Fruiting | 6.50 | 3 | 19.50 | 16 | 85 | 1360.00 | 1340.50 |
| | control | - | - | | 1 | 85 | 85.00 | 63.75 |
| Suggested by this study At best yield/plot | Flushing | 6.50 | 7 | 45.50 | 29 | 85 | 2465.00 | 2419.50 |
| | Flowering | 6.80 | 5 | 34.00 | 28 | 85 | 2380.00 | 2346.00 |
| | Fruiting | 6.50 | 3 | 19.50 | 26 | 85 | 2210.00 | 2190.50 |
| | control | - | - | - | 1.5 | 85 | 127.50 | 106.25 |

**Table 4:** Economic impact of increased frequency of application ofRidomilfor the control of anthracnose in Shashogo Ethiopia, 2014

| Options | First Application at: | Price (application) (A) | Frequency of application (B) | Price/plot/season A*B | Yield/plot/season (Kg) (C) | Price/ Kg D | Total gain/ plot/season (C*D) | Profit/ plot/season (C*D-A*B) |
|---|---|---|---|---|---|---|---|---|
| Farmers' practices | Flushing | 6.50 | 2 | 13.60 | 4 | 80 | 320.00 | 306.40 |
| | Flowering | 6.80 | 1 | 6.80 | 4 | 80 | 320.00 | 313.20 |
| Suggested by this study At minimum yield/plot | Flushing | 6.50 | 7 | 45.50 | 10.01 | 80 | 800.00 | 754.50 |
| | Flowering | 6.80 | 5 | 34.00 | 8.01 | 80 | 640.00 | 606.00 |
| | Fruiting | 6.50 | 3 | 19.50 | 6.02 | 80 | 480.00 | 460.50 |
| | control | - | - | - | 0.3 | 80 | 20.00 | 20.00 |
| Suggested by this study At average yield/plot | Flushing | 6.50 | 7 | 45.50 | 19.55 | 80 | 1560.00 | 1514.50 |
| | Flowering | 6.80 | 5 | 34.00 | 19.02 | 80 | 1520.00 | 1486.00 |
| | Fruiting | 6.50 | 3 | 19.50 | 16.03 | 80 | 1280.00 | 1260.50 |
| | control | - | - | - | 0.99 | 80 | 80.00 | 80.00 |
| Suggested by this study At best yield/plot | Flushing | 6.50 | 7 | 45.50 | 28.99 | 80 | 2320.00 | 2274.50 |
| | Flowering | 6.80 | 5 | 34.00 | 27.96 | 80 | 2240.00 | 2206.00 |
| | Fruiting | 6.50 | 3 | 19.50 | 25.97 | 80 | 2080.00 | 2060.50 |
| | control | - | - | - | 1.49 | 80 | 120.00 | 120.00 |

**Financial impact of Ridomil Frequency**

As indicated in Table 3, there is a variation among frequency of applications in financial terms in 2013 cropping season. The usual practices of farmers in Ethiopia, two applications at flushing and flowering had been compared with the minimum, average and best yield/plot scenarios. At poor yield-per-plot scenario, the minimum and maximum profit/plot/season was observed in untreated control (zero application) and flushing (7 times application) with 21.00 and 804.50 ETB, respectively. At average yield-per-plot scenario, the minimum and maximum profit/plot/season was observed in untreated control (zero application) and flushing (7 times application) with 63.75 and 1612.00 ETB, respectively. At best yield-per-plot scenario, the minimum and maximum profit/plot/season was observed in untreated control (zero application) and flushing (7 times application) with 106.00 and 2419.50 ETB, respectively (Table 3). In 2014 cropping season, the replica of this research had been conducted in the same area with aim to examine the reliability of the data across seasons. Yet a very comparable result had been obtained. At poor yield-per-plot scenario, the minimum and maximum profit/plot/season was observed in untreated control (zero application) and flushing (7 times application) with 20.00 and 754.50 ETB, respectively. At average yield-per-plot scenario, the minimum and maximum profit/plot/season was observed in untreated control (zero application) and flushing (7 times application) with 80.00 and 1514.50 ETB, respectively. At best yield-per-plot scenario, the minimum and maximum profit/plot/season was observed in untreated control (zero application) and flushing (7 times application) with 120.00 and 2274.50 ETB, respectively (Table 4).

**Discussion**

Effective control of the disease using a specific fungicide spraying plan is the desirable strategy today in Ethiopia. In this trial, leaf and fruit anthracnose spread (incidence) on chili young shoots at Shashogo farm during two crop seasons, was significantly reduced by ten applications of Ridomil starting at flowering as compared to untreated. The same fungicide application plan was also highly effective against severity. Simultaneous management of anthracnose on mango has been reported in a 25 times application plan of fungicides per season (Sijaona, *et al.*, 2001; Arauz, 2000). When to initiate the spraying is a critical aspect. In Brazil, using a 0 to 4% leaf area damage scale and chemical action is recommended when 2% of the assessed leaf area has developed necrosis (Uaciquete, 2013; Cardoso *et al*,. 2004). Adopting an action point of two percent disease severity implies starting applications at flowering. In the current study, this notion coincided with the most profitable timing of applications. Therefore, confirming the findings of Cardoso *et al.*(2004).

In many countries including Ethiopia, disease surveillance is not common, due to logistics, high rate of disease spread (Karungi*et al.*, 2010; Topper *et al.*, 1998) endemic nature of the disease (Sijaona*et al.*, 2001), phenologically heterogeneous farms(Freire, 2002)and time and labor consuming for scouting procedure. Consequently, spraying service providers instead, start sprayings following the plant phenology (flowering phase) rather than scouting individual plants. However the use of a measurable action point avoids un-necessary sprays with all ecological concerns and development of resistance by the pathogen as referred by Cardoso *et al.* (2004).

Field evaluation, including economic aspects of control of multiple pathogens on chili by Ridomil has been recommended, following an in vitro demonstration of high spectrum of activity on chili pathogens (Uaciquete, 2013; Stirling, 1999). Hence the product has revealed its effectiveness in the field preventing significantly both anthracnose spread and severity. In best performing plots, a conservative yield and profit of 29 kg/plot 2419.50 ETB, respectively, had been observed after seven applications. On the other hand, 804.50 and 10.00kg/plot was obtained at minimum bio-efficacy, after 7 sprays. This profit is conservative because, as in many cases in East Africa, the value of chili apple is officially neglected despite its traditional high value. In addition, chili fruit price varies from 80 to 85 ETB per kg in a season and yield may also reach as high as 29kg/plot. In chili anthracnose disease epidemics, high relationships between incidence and severity on leaves have been demonstrated as stated by Uaciquete (2013); Karadimos *et al*.(2005). But, high association between chili anthracnose incidence on young leaves and subsequent incidence on young fruits was observed in this study strengthening the reports by Topper *et al.* (1998).

Insecticide was applied once but not included in economic evaluation. It was used as a mixture with fungicide when mosquito bug and aphids infestation was noticed. The cost of spraying insecticide was considered only for the fungicide. Occurrence of these pests on chili was well documented in Tanzania and India (Topper *et al.*, 1998; Uaciquete, 2013; Stirling, 1999). In fact, Helopeltis infestation has been reported as facilitator for *Colletotrichumgloeosporioides* penetration (Uaciquete, 2013; Stirling, 1999) and consequently an integrated (Fungicide + insecticide) approach recommended (Karungi*et al.*, 2010; Uaciquete, 2013; Karadimos *et al*., 2005).

**Conclusion and recommendations**

Despitetheextensiveresearchbeingcarriedoutinanthracnosediseaseof chili, the frequency of fungicide application is not yet fully addressed in consistent way. This may be due to lack of information concerning interactions of different metabolites related with chili anthracnose. Deep insight into plant pathogen interactions is required in order to understand pathosystem of *Colletotrichum*. Although there are diverse strategies for disease management, use of proper fungicide rate is quick and efficient. Use of molecular approaches for the development of resistant varieties should be focused as it provides long lasting resistance. Major reports on anthracnose, plant pathogen interactions are still needed. This review article will be helpful to the researchers for better understanding. Effective and economic control of both anthracnose diseases was achieved by spraying at least ten times fungicide, starting at flushing phenological phase of the crop and therefore the fungicide application plan is hereby recommended.

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