

# **IDENTIFICATION AND MANAGEMENT OF COFFEE BERRY DISEASE (CBD) AND COFFEE LEAF RUST (CLR)**



## **1.0 COFFEE BERRY DISEASE (CBD)**

### **1.1 Cause**

- Caused by the fungus *Colletotrichum kahawae*

### **1.2 Occurrence**

- Low to high altitudes in all coffee growing areas
- Fungus sporulates rapidly on the bark of the tree during the start of the rains
- Berries most susceptible at 4-20 weeks after flowering.

### **1.3 Symptoms**

- Dark brown blotches on flowers
- Small dark sunken patches on green berries
- Dark sunken patches with black dots on ripe berries- Brown Blight
- Dark brown colouration (internodes) on the maturing bark
- Infected berries shrivel and turn black
- They may shed or remain on the tree



*CBD on berries*

### **1.4 Conditions favouring spread**

- High humidity
- Rainfall, particularly in late afternoon
- Warm/cool temperatures ( $17^{\circ}\text{C}$ - $30^{\circ}\text{C}$ )

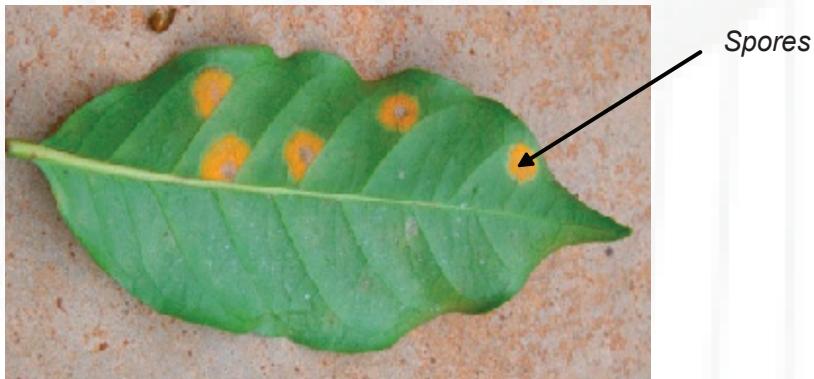
## 2.0 COFFEE LEAF RUST (CLR)

### 2.1 Cause

Caused by the fungus *Hemileia Vastatrix*

### 2.2 Occurrence:

Mainly found in Low altitude- below 1700m above sea level but has also been reported in high altitude areas



*Leaf rust symptoms*

### 2.3 Symptoms

- Orange patches appear on the lower surface of the leaves (plate 2)
- Pale yellow spots are the first to appear
- Colour later changes to yellow/ orange
- Whole leaf may become infected
- Defoliation may occur in cases of severe infection

### 2.4 Conditions favouring spread

- Warm temperatures ( $17^{\circ}\text{C}$ - $30^{\circ}\text{C}$ )
- Wet conditions
- Timely pruning, handling and desuckering

## **3.0 MANAGEMENT OF CBD AND CLR**

### **3.1 Resistant Cultivars**

- Plant or convert susceptible varieties to disease resistant cultivars such as Ruiru 11

### **3.2 Cultural**

- Timely pruning, handling and desuckering
- Regular change of cycle because young bearing heads have some tolerance to diseases

### **3.3 Chemical**

- Spray just before flowering and continue spraying up to just before berry ripening to control CBD
- Spray every 21 days if using copper formulations and every 28 days if tank mixtures

#### **NB:**

- If it becomes too wet spray every 14 days
- Where leaf rust infection approaches approx 20% level (percentage of leaves with rust), use a curative fungicide (see Table13).Do not apply more than 2 sprays of any systemic fungicide in one coffee season
- For tested and recommended fungicides (chemicals) and spray programme refer to the tables as indicated below;
- CBD see Table 1 & 2
- CLR see Table 3 & 4
- Integrated Control for both CBD and CLR see Table 5
- Rates for small holder farmers see Table 6

**Table 1 :Tested and recommended fungicides for CBD control**

No.	Common Name	Proprietary Name (Trade Name)	Formulation	Rate (kg/ha or l/ha)	Spray Interval (Weeks)
1.	Pyraclostrobin	Cabrio 250 EC*	25 % EC	0.44	4
2.	Chlorothalonil	Daconil 2787-W75	75% WP	4.4	4
		Dakota	500 SC	4.4	4
		Twigathalonil	720 SC	4.4	4
		Odeon	82.5 WDG	3.3	4
		Clortocaffaro	75% WP	4.4	4
		Clortocaffaro 500 Flow (Rova 500 SC)	50% SC	4.4	4
		Rova	75% WP	4.4	4
		Daconil 720 Flowable	72% SC	3.5	4
		Griffinil	75% WP	4.4	4
		Banko (Ranko or Koban)	75% WP	4.4	4
		Helmonil	75% WP	4.4	4
3.	Fluazinam	Altima	50% SC	1.1	4
4.	Dithianon	Delan	75% WP	3.3	4
		Delan 500 SC	50% SC	2.2	4
5.	Azoxystrobin	Quadris*	50% WG	0.33	4
6.	Anilazine	Dyrene	75% WP	4.4	4
		Dyrene 480 SC	48% SC	6.0	4
7.	Anilazine/Copper	Dyrene C 47	17/30 %WP	9.0	4
8.	Chlorothalonil/Copper	Dacobre 500	25/30%WP	7.7	4

9.	<b>Copper formulations</b> a) Cuprous Oxide (Red Copper)	Copper Nordox	50% Cu WP	7.7	4
		Copper Sandox	50% Cu WP	7.7	4
		Copcel	50% Cu WP	7.7	4
		Copper Nordox Super	75% Cu WP	3.8	4
	b) Cupric Chloride (Copper Oxychloride or Green Copper)	Cobox	50% Cu WP	7.7	4
		Amicop	50 % Cu WP	3.8	4
		Recop	50% Cu WP	7.7	4
		Microcop - 50	50% Cu WP	7.7	4
		Funguran	50% Cu WP	7.7	4
		Cuprocal	50% Cu WP	7.7	4
		Copsap	50% Cu WP	7.7	4
		Cupravit	50% Cu WP	7.7	4
		Vitigran conc.	50% Cu WP	7.7	4
		Cuprocaffaro (Isacop)	50% Cu WP	7.7	4
		Vericuivre	50% Cu WP	7.7	4
		Kopox	50% Cu WP	11.0	4
		Perecopper	50% Cu WP	7.7	4
		Blitox	50% Cu WP	7.7	4
		Cuprox	50% Cu WP	7.7	4
		Oxycop	50% Cu WP	7.7	4
	c) Cupric hydroxide (Blue Copper)	Cuprasol	50% Cu WP	7.7	4
		Worprocop	50% Cu WP	11.0	4
		Oxycop Flow	24% Flow	14.0	4
		Orioncop	50% Cu WP	7.7	4
		Kocide 101	50% Cu WP	7.7	4
10.	Copper Sulphate Lime (Proprietary Pre-mix)	Parasol	50 % Cu WP	7.7	4
		Champion	50 % Cu WP	7.7	4
		Funguran-OH	50%Cu WP	7.7	4
		Kocide DF	40% Cu Granules	7.15	4
		Procida Bordeaux Mixture*	25% Cu WP	11.0	4

\*Bordeaux mixture may be prepared on the farm as follows

- (i) Copper sulphate (CuSO<sub>4</sub>) - 10kgs
- (ii) Lime - 10 kgs
- (iii) Water - 1,000 ltr/ ha

**Table 2: Spray regimen for control of CBD and CLR**

Programme	Jan	Feb	Mar	April	May	June	July		Aug	Sept	Oct	Nov
Ia	*	*	*	*	*	*	*				*	*
Ib	+	+	+	+	+	+	+				+	+
IIa	x	x	X	*	*	*	*				x	x
IIb	x	x	X	X	X	x	x			x	x	
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
IIIa	+	+	+	+	+	+	+	*	*	(#)		
IIIb	X	X	x		x	X	x	x	X (#)			

\* Any of the straight organic fungicides as per Table 1 (1-5)

+ Any of the Coppers as per Table 1 (8-9)

x Tank mixtures as per Table 5 or Dydrene C47, Dacobre 500 (Table 5 (6—7))

# Apply if conditions are wet and the early crop is deemed to be at risk of Brown Blight

**Table 3: Tested and recommended fungicides for Leaf Rust control**

Common Name	Proprietary Name	Formulation	Rate Kg/ha or l/ha	Spray Interval (Weeks)
1. <b>Copper Formulations</b> Cuprous oxide (Red Copper)	Copper Sandoz	50% Cu WP	3.8	3
	Copper Nordox	"		
	CopperNordox Super	75% Cu WP	2.4	3
	Chemcopp	50% Cu WP	2.4	3
	Agcopp	75% Cu WP	2.4	3
	Cupric hydroxide	Kocide 101	50 % WP	3.8

(Blue Copper)	Parasol	"	"	"	
	Champion	"	"	"	
	Kocide DF	40% Cu granules	"	"	
	Funguran OH	50% Cu WP	"	"	
	Kocide 2000	35% Cu WP	2.86	3	
Cupric Chloride (Copper Oxychloride or Green Copper)	Cobox	50% Cu WP	3.8	3	
	Vitigran Conc.	"	"	"	
	Pereclor	"	7.7	"	
	Cupravit	"	3.8	"	
	Copsap	"	"	"	
	Recop	"	"	"	
	Funguran	"	"	"	
	Cuprocal	"	"	"	
	Microcop-50	"	"	"	
	Cuprocaffaro (Isacop)	"	"	"	
	Kopox	"	7.7	"	
	Perecopper	"	3.8	"	
	Oxycop	"	"	"	
	Blitox	"	7.7	"	
	Cuprox	"	"	"	
	Coptox	"	4.4	"	
	Amicop	50% WP	2.4	3	
	Cuprasol	50% WP	3.8	3	
	Coprado-S	50%	3.8	3	
	Demildex	50% Cu WP	5.5	"	
	Worprocop	"	3.8	"	
	Orioncop	"	"	"	
	Helmoxy	"	"	"	
	Copper Sulphate + Lime (Proprietary Premix)	Procida Bordeaux Mixture	25% WP	5.5	"
2.	Chlorothalonil/Copper	Dacobre 500	25/30 % WP	7.7	4
3.	Fentinhydroxide	Duter-Extra	47.5% WP	2.75	4
4.	Dithianon	Delan	75% WP	3.3	"

	Dithianon	Delan 500 SC	50% SC	2.2	"
5.	Triadimefon*	Bayleton	25% WP	2.0	Curative*
6.	Benodanil	Calirus	50% WP	2.2	4
7.	Propiconazole	Tilt	25% SC	750 ml	Curative*
8.	Cyproconazole*	Alto 100 SL	10% SL	0.5	Curative*
9.	Hexaconazole*	Anvil	5% EC	2.2	Curative*
10.	Epoxiconazole*	Opus	12.5% SC	0.4	Curative*
11.	Flutriafol*	Amour-G	1% granules	19 g/tree	Curative#
12.	Quadris	Azoxystrobin	50 % WG	0.22	3 <sup>y</sup>

### Key

- + Straight copper sprays or Kamusin - Bordeaux
- \* Tank-mixture of Copper + CBD organic fungicide at reduced rates
- # Copper sprays timed by 125 + 10 mm rainfall
- Y Tank mix spray of Quadris with copper advisable
  
- \* Apply sprays of Bayleton 25% WP; Alto 100 SL; Anvil; Tilt and Opus only after CLR infection level is approximately 20% in the field (i.e. 20% of the leaves have rust on them). A second application may be made 4 weeks after, if the situation does not improve after first application.
- # Apply Amour-G once along the drip line of the coffee tree when the ground is wet at the beginning of the rainy season.
- y Tank mix sprays of Quadris with copper advisable (see table 3).

**Table 4: Recommended spray programme for CLR control**

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept
+	+			+	+	+					

**Table 5: Tested tank mixtures for CBD and CLR control**

<b>Organic Fungicide</b>	<b>Copper Formulation</b>	<b>Rate Kg or l/ha (Organic + Copper)</b>
Cabrio 250 EC	Cobox 50% WP	0.33+3.3
Daconil 2787 75 % WP	Copper Nordox 50% WP	2.2 + 5.5
	Kocide 101 50% WP	2.2 + 5.5
	Copper Sandoz50% WP	2.2 + 5.5
	Cobox 50% WP	2.2 + 5.5
	Microcop-50 WP	2.2 + 5.5
	Funguran 50% WP	2.2 + 5.5
	Parasol 50% WP	2.2 + 5.5
	Recop 50% WP	2.2 + 5.5
	Kocide DF 40 WP	2.2 + 4.0
	Copper Nordox super 7 5 % WP	2.2+2.75
Daconil 720 SC	Cobox	2.2 + 3.3
Delan 75% WP	Copper Nordox	1.6 + 5.5
	Kocide 101	1.6 + 5.5
	Copper Sandoz	1.6 + 5.5
	Vitigran Conc.	1.6 + 5.5
	Cobox	1.32 + 6.6
Dyrene 75% WP	Cobox	2.2 + 5.5
	Cuprocal	2.2 + 5.5
	Cupravit	2.2 + 5.5
	Recop	2.2 + 5.5
	Copper Nordox	2.2 + 5.5
Clortocaffaro 75% WP	Cuprocaffaro (Isacop)	2.2 + 5.5
Rova 75% WP	Cuprocaffaro (Isacop)	2.2 + 5.5
Quadris	Cobox	0.22 + 3.3
Delan 500 SC	Cobox	1.1 + 5.5
Odeon 82.5 WDG	Funguran	1.7+5.5

Table 6: No of level "Kiwi" tinfuls to be put in 20 lt (debe) for 25 trees for CBD and CLR control

Chemical	Formulation	Field Rate		Small tin (15 ml)	Medium tin (40 ml)	Large tin (100 ml)
		Kg/ha or lt/ha	%	No. (wt/vol)	No. (wt/vol)	No. (wt/vol)
<b>a) CBD CONTROL</b>						
Daconil 2787 W75	75% WP	4.4	0.4	11 (80g)	5 (80g)	2 (80 g)
Delan	75% WP	3.3	0.3	9 (60g)	5 (60g)	2 (60 g)
Delan 500 SC	50% SC	2.2	0.2	3 (40 ml)	1 (40 ml)	-
Daconil 720 Flow	72% SC	3.5	0.32	5 (70 ml)	2 (70 ml)	1 (70 ml)
Dyrene	75% WP	4.4	0.4	10 (80g)	4 (80g)	2 (80 g)
Altima	50% SC	1.1	0.1	1 (20 ml)	-	-
Clortocaffaro 500 Flow (Rova500 SC)	50% SC	4.4	0.4	5 (80 ml)	2 (80 ml)	1 (80 ml)
Clortocaffaro (Rova)	75% WP	4.4	0.4	11 (80g)	5 (80g)	2 (80 g)
Griffinil	75% WP	4.4	0.4	11 (80g)	5 (80g)	2 (80 g)
Banko	75% WP	4.4	0.4	8 (80g)	4 (80g)	2 (80 g)
Helmonil	75% WP	4.4	0.4	11 (80g)	5 (80g)	2 (80 g)
Dyrene 480 SC	48% SC	6.0	0.55	8 (109 ml)	3 (109ml)	1 (109 ml)
Dyrene C47	17/30 WP	9.0	0.82	16 (164 g)	8 (164 g)	3 (164 g)
Dacobre 500	25/30 WP	7.7	0.7	18 (140g)	9 (140 g)	3 (140 g)
Parasol	50% WP	"	"	16 (140g)	8 (140g)	3 (140 g)
Copper Nordox Super	75% WP	3.8	0.35	4 (70g)	2 (70g)	1 (70 g)
Copper Nordox	50% WP	7.7	0.7	7 (140g)	3 (140g)	1 (140 g)
Copper Sandoz	50% WP	"	"	6 (140g)	3 (140g)	1 (140 g)
Cobox	50% WP	7.7	0.7	12 (140 g)	4 (140g)	2 (140 g)
Kocide 101	"	"	"	23 (140g)	11 (140g)	4 (140 g)
Copcel	"	"	:	8 (140g)	3 (140g)	1 (140 g)
Recop	"	"	"	12 (140g)	5 (140g)	2 (140 g)
Microcop-50	"	"	"	13 (140g)	6 (140g)	3 (140 g)
Funguran	"	"	"	12 (140g)	3 (140g)	1 (140 g)
Cuprocal	"	"	"	12 (140g)	5 (140g)	2 (140 g)

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table 6 cont'

Perecopper	"	11.0	1.0	14 (200g)	5 (200g)	2 (200 g)
Kopox	"	"	"	14 (200g)	5 (200g)	2 (200 g)
Cuprasol	"	7.7	0.7	13 (140g)	6 (140g)	2 (140 g)
Oxycop	"	"	"	11 (140g)	5 (140g)	2 (140 g)
Worprocop	"	"	1.0	20(200g)	9 (200g)	4 (200 g)
Cuprox	"	"	0.7	7 (140 g)	3 (140g)	1 (140 g)
Blitox	"	"	"	14 (140g)	5 (140g)	2 (140 g)
Kocide DF	40%G granules	7.15	0.65	13(130 g)	4 (130 g)	2 (130 g)
Funguran – OH	50% WP	7.7	0.7	14(140 g)	7 (140 g)	4 (140 g)
Oxycop Flow	24% floe Flow	14.0	1.4	13 (255 ml)	7 (255 ml)	3 (255 ml)
Champion	50% WP	7.7	0.7	23 (140 g)	14 (140 g)	4 (140 g)
Cuprocaffaro (Isacop)	"	"	"	14 (140g)	6 (140 g)	2 (140 g)
Copsap	"	"	"	9 (140 g)	4 (140 g)	2 (140 g)
Cupravit	"	"	"	14 (140 g)	6 (140 g)	3 (140 g)
Vitigran Conc.	"	"	"	9 (140 g)	5 (140 g)	2 (140 g)
Vericuivre	"	"	"	11 (140 g)	5 (140 g)	2 (140 g)
Procida Bordeaux Mixture	25% WP	11.0	1.0	22 (200 g)	10 (200 g)	4 (200 g)

Orioncop	50% WP	7.7	0.7	12 (140gm)	5 (140 g)	2 (140 g)
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**Leaf Rust control**

Duter-Extra	47.5% WP	2.75	0.25	6 (50 g)	3 (50 g)	1 (50 g)
Bayleton	25% WP	2.0	0.2	6 (40 g)	3 (40 g)	1 (40 g)
Copper Sandoz	50% WP	3.8	0.35	3 (70 g)	1 (70 g)	-
Copper Nordox	50% WP	3.8	0.35	3 (70 g)	2 (70 g)	1 (70 g)
Copper Nordox Super	75% WP	2.4	0.22	3 (45 g)	2 (45 g)	-
Cuprocal	50% WP	3.8	0.35	5 (70 g)	3 (70 g)	1 (70 g)
Cupravit	50% WP	3.8	0.35	7 (70 g)	3 (70 g)	1 (70 g)
Cuprocaffaro	50% WP	3.8	0.35	7 (70 g)	3 (70 g)	1 (70 g)
Champion	50% WP	3.8	0.35	11(70 g)	7 (70 g)	2 (70 g)
Kocide 101	50% WP	3.8	0.35	12 (70 g)	5 (70 g)	2 (70 g)
Kocide DF	40 % WG	3.8	0.35	6 (70 g)	2 (70 g)	1 (70 g)
Cobox	50% WP	3.8	0.35	6 (70 g)	3 (70 g)	1 (70 g)
Vitigran Conc.	50% WP	3.8	0.35	5 (70 g)	2 (70 g)	1 (70 g)

table 6 cont'

Pereclor	50% WP	7.0	0.7	12 (140 g)	5 (140 g)	2 (140 g)
Copsap	50% WP	3.8	0.35	3 (70 g)	2 (70 g)	1 (70 g)
Cuprasol	50% WP	7.7	0.7	13 (140 g)	6 (140 g)	2 (140 g)
Oxycop	50% WP	3.8	0.35	5 (70 g)	2 (70 g)	1 (70 g)
Worprocop	50% WP	3.8	0.35	7 (70 g)	4 (70 g)	2 (70 g)
Cuprox	50% WP	7.7	0.7	7 (140 g)	3 (140 g)	1 (140 g)
Blitox	50% WP	7.7	0.7	13 (140 g)	5 (140 g)	2 (140 g)
Demildex	50% WP	5.5	0.5	10 (100 g)	4 (100 g)	2 (100 g)
Amicop	50% WP	2.4	0.22	3 (45 g)	2 (45 g)	-
Amour G	1% granules	19 g/tree	-	1(19gm/tree)	-	-
Alto 100 SL	10% SL	0.5	0.05	(10 ml)	(10 ml)	(10 ml)
Recop	50% WP	3.8	0.35	5 (70 g)	2(70 g)	1 (70 g)
Dacobre	25/30 WP	7.0	0.7	18 (140)	9 (140)	3 (140)
Funguran OH	50% WP	3.8	0.35	11 (70 g)	5(70 g)	2 (70 g)
Funguran	50% WP	3.8	0.35	5 (70 g)	2(70 g)	1 (70 g)
ProcidaBordeaux Mixture	25% Cu WP	5.5	0.5	11(100 g)	5 (100 g)	2 (100 g)
Parasol	50% Cu WP	3.8	0.35	8 (70 g)	4(70 g)	1 (70 g)
Calirus	50% WP	3.3	0.2	8 (40 g)	3(40 g)	1 (40 g)
Tilt	25% EC	750 ml	0.75	(15 ml)	-	-
Delan 500 SC	50% SC	2.2	0.2	3 (40 ml)	1 (40 ml)	-
Microcop-50	50% WP	7.7	0.7	13 (140 g)	6(140 g)	3 (140 g)
Coprado-S	50% WP	3.5	0.7	6 (140 g)	3(140 gm)	1 (140 g)
Coptox	50% WP	4.4	0.4	8 (80 g)	3(80 g)	1 (80 g)
Perecopper	50% WP	3.8	0.35	3 (70 g)	2(70 g)	-
Orioncop	50% WP	3.8	0.35	6 (70 g)	3(70 g)	1 (70 g)
Anvil	5% EC	1.1L	0.1	2 (20 ml)	1 (20 ml)	-
Helmoxy	50% WP	3.8	0.35	5 (70 g)	2(70 g)	1 (70 g)
Opus	12.5% SC	0.44	0.04	(8 ml)*	-	-
Chemcopp	50% WP	2.4	0.22	2 (45 g)	1(45 g)	3 (45 g)
Agcopp	75% WP	2.4	0.22	3	1(45 g)	3 (45 g)

table 6 cont'

<b>Tank mixtures for CBD and CLR</b>						
<b>a) Organic Fungicides</b>						
Daconil 2787	75WP% WP	2.2	0.2	6 (40 g)	3 (40 g)	-
Delan	75WP% WP	1.6	0.15	5 (30 g)	3 (30 g)	-
Dyrene	75WP% WP	2.2	0.2	5 (40 g)	3 (40 g)	-
Clortocaffaro (Rova)	75WP% WP	2.2	0.2	7 (40 g)	3 (40 g)	-
Quadris*	50%WG	0.22	0.02	(4g)	-	-
Delan 500 SC	50%SC WG	1.1	0.1	2 (20 ml)	-	-
Daconil 720 SC	72 % SC	2.2	0.2	3 (40 ml)	1 (40 ml)	-

<b>b ) Copper Fungicides</b>						
Copper Nordox	50% WP	5.5	0.5	5 (100 g)	2 (100 g)	-
Kocide 101	50% WP	5.5	0.5	17 (100 g)	8 (100 g)	-
Kocide DF	40% granules	4.4	0.4	7 (80 g)	3 (80 g)	-
Copper Sandoz	50% WP	5.5	0.5	4 (100 g)	2 (100 g)	-
Cobox	50% WP	6.6	0.6	12 (120 g)	5 (120 g)	-
Cobox	50% WP	5.5	0.5	9 (100 g)	4 (100 g)	-
Cobox	50% WP	3.3	0.3	6 (60 g)	2 (60 g)	-
Cuprocaffaro (Isacop)	50% WP	5.5	0.5	9 (100 g)	4 (100 g)	-
Recop	50% WP	5.5	0.5	9 (100 g)	4 (100 g)	-
Parasol	50% WP	5.5	0.5	12 (100 g)	5 (100 g)	-
Microcop-50	50% WP	5.5	0.5	10 (100 g)	4 (100 g)	-
Funguran	50% WP	5.5	0.5	7 (100 g)	3 (100 g)	-
Vitigran Conc.	50% WP	5.5	0.5	9 (100 g)	4 (100 g)	-
Cupravit	50% WP	5.5	0.5	10 (100 g)	4 (100 g)	-
Cuprocal	50% WP	5.5	0.5	9 (100 g)	4 (100 g)	-

## **4.0 GOOD AGRICULTURAL/HYGIENIC PRACTICES**

- Apply only recommended amounts and rates of recommended fungicides to prevent pesticide residue accumulation
- Remove all un-decomposed pulp from the farm/vicinity of the coffee plants to eliminate any fungal vector
- Adhere to recommended spray programme
- Sterilise all pruning implements used on diseased plants.
- Control CBD to prevent development of entry points for OTA causing fungi on the coffee bean
- Use resistant cultivars to reduce pesticides usage



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