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**Editorial and Publication Coordinated by:**  
Knowledge, Information and Outreach Unit

KALRO Advisory Bulletin Series No. 2017/003

**Kshs. 50**

# **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°C-30°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



Spores

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°C-30°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 Table 13). 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
		Vericuvre	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

		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
	c) Cupric hydroxide (Blue Copper)	Kocide 101	50% Cu WP	7.7	4
		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
10.	Copper Sulphate Lime (Proprietary Pre-mix)	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 lt/ 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
	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 Dyrene 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	3



(Blue Copper)	Parasol	"	"	"
	Champion	"	"	"
	Kocide DF	40% Cu granules	"	"
	Funguran OH	50% Cu WP	"	"
	Kocide 2000	35% Cu WP	2.86	3
	Cupric Chloride	Cobox	50% Cu WP	3.8
	(Copper Oxychloride or Green Copper)	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
		Cuprasol	50% WP	3.8
		Coprado-S	50%	3.8
		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
3.	Fentinhydroxide	Duter-Extra	47.5% WP	2.75
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**

Organic Fungicide	Copper Formulation	Rate Kg or l/ha (Organic + Copper)
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 Sandoz 50% 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 75 % 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)
a) CBD CONTROL						
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)

cont' next page



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)
Fungran – 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)
Cuprocattaro (isacop)	"	"	"	14 (140g)	6 (140 g)	2 (140 g)
Copsap	"	"	"	9 (140 g)	4 (140 g)	2 (140 g)
Cupraviti	"	"	"	14 (140 g)	6 (140 g)	3 (140 g)
Vitigran Conc.	"	"	"	9 (140 g)	5 (140 g)	2 (140 g)
Verticivire	"	"	"	11 (140 g)	5 (140 g)	2 (140 g)
Procidabordeaux	25% WP	11.0	1.0	22 (200 g)	10 (200 g)	4 (200 g)
Mixture						

## Leaf Rust control

Ortoncop	50% WP	7.7	0.7	12 (140gm)	5 (140 g)	2 (140 g)
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)	-
Cuprocacal	50% WP	3.8	0.35	5 (70 g)	3 (70 g)	1 (70 g)
Cupraviti	50% WP	3.8	0.35	7 (70 g)	3 (70 g)	1 (70 g)
Cuprocattaro	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)	3 (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)
Dermilindex	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 tree	19 g/	-	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)
Fungran OH	50% WP	3.8	0.35	11 (70 g)	5(70 g)	2 (70 g)
Fungran	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)
Callirus	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)	-
Ortoncop	50% WP	3.8	0.35	6 (70 g)	3(70 g)	1 (70 g)
Anvili	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)



Tank mixtures for CBD and CLR						
a) Organic Fungicides						
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) Copper Fungicides						
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