Uganda Journal of Agricultural Sciences, 2000, 5:57-60

ISSN 1026-0919

Recent advances in coffee berry disease (CBD) control in Uganda

John B. Birikunzira
Coffee Research Centre (COREC)
P.O. Box 185, Mukono

Abstract

Coffee Berry Disease (CBD) caused by the fungus *Colletotrichum kahawae* (Waller & Bridge) attacks arabica coffee in most African arabica coffee growing countries. The disease was first recorded in Uganda in 1959 and surveys on the disease indicated that up to 50% crop losses were being incurred. Most of the commercial varieties are still susceptible to the disease, and use of chemicals remains the only sure control method available. During early 1970s, fungicides like Benlate (Benomyl 50%), Perenox (50% copper) and Captafol (Orthodifolatan) were tested and recommended for CBD control. These chemicals became unavailable during mid 1970s and early 1980s. In the late 1980s, the spray programme was reviewed and new chemicals tested for recommendation to farmers. Trials were conducted on slopes of Mt. Elgon at Buginyanya sub-station at altitude of 1980-2133 masl. This paper gives an account of the work done during 1991-1996. Results on CBD incidence and coffee yield on annual basis are presented. The performance of the fungicides varied in years due to a number of reasons. However, Copper based fungicides, namely Nordox 50% and 75% as well as Kocide 101 consistently kept the CBD incidence low and increased coffee yields by over 50%. Organic based fungicides namely Delan, Benlate and Derosal (except Dyrene) performed poorest consistently giving higher disease incidence. The copper tonic effect on coffee performance was also evident. Use of copper based fungicides - namely Copper Nordox 75% and 50% and Kocide 101 is recommended for CBD control. Dyrene could be considered as an alternative fungicide.1

Key words: Coffee berry disease, control, Arabica.

Introduction

Coffee Berry Disease (CBD) caused by the fungus *Colletotrichum kahawae* (Waller and Bridge) is a major disease in many African arabica coffee growing countries. It was first reported in Sotik area in Western Kenya in 1922 (Nutman, 1970). CBD has since spread to other African countries and occurs in Angola, Cameroon, Malawi, Rwanda, Tanzania, Democratic Republic of Congo, Zimbabwe and Uganda. The disease was reported in Uganda in 1959 in the Eastern highlands at an altitude of 1,500 metres above sea level (masl). In 1960, it was reported in Western Uganda at an altitude of 1,600 masl (Anon, 1959). Its occurrence in mid and low altitude areas was reported in 1972 at Bugusege Experiment Farm (Matovu, 1970).

CBD is positevely influenced by high rainfall, high relative humidity and low temperatures (17-20°C) which conditions prevail in highland areas where arabica coffee is grown. The disease attacks flowers and fruits at all stages of growth, but it is more destructive on young berries especially during expanding period 4-16 weeks after flowering (Mulinge, 1970). Surveys of 1960's revealed that the disease was causing up to 50% crop losses (Matovu, 1970). Recent observations indicate that as high as 90% crop losses can be incurred during high epidemic periods in unsprayed plots. Similar observations were also made in Ethiopia and Kenya (Javed (1975) - quoting Griffithis et al (1971).

The main commercial varieties grown in Uganda are quite susceptible to the disease and use of chemicals remains the sure and quickest method of control.

Earlier chemical tests and evaluations against CBD came up with the spray schedule recommendations; one for Eastern and another for Western Uganda each with a minimum of 5 sprays in a season and depending on onset of rains. The fungicides recommended were Benlate (Benomyl 50%), Perenox (Cuprous oxide 50%) and Captafol (Orthodifolatan 80%). Although these fungicides were quite effective on CBD control in Uganda, Benlate and Captafol were, for environmental reasons, withdrawn from the market while Perenox just became unavailable during 1980s. Some farmers resorted to buying any fungicide they could come across, others abandoned their coffee plots and coffee production in the country declined.

During late 1980s and early 1990s, the European Union started and implemented a Coffee Rehabilitation Programme of which reactivation of coffee research activities was one of its components. Among the constraints faced at that time was lack of fungicides on the market to recommend to the farmers for CBD control. Thus, work on chemical evaluation had to start using both new and earlier recommended ones. This paper gives an account of the work done on chemical evaluation for a period of 5 years and on which present CBD control recommendation is based.

Materials and methods

The chemicals listed in Table 1 were tested at Buginyanya coffee sub-station which is located on slopes of Mt. Elgon at an altitude of 1900 masl. Treatments (fungicides) were applied in a randomised complete block design replicated 3 times. Each plot consisted of 12 trees spaced at 2.44 x 2.44 metres (8 x 8 ft) square and surrounded by one row of guard trees. Spraying was done using CP15 Knapsack sprayer at the rates and intervals indicated in Table 1. Plots received a maximum of 5 sprays each year. Copper oxychloride was taken as a standard fungicide.
Other management operations like desuckering, pruning, weeding and pest control were routinely carried out.
CBD incidence was recorded from 2 primaries on selected 8-10 cropping nodes from each of 6 trees in the two central rows per plot. Recording was done on monthly basis two weeks after treatments have been imposed. Percentage disease infection was calculated from total infected berries against the total number of berries per plots. Disease incidence data was transformed into angles before statistical analysis.

Crop yields were recorded as fresh cherry on whole plot basis of 12 trees and converted to clean coffee per hectare using a 7:1 (cherry:clean) ratio and based on 1680 trees per hectare. Rainfall data was recorded from Buginyanya meteorological station.

Table 1. A list of fungicides evaluated during 1991-1996

Trade name	Common name	Formulation	Rate of application (Kg or lts/ha)	Spray interval in week	Number of test season
Delan	Dithionan	75% WP	3.3 kg	4	5
Benlate	Benomyl	50% WP	1 kg	4	5
Copper oxychloride*	Cupric chloride (Green)	80% WP	8 kg	4	5
Dyrene	Anilazine	75% WP	3.5 kg	4	5
Derosal	Carbendazin (blue)	19.6 Disp.	3 lts	4	3
Kocide 101	Copper hydroxide)	50% WP	8 kg	4	5
Antracol	Propineb	70% WP	3 kg	4	4
Copper Nordox 75%	Copper oxide 75%	75% WP	5 kg	4	2
Copper Nordox 50%	Copper oxide 50%	50% WP	8 kg	4	2

* - Standard fungicide

Results and discussion

Results are presented in tables 2, 3 and Figure 1.
Table 2 summarises the fungicide performance over the test period. High CBD incidence accompanied by low crop yields were recorded in 1994 which is the year that had high rainfall. Copper oxychloride, which was the recommended (standard) fungicide for CBD control was the poorest in CBD control and yield compared to other copper based fungicides. Its field performance was however higher than Delan, Derosal and Antracol.

Dyrene organic fungicide which is also recommended for CBD control in Kenya (Anon, 1997) performed well. This could be considered as an alternative fungicide especially if copper phytoxicity is detected. Benlate, a once recommended fungicide for CBD control in Uganda and Kenya, performed poorly with relatively high disease incidence and low yields. It is possible the chemical was creating pathogen resistance as pointed out by Okioga, (1995). Antracol, Derosal and Delan, which were relatively new fungicides did not do well.

Copper Nordox 75% and Copper Nordox 50%, whichare new formulations of Copper oxide, were tested only for two seasons. The two fungicides outperformed the rest of the fungicides including other copper based fungicides. The two fungicides kept disease levels very low, gave very high crop yields and general coffee appearance was very good with good foliage retention. On the average, the two fungicides increase crop yields by 40% while disease incidence was reduced by 60%. In some years, CBD incidence was lower in control than in some sprayed plots. A similar situation was observed by Griffiths et al (1971) and Patel, (1982). This could be due to too much defoliation, which led to unfavourable micro-environment for CBD development.

Table 3 gives a summary of 5 years mean figures for both disease and yield in comparison with the standard fungicide. The figures give a negative correlation of (r=-0.770) which indicates that there is some crop loss attributed to high CBD incidence.

Although there was generally low CBD levels during the period, the data shows that where the disease incidence is high, crop yields are reduced. Similar information is reflected graphically in figure 1. Hence, it is necessary to spray and keep CBD levels to a minimum in order to reduce on crop losses.

Table 2. Effect of fungicides on CBD incidence and crop yields during 1991-1996 fungicide evaluation.

Treatment		Parameters (CBD and yield) during the years					Average
		1991	1992	1994	1995	1996	
Delan:	CBD	1.99	1.20	7.3	4.6	6.21	4.26
	Yield	**750.3**	**1038.8**	**318.7**	**1474^{d}**	**1045.7^{c}**	**925.5**
Benlate:	CBD	6.99	4.05	5.1	4.5	3.85	4.89
	Yield	**718.5**	**855.4**	**528^{c}**	**1857^{c}**	**1011.4^{c}**	**994.06**
Copper oxychloride:*	CBD	164	11.42	9.4	3.2	4.61	6.05
	Yield	**484.3**	**712.5**	**580^{c}**	**2836a^{b}**	**1737.2^{b}**	**1270.0**
Dyrene:	CBD	2.90	2.74	2.7	4.4	3.55	3.26
	Yield	**587.3**	**1176.0**	**1700^{a}**	**2592^{b}**	**2146.0^{a}**	**1640.26**
Derosal:	CBD	0.98	7.15	10.0	-	-	6.04
	Yield	**591.6**	**1062.4**	**373.3**	-	-	**675.77**
Kocide 101:	CBD	-	3.62	3.1	5.6	4.97	4.14
	Yield	-	**1435.1**	**1020^{b}**	**3229^{a}**	**1706.9^{b}**	**1593.26**
Antracol:	CBD	3.28	5.27	3.4	4.1	5.28	4.51
	Yield	**575.3**	**746.3**	**430.7^{c}**	**1809^{c}**	**1226.9^{b}**	**985.73**
Copper Nordox 75:	CBD	-	-	-	4.3	2.95	3.63
	Yield	-	-	-	**3499^{a}**	**2419.5^{a}**	**2984.4**
Copper Nordox 50:	CBD	-	-	-	4.3	2.95	363
	Yield	-	-	-	**2.7**	**1.65**	**2.18**
Control:	CBD	2.79	7.70	12.9	6.4	9.03	7.76
	Yield	**352.5**	**709.9**	**360.0**	**2427^{b}**	**932.7^{c}**	**556.42**
Rainfall:		**1862.1**	**1804.4**	**2048.7**	**2028.4**	**1841.9**	
Number of rain days:		**169**	**178**	**162**	**163**	**156**	
		NSP = 0.05	**NSP = 0.05**	***P=0.05** S.E = 54.3	***P = 0.05** S.E = 779.9	**(P = 0.05)** S.E = 392.0	

Note: **CBD - is average disease incidence during the year.**
Yield - Clean coffee/ha - Figures with the same superscripts in the same column are not significantly different. (P = 0.05)
*** Standard fungicide during the evaluation period.**

Table 3. Effect of fungicides on CBD incidence and crop yields in relation to standard fungicide (5 year means)

Treatment	Disease incidence (% mean)	Crop yields (kg/ha cc)	Mean yield increases a bove the standard fungicide
Delan	4.26	925.5	-345.5
Benlate	4.89	994.1	-276.0
Copper oxychloride*	6.05	1270.0	-
Dyrene	3.26	1640.3	+370.0
Derosal	6.04	675.8	-594.2
Kocide 101	3.81	2010.9	+740.9
Antracol	4.51	985.7	-284.3
Copper Nordox 75%	3.63	2984.4	+1714.0
Copper Nordox 50%	2.18	2906.4	1636.4
Control	7.76	56.4	-713.6
r = -0.770			

*Standard fungicide

Conclusion

For effective field evaluation, chemicals should be tested for at least three seasons (Masaaba, 1995). Most of the chemicals in the trials discussed were tested for five seasons. The results have consistently shown that copper based fungicides are more superior to other fungicides tested and are quite reliable in the control of CBD and their tonic effect leads to general good tree performance. Although work on determination of the most economic spray rate and interval of these fungicides is yet to be published, these trials have indicated that, the following fungicides could be recommended for spray on arabica coffee for management of CBD in high altitude areas;- *Copper Nordox 50%, Copper Nordox 75%* and *Kocide* (all copper based fungicides) and Dyrene (an organic fungicide). This gives a wider choice to the farmer depending on prices and availability on the market. The effectiveness of the fungicide and the benefits accrued, will depend on the timing, the spray interval, amount sprayed and overall field management practices.

References

Anonymous, 1959 - Annual Report, 1959. Department of Agriculture, Uganda Government.

Anonymous 1997 - Technical Circular No. 70: Control of CBD and Leaf Rust in 1996: Kenya Coffee Vol. 62 (724) Feb. 1997.

Griffiths, E.; Gibbs, S.N. and Waller, J.M. 1971. Control of CBD: Annals for Appl. Biol. 67: 45-74.

Javed, Z.V.R. 1975 - Established Procedures for Laboratory and Field Screening of New Fungicides for Control of Coffee Diseases in Kenya. Kenya Coffee Vol. 46 (540).

Masaba, D.M. 1978 - Procedures for testing New Fungicides for the Control of CBD and Leaf Rust Diseases in Kenya. Kenya Coffee Vol. 62 (723) Feb. 1978.

Matovu, S. 1970 - Annual Reports for 1969/70. Coffee Research Unit, Kawanda Research Station, Uganda.

Mulinge, S.K 1970: Development of coffee berry disease in relation to the stage of growth of the berry. Ann. Appl. Biol. 65: 269-276.

Nutman, F.J 1970 - Coffee Berry Disease PANS. 16(2).

Okioga, D.M. 1975 - Procedures Established at Coffee Research Foundation in recommending fungicides for control of Coffee Diseases. Kenya Coffee Vol. 40, 1-4.

Patel, K.K. 1982: Control of coffee berry disease with Dyrene. Proceedings of Regional Workshop on Coffee Berry Disease. 19-24 July, 1982, Addis Ababa (Ethiopia).