

CHEMICAL CONTROL OF SUNFLOWER RUST IN KENYA

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Sunflower rust caused by *Puccinia helianthi* Schw. is regarded as a disease of major importance in Kenya. In severe cases, it causes 60% yield loss. The disease was initially recorded by Natrass (1951). Martens et al. (1970) reported heavy damage and estimated yield loss of more than 25% due to this disease in Kenya. The rust appears every year in varying intensities and causes heavy reduction in yield. Severe incidence of this disease has been recorded in Kitale, Kakamega, Machakos and Kabete. Under Kabete conditions, the rust appears in the field even though it has never developed into a serious epidemic. Very little work has been done on sunflower rust in Kenya and practically no information is available on its chemical control in this country. It was decided, therefore, to carry out a field experiment for the control of this disease by fungicides.

MATERIALS AND METHODS

A fungicidal field trial was conducted during the long rainy season (April-July) of 1973 at the University Field Station, Kabete where sufficient natural infection by *P. helianthi* has been noticed in the past. Sunflower variety „Gray White“, which is highly susceptible to rust was sown in April in 10.0 × 5.4 meter plots, consisting of six rows/plot spaced at 0.90 m with 0.25 m spacing within the rows at one fertility level. Each treatment was randomized and replicated five times.

Fungicidal applications were started 45 days after sowing with the following chemicals: Antracol (zinc-propylene-bis-dithiocarbamate), Blitox (copper oxychloride), Captan (N-trichloromethylmercapto-4-cyclohexene-1, 2-dicarbomixide), Daconil 2787 (tetrachloisophthalonitrile), Dithane M-45 (zinc-manganese ethylene bis-dithiocarbamate), Plantvax (2,3-dihydro-5-carboxamilido-6-methyl-1, 4-oxathin-4, 4-dioxide), Zineb (zinc ethylene bis-dithiocarbamate), and sulphur. All the above fungicides were used at 2 kg/ha in 475 litres of water (10.8 g/plot in 2.5 litres of water) except sulphur dust which was used at 15 kg/ha (81 g/plot). A total of five sprays were given with Knapsack hand sprayers at fortnightly intervals on June 10,

June 25, July 10, July 25 and August 9, 1973. Sulphur was dusted with a piece of muslin cloth on wetted leaves so as to ensure good sticking of the chemical. The control plots were sprayed with water.

The effects of the fungicides on the intensity of rust was recorded 15 days after the last spraying by estimating the percentage of plant surface affected, using a scale of 1—10 as follows: 1 = 0%, 2 = 1—3%, 3 = 4—10%, 4 = 11—17%, 5 = 18—25%, 6 = 26—45%, 7 = 46—60%, 8 = 61—75%, 9 = 76—85%, and 10 = 86—100%. A grain yield comparison was made using only the two central rows of each plot to avoid side effects of other fungicides.

The cost of fungicidal sprays per hectare was calculated by adding the cost of the fungicides to labour charges. The assumption was that two labourers (K. Shs. 3.55/labourer/day) could spray one hectare with an ordinary knapsack sprayer per day, with depreciation of the sprayer amounting to K. Shs. 0.60/day. The total cost of the fungicidal application was subtracted from the market value of the increase in yield of grain over the control, in order to obtain an estimate of the net benefit resulting from fungicide treatment.

RESULTS

The data on the intensity of the disease — (disease index) were averaged and the yield data were analysed statistically. The results are presented in table 1.

Table 1

Effect of application of fungicides on the control of rust disease and grain yield of sunflower

Treatments	Disease index*	Yield in kg/pot	Yield in kg/ha	Percent yield increase over control
Control	8.2	1.71	950.0	—
Antracol	5.6	2.40	1333.3	40.3
Blitox	6.5	1.94	1077.7	13.4
Captan	6.9	1.83	1016.6	7.0
Daconil 2787	5.4	2.44	1355.5	42.6
Dithane M-45	5.0	2.57	1427.7	50.2
Plantvax	3.4	4.36	2422.2	154.9
Sulphur	3.8	3.52	1955.5	105.8
Zineb	3.8	3.33	1850.0	94.7

* Average of five replications.

** Average of two central rows of five replications.

For yield/plot: S.E. mean = 0.45
L.S.D. = 0.96

It is evident from the table that all fungicidal treatments were superior to the control in respect of both disease index and yield. The fungicides tested showed important differences in their efficacy of controlling this disease. Plantvax gave the best control and led to a yield substantially superior to that in the sulphur and Zineb treated plots.

There was no significant difference between Daconil, Dithane M-45 and Antracol in reducing rust infection or improving yield; all these were significantly less effective than Plantvax. Blitox and Captan were the poorest in controlling this disease. Thus, it appears that Plantvax was the most effective in controlling rust infection and improving yield, followed by sulphur and Zineb (table 2).

Table 2

Economics and profit per hectare resulting from the application of fungicides

Treatments	Increase in yield over control kg/ha	Value of yield increase at KSh.1.0/kg	Retail price of fungicides in KSh/kg*	Total cost of control operation KSh.Cts.	Profit KSh.Cts.
Antracol	383.3	383.30	16.80	209.50	173.80
Blitox	127.7	127.70	26.45	306.00	— 178.30
Captan	66.6	66.60	15.00	191.50	— 124.90
Daconil 2787	405.5	405.50	26.00	301.50	104.00
Dithane M-45	477.7	477.70	14.00	181.50	296.20
Plantvax	1472.2	1472.20	253.00	2571.50	—1099.30
Sulphur	1005.5	1005.50	4.35	367.75	637.75
Zineb	900.0	900.00	14.00	181.50	718.50

* as at 1st. February, 1974 (Nairobi)
 — Indicate negative profit.

The data in this table show that control operations with Zineb, Sulphur and Dithane M-45 were resulted to be more economical and profitable in comparison to other fungicides tested. The economic gain per hectare resulting from the application of Zineb (K. Shs. 718.50) was slightly more than that obtained with sulphur (K. Shs. 637.75) and substantially higher than other gain obtained with Dithane M-45 (K. Shs. 296.20). Plantvax, though very effective against this rust was found to be uneconomical because of its high cost per kg.

DISCUSSION

Plantvax, a systemic fungicide is known to be very effective for the control of other plant rusts (Schmeling and Kulka, 1966). In the present experiment, five sprays of this fungicide reduced the rust infection satisfactorily and increased yield significantly. Sulphur and Zineb were rated as the second best fungicides. The relatively good performances of these fungicides confirm the results obtained by Sackston (1953), Szoko and Szabo (1963), and Kurnik and Meszaros (1966). Dithane M-45, Antracol and Daconil despite their fairly effective rust control, did not lead to statistically significant increase in yield which might be due to the physical and chemical properties of these fungicides and also environmental conditions influence the effectiveness of them when sprayed over the plants.

Some workers in the past have considered chemical control of cereal rusts on a commercial basis to be uneconomical (Dickson, 1959 and Jones, 1961). In the present preliminary trial, however, fungicidal sprays with Zineb and sulphur were economical and gave additional profits on sunflower up to K. Shs. 718.50 and K. Shs. 637.75 (equivalent to U.S.\$90—100) per hectare, respectively. As the experiment was conducted under conditions of natural infection where disease was not so severe, it could be more economical to spray this crop under epidemic conditions or in areas where rust may be serious threat to sunflower cultivation.

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