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Fungicidal Control of 'Tikka Leaf Spot' of Groundnut in Tamil Nadu.

by

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Introduction: Groundnut which is one of the most important oilseed crops is susceptible to some of the most serious diseases like 'tikka'-*Cercospora personata* (Berk. & Curt.) Ell. & Eve., *Cercospora arachidicola* Hori. and Root rot-*Rhizoctonia bataticola* (Taub.) Butl. The low yield of pods in India is to a great extent attributed to some of these diseases as well as pests. Reduction in yield from 20 to 50% due to severe cases of tikka alone has been reported from Uttar Pradesh by Mehta *et al.* (1954). Similarly Sulaiman (1965) has recorded a loss in yield upto 40% in the Maharashtra State.

Reduction in yield is largely due to the damage caused to the leaves as a result of intense spotting and the consequent loss in photo-synthetic tissue; 35% of the leaf area has been reported to be lost in parts of North America (Wolf, 1916). Spots on the pegs also tend to decrease yield by restricting translocation of food to the seeds (Reys *et al.*, 1940). Premature leaf fall, which is invariably associated with tikka incidence, is also a factor contributing to the low yield of groundnut.

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as no strains, resistant to tikka, are available, economic use of suitable fungicides has to be resorted to, for controlling the disease to the possible extent and thereby enhancing the yield. To achieve this objective, fungicidal trials against 'tikka' were laid out at the Regional Agricultural Research Station, Tindivanam, Tamil Nadu and the results of the trials conducted during three consecutive years have been presented in this article.

Materials and Methods: The bunch variety TMV 2, which is highly susceptible to 'tikka' was selected for the trials and thirteen proprietary fungicides belonging to different groups viz. Copper, Sulphur, Mercury, Tin and the Dithiocarbamates were tested to assess their efficacy in controlling the disease.

Foliar application of the fungicides was adopted. The first round of treatment was given 30 days after sowing and the subsequent two rounds at 20 days interval.

The experiments were laid out in a simple randomised block design with six replications during the rainfed season i.e. July–December of 1966, 1967 and 1968. Plot size of 6.00×3.75 metres was adopted in the first year and 5.45×3.63 metres during the subsequent two years. The crop was fertilised with Urea, Super phosphate and Muriate of potash besides a basal dose of compost to supply 34 Kg. of N, 17 Kg. of P_2O_5 and 22 Kg. of K_2O per hectare. A higher dose of N was given to render the crop more susceptible to 'tikka'.

Observations on the incidence of 'tikka' were recorded prior to the application of fungicides as well as after each round of treatment. The final observations were recorded 10 days after the third round of fungicidal application. Twentyfive plants selected at random in each plot were examined for recording the disease incidence, the intensity of which was graded according to the method described by Krishnaswamy *et al.* (1959).

A leaflet count was also taken 90 days after sowing by selecting 10 plants at random in each plot in the trial conducted during 1968, in order to gather some information as to whether there was any reduction in leaf fall as a result of fungicidal application.

The data in respect of yield of pods, incidence of 'tikka', expressed as leaf disease index, as well as the leaflet counts were subjected to statistical scrutiny.

Experimental findings: The results of all the the three years' trials attained the level of significance with respect to yield of pods and leaf disease index, while the results on leaflet counts were also significant in the trial

conducted in 1968. The data on the leaf disease index and leaflet counts are presented in Table 1.

TABLE 1. *Effect of fungicides on the intensity of tikka and number of leaflets*

Treatments		Average leaf disease index			Mean number of leaflets per plant
		1966	1967	1968	1968
Bordeaux mixture	0.75%	77.33	90.17	62.33	51.2
Cupramar	0.3%	78.67	95.83	65 00	52.3
Wettable sulphur	0 25%	81.17	92.17	—	—
Cosan	0.25%	77.83	96.17	65.33	50.3
Hexathane	0.2%	86.33	—	—	—
Zineb	0.2%	86.67	93.83	66.67	42.0
Cuman	0.1%	88 33	94.83	65 33	45.9
Zincop	0.25%	82.67	98 33	64 00	45.7
Ceresan lime dust	28 kg/ha	77.67	71 00	56 67	56.4
Brestan	0.1%	82.17	85.67	62.67	53.7
Du-ter	0.25%	78.50	89.50	61.33	52.5
Thiovit	0.4%	—	95.83	63.50	56 9
Miltox	0.25%	—	96.50	65.83	49 6
Control – No treatment		101.50	148.67	71.00	41.0
C.D. at 5%		3.78	5.51	5.07	7.76

In all the three years, all the fungicides tested were significantly superior to control in reducing the incidence of 'tikka'. In 1966, Bordeaux mixture, Ceresan lime dust, Cesan, Du-ter and Cupramar were on par and superior to all the other treatments and control, closely followed by Wettable sulphur and Brestan. In 1967, Ceresan lime dust was outstanding and superior to all the other treatments. Brestan, Du-ter and Bordeaux mixture were on par and ranked next to Ceresan lime dust followed by wettable sulphur, zineb and Cuman. In 1968, Ceresan lime dust and Du-ter were on par and superior to the other treatments and control. Except Zineb, all the other fungicides were on par with Du-ter.

Significant differences among treatments were obtained in the data on leaflet counts also. The treatments Thiovit, Ceresan lime dust, Brestan, Du-ter, Cupramar, Bordeaux mixture, Cosan and Miltex were all on par and superior to the other treatments in recording more number of leaflets per plant.

The plot yield and hectare yield of pods are recorded in Table 2.

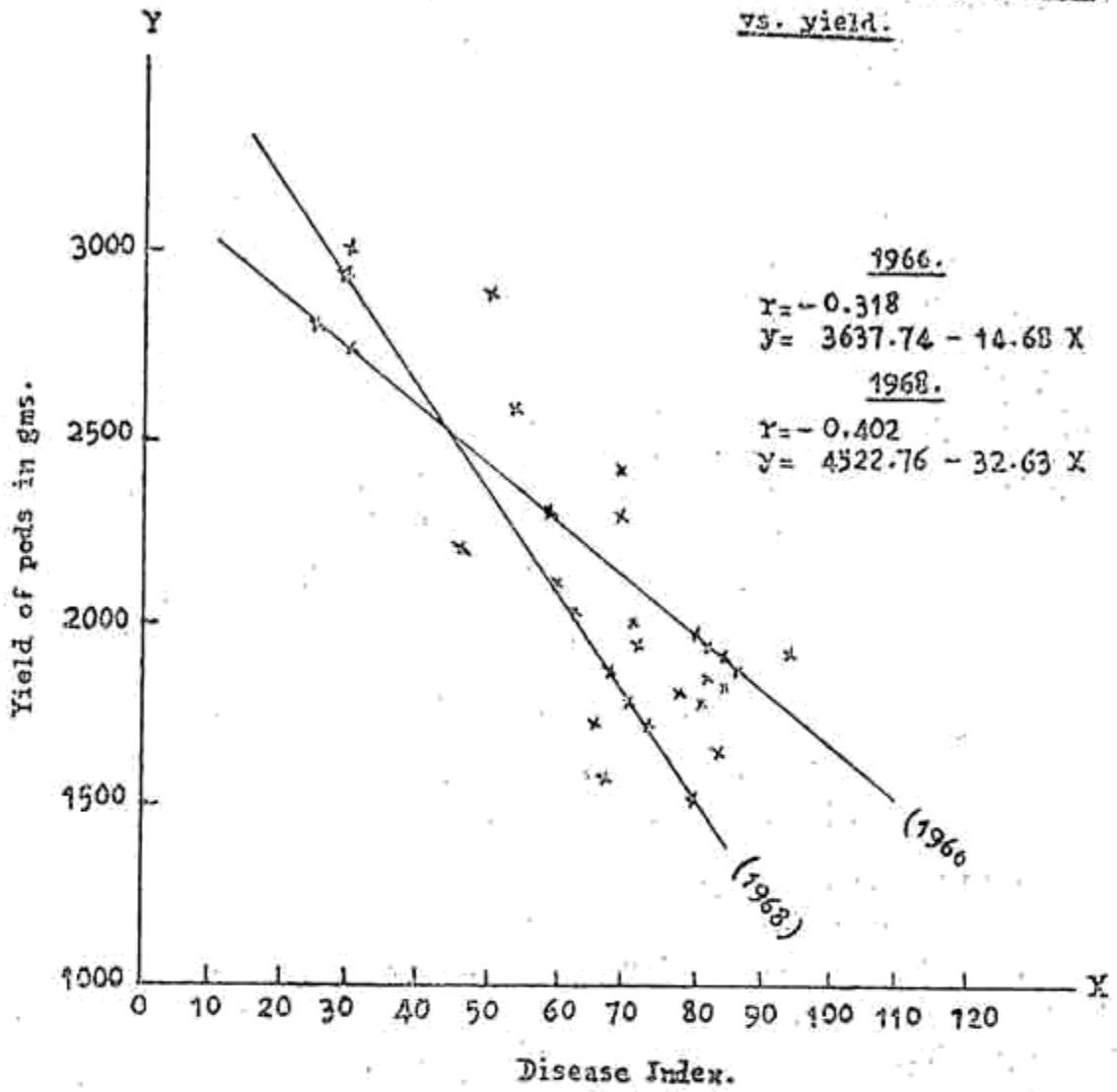
TABLE 2. *Effect of fungicides on the yield of pods*

Treatments	Plot yield in gm			Hectare yield in kg			Percentage on control		
	1966	1967	1968	1966	1967	1968	1966	1967	1968
Bordeaux mixture	2730 0	3057.0	2670.8	1213	1523	1350	121 8	110.8	130 4
Cupramar	2573 7	3222 0	2500.8	1144	1604	1264	114.9	116.6	122.2
Wettable sulphur	2260.3	2853 7	—	1004	1421	—	100.8	103.4	—
Cosan	2432.7	3151.8	2428.3	1081	1570	1228	108 5	114.2	118.7
Hexathane	2105.3	—	—	936	—	—	94.0	—	—
Zineb	2211.5	3035 2	1858.3	983	1511	9:9	98.7	109.9	90.7
Cuman	2086.0	2783.7	2056 7	927	1387	1040	93.1	100.9	100.5
Zincop	2444.7	3084 8	2437.5	1087	1537	1232	109.1	111 8	119.1
Ceresan lime dust	2580 3	3094.5	2576.7	1147	1541	1302	115.2	112.0	125 8
Brestan	2749 5	3266.2	2811.7	1222	1628	1421	122.7	118.4	137.3
Du-ter	2522.0	3046 5	2703.3	1121	1517	1367	112 6	110.4	132.1
Thiovit	—	3152 7	2585.0	—	1570	1307	—	114.2	126.3
Miltox	—	3046.2	2470.0	—	1517	1248	—	110.4	120.6
Control	2241.2	2761.5	2047.5	996	1375	1035	100 0	100.0	100.0
C.D. at 5%	312 6	287 2	287.7	—	—	—	—	—	—

A perusal of Table 2, indicates that the yield data of all the three trials were statistically significant. In the year 1966, Brestan, Bordeaux mixture, Ceresan lime dust, Cupramar, Du-ter and Zincop were all on par and superior to the other treatments in recording increased yield, closely followed by Cosan. In 1967, all the treatments except Wettable sulphur, Cuman and control were on par and superior. In 1968, Brestan, Du-ter, Bordeaux mixture, Thiovit and Ceresan lime dust were on par and superior to the other treatments. Cuman and Zineb were definitely inferior to all the other fungicides. In all the three trials Brestan had consistantly given the highest yield over all the other treatments. Bordeaux mixture, Cupramar, Thiovit, Ceresan lime dust, Du-ter and Cosan had also given consistantly higher yields.

Further, to ascertain whether there was any significant correlation between yield and the disease incidence, the correlation coefficient between yield and disease index was worked out for the three trials and significance was attained in two trials. The correlation coefficient, $r = -0.318$ and $r = -0.402$ as well as regression coefficient, -14.68 and -32.62 were obtained for trials during 1966 and 1968 respectively, thereby indicating an increase in yield of pods by 14.68 gm. per plot for the 1966 trial and 32.62 gm. per plot for the 1968 trial, for every unit decrease in disease index. The regression curve is presented in figure 1.

Fig. 1 : Regression line of Y on X - Disease index vs. yield.



The economics of the different treatments was also worked out separately for the three trials and the extra profit earned due to increased yield owing to control operations is presented in Table 3.

It is evident from Table 3, that substantial profit was obtained as a result of treatment with the fungicide viz., Brestan, Bordeaux mixture, Thievit, Cosan and Cupramar. Ceresan lime dust and Du-ter, though capable of reducing 'tikka' incidence and enhancing the yield were not economical because of their high cost.

Discussion: Numerous workers in various gruondnut growing countries including India had conducted fungicidal trials and different fungicidal formulations either as sprays or as dusts had been recommended for use to control 'tikka' disease and to enhance the yield of groundnut. Some of the Copper and Sulphur formulations had been consistently recommended for tikka control by many workers viz., John (1947); Anon. (1954); Vijayan *et al.* (1964); Corbett

TABLE 3. *Economics of the control operations*

Treatment	1966				1967				1968			
	Increase in yield over control	Value of increased yield	Cost of control operations	Profit	Increase in yield over control	Value of increased yield	Cost of control operations	Profit	Increase in yield over control	Value of increased yield	Cost of control operations	Profit
	kg/hec	Rs.	Rs.	Rs.	kg/hec	Rs.	Rs.	Rs.	kg/hec	Rs.	Rs.	Rs.
Bordeaux mixture	217	271	90	181	148	185	95	90	315	394	100	294
Cupramar	148	185	120	65	229	285	125	160	229	283	130	153
Wettable sulphur	8	10	40	—	46	57	45	12	—	—	50	—
Cosan	85	105	48	57	195	243	53	190	193	241	58	183
Zincop	91	113	125	—	162	202	130	72	197	246	135	111
Ceresan lime dust	151	190	255	—	166	205	260	—	267	334	265	69
Brestan	226	280	128	152	253	315	133	182	386	483	138	345
Du-ter	125	156	305	—	142	177	310	—	332	415	315	100
Miltox	—	—	122	—	142	177	127	50	213	266	132	134
Thiovit	—	—	58	—	195	243	63	180	272	340	68	272

et al. (1966); Sulaiman (1965); Mehta *et al.* (1954); Vasudeva (1958); Hoof (1950); Harrison (1966); Miller (1946) and Tandon *et al.* (1968). In the present study also it was found that the fungicides belonging to the Copper group viz. Cosan and Thiovit had consistently given higher yield besides reducing the intensity of the disease in all the three trials.

However, in recent times difficulty in obtaining Copper and Sulphur based fungicides was felt to a considerable extent and this in turn had prompted the scientists to explore the possibilities of economic use of compounds belonging to other groups viz the Dithiocarbamates, synthetic organic formulations etc. for plant protection measures. According to Tandon *et al.* (1968), tikka was effectively controlled by 5 to 6 applications of NCDB – 83+ Sulphur, Dithane M.22, Cosan, C–550, Fycol 8B and Dithane Z–78. Harrison (1966) also obtained similar results with recent Dithiocarbamate fungicides, a compound of ionic Zinc with Maneb giving the best results against tikka. The Dithiocarbamates viz. Cuman, Zineb and Hexathane were not found to be very effective against tikka in the present studies. However, the fungicides with Dithiocarbamates and Copper in combination viz. Zincop and Miltex were more effective against tikka.

Besides recording good control of tikka, considerable yield increases were also obtained by spraying with materials like Triphenyl tin hydroxide and

some synthetic organic fungicides. But it was noticed that Copper and Sulphur fungicides, mixed or by themselves, were as effective as many of the new compounds (Harrison, 1966) and Lyle *et al.* (1966). But it was seen here, that though Du-ter recorded good control of tikka it was not economical.

According to Solel (1964), 3 to 6 treatments with Brestan gave excellent results against *Cercospora beticola* on sugarbeet. But Tanden *et al.* (1968) found Brestan to be phytotoxic to groundnut crop at 8 oz per 100 gallons and the yield also did not differ much from the control. But in the present studies, Brestan had consistently given the maximum yield besides controlling tikka effectively without producing any phytotoxic effect even at 0.1% concentration.

From the above studies, it can be concluded that effective and economic control of tikka can be obtained by the application of fungicides *viz.* Brestan, Cupramar, Thiovit, Cosan or the standard fungicide Bordeaux Mixture.

Summary: Fungicidal trials to control tikka disease of groundnut were conducted during three consecutive years (1966 to 1968) at the Regional Agricultural Research Station, Tindivanam, Tamil Nadu. Of the thirteen proprietary fungicides tested, Brestan, Bordeaux Mixture, Cupramar, Thiovit and Cosan were found to be very effective in controlling the disease, at the same time recording higher yields, and the control operations were also very profitable.

Among the above fungicides, Brestan had given on an average 25.4% increased yield over control, besides recording appreciable reduction in disease incidence and a net profit of rupees two hundred and twentyfive per hectare considering the results of all the three years of trials.

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* Originals not seen.