FURTHER STUDIES ON THE CONTROL OF PRE-EMERGENCE ROT AND CROWN ROT OF PEANUTS

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SUMMARY

Experiments with fungicidal seed dressings on peanuts conducted during the seasons 1955 to 1959 are described.

In laboratory tests there was a differential effect of fungicides on *Rhizopus* spp., *Aspergillus niger* and *Penicillium* spp. Organo-mercurials were very effective against *Rhizopus* spp. but not so effective against *A. niger* and *Penicillium* spp. Captan, thiram and chloranil were effective against *A. niger* and *Penicillium* spp. but not as consistently effective against *Rhizopus* spp. as the organo-mercurials.

Field trials demonstrated that, under certain conditions, organo-mercurials increased the incidence of crown rot caused by *A. niger*. A number of fungicides controlled pre-emergence rot but the organo-mercurials and captan were the most consistent. A combination of these two fungicides gave best control over both pre-emergence rot and crown rot.

Sowing rates could be profitably reduced to the recommended level, when reasonable control over crown rot can be expected.

I. INTRODUCTION

Two seedbed diseases of peanuts termed pre-emergence rot and crown rot are prevalent in Queensland and have been described previously (Morwood 1953). Pre-emergence rot causes decay of the seed before or just after germination and is usually caused by the pathogen *Rhizopus arrhizus* Fischer. Crown rot usually affects the plant soon after emergence and may be caused by a number of organisms, including *Aspergillus niger* van Tiegh., *Diplodia natalensis* Pole-Evans, *Rhizoctonia solani* Kuehn and *Sclerotium rolfsii* Sacc. Reference to crown rot in this paper is to the seedling disease caused by *A. niger,* the most commonly encountered pathogen. This fungus is also capable of causing a pre-emergence rot by attacking and killing the seedling prior to emergence.

Both these diseases occur elsewhere and considerable success has been achieved in their control by the use of fungicidal seed dressings. In general, the organo-mercurial compounds have been considered superior for the control of pre-emergence rot, although under some conditions non-mercurials are preferred

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(Gibson and Clinton 1953; Nema, Jain, and Asthana 1955; Wilson 1950; Tarr 1958). However, it has been found in East Africa that the use of organo-mercurials considerably increases the incidence of crown rot. Gibson (1953b) demonstrated that this effect is probably a result of the partial soil sterilization produced by these materials in the vicinity of the seed. Tolerant *A. niger* colonies are at an advantage under such conditions and can more readily attack the peanut seedling. He found no such effect with thiram, which gave good control of crown rot. On the other hand, it is reported that organo-mercurials still give good crown rot control in India (Nema, Jain, and Asthana 1955). In Queensland, control of both diseases by the use of organo-mercurial dressings has been reported previously (Morwood 1953) but the data presented indicate that it was by the control of pre-emergence rot that better plant stands were achieved. Despite the use of such dressings on all peanut seed sold in Queensland for many years, crown rot has continued to cause serious losses. For example, losses of up to 30 per cent. of plants were observed in the 1955-56 season, these being greater than any reported by Gibson (1953a) for East Africa.

This paper reports further experiments carried out to examine critically the effect of organo-mercurials on crown rot incidence in Queensland and to determine a seed dressing capable of giving control over both pre-emergence rot and crown rot.

II. EXPERIMENTAL METHODS

The effect of fungicidal seed dressings has been assessed under both laboratory and field conditions.

(a) Laboratory Tests

During laboratory germination tests of peanuts the growth of fungi seriously interferes with determination of germination percentage (Morwood 1953). Three groups of fungi predominate, namely *Rhizopus* spp., *Aspergillus niger* and *Penicillium* spp. Although the relationship of the seed-borne inoculum of *Rhizopus* spp. and *A. niger* to disease in the field is uncertain, the behaviour of a fungicide against these two fungal groups could conceivably act as a guide to its behaviour against pre-emergence rot and crown rot in the field.

In laboratory tests, treated seed was placed in germination trays between moist towelling. Fifty seeds were placed on each tray for each treatment and in most cases four replications were employed. The trays were placed in a constant temperature chamber (27°C) and after three days the percentage germination was determined. Fungal infections were classified into the three major groups previously mentioned. No seed carrying an infection was considered to have germinated and if more than one fungal type was present on a kernel each type was recorded.

(b) Field Trials

The ability of a fungicide to control pre-emergence rot was assessed by an accurate measurement of the percentage of seed which emerged from the soil as healthy seedlings. Crown rot control was assessed by observations and counts after emergence.

Field trials were carried out in three different ways.

(i.) *Hand-planted Trials.*—Furrows 3 ft. apart were opened up in moist soil. Plots were 1 chain long, in which length exactly 100 seeds were sown. Either four or six replications were employed.

(ii.) *Replicated Trials Sown with Normal Sowing Machinery.*—Either a 2-row or a 4-row planter was employed. Plots were 2 chains long and 2 rows wide except in one case, when the plots were 3½ chains long. The planters were fitted with normal peanut plates and the rate of sowing was calculated by weighings before and after sowing. In addition to emergence and crown rot determinations, yield figures were recorded in some trials.

(iii.) *Observation Plots.*—These were sown on properties to assess overall district behaviour of fungicidal seed dressings during the 1956-57 and 1957-58 seasons.

In all cases where statistical analysis has been required, transformed variates have been used.

III. MATERIALS

The fungicides studied were as follows:

1. *Captan (50% N-trichloromethylthio-tetrahydrophthalimide).
2. Captan A and B (Proprietary preparations containing 20% active ingredient).
3. Cerenox (10% quinoxyme benzoyl hydrazone).
4. Chloranil (98% tetrachloro-para-benzoquinone).
5. *Dichlone (50% 2,3-dichloro-1,4-naphthoquinone).
6. Organo-mercurials, "Harvesan", "Ceresan" and "Drisan" each 1.5% Hg; and "Agrosan" 1.0% Hg.
7. *P.C.N.B. (75% pentachloronitrobenzene).
8. Thiram (50% tetramethyl thiuram disulphide).
9. *Zineb (65% zinc ethylene bisdithiocarbamate).
10. *Ziram (76% zinc dimethyl dithiocarbamate).

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* Wettable powder used in these cases. All other fungicides were prepared seed dressings.

Where mixtures of these fungicides were employed proportions were determined by weight and the fungicides thoroughly mixed by stirring and agitation in a jar.

Unless otherwise stated, all fungicides were added at a rate of 1 oz to 20 lb of seed. For small quantities the material was applied in glass jars which were agitated on rollers. For larger quantities the material was added to the seed in small bags and agitated by hand until a good cover was obtained. In the case of seed for field trials, treatment was carried out usually just prior to planting. In the 1957-58 season, planting was delayed for over three months after treatment owing to dry weather conditions.

The seed used was of the variety Virginia Bunch, which was machine-shelled. Each year seed samples being tested for germination by the Peanut Marketing Board were closely observed and a suitable grade selected. Careful attention was paid to fungal infections because it was considered desirable to use seed carrying relatively high infections of both *Rhizopus* spp. and *A. niger*. In the course of these observations it was noted that considerable variation occurred between grades in any year but more particularly between seed harvested in different seasons. In Table 1 the relative amounts of the two test fungi *Rhizopus* spp. and *A. niger* in the seasons under review are summarized.

Table 1

Relative Amounts of Fungal Groups on Seed Peanuts at Kingaroy

Season	*Rhizopus* spp.	*Aspergillus niger*
1955–56 . .	High	High
1956–57 . .	Low	Nil
1957–58 . .	Very high	Very high
1958–59 . .	Low	Very low

It is evident that it has been impossible to select seed over the years having similar amounts of fungi infection.

IV. SUMMARY OF 1955–56 EXPERIMENTS

During the 1955-56 season, laboratory tests on germination trays and hand-planted field trials were carried out. Results appear in Table 2.

These results show the effectiveness of organo-mercurial compounds against *Rhizopus* spp. and their relative ineffectiveness against *A. niger*. Thiram, captan and chloranil had the opposite effect. Under field conditions all treatments gave a significantly better emergence than the untreated. Crown rot was significantly higher with the organo-mercurial compounds.

Table 2

Laboratory and Field Tests of Treated Peanut Kernels, showing Germination, Percentage Seed Infected, Field Emergence and Crown Rot Incidence during 1955–56 Season

Treatment	Laboratory Tests			Field Trials	
	Germination (equiv. %)	Seed Infected		Emergence (equiv. %)	Crown Rot (equiv. %)
		A. niger (equiv. %)	*Rhizopus* spp. (equiv. %)		
1. " Harvesan " ..	77·7	3·6	1·8	53·0	13·7
2. " Ceresan " ..	71·3	4·0	4·8	49·4	18·0
3. Thiram ..	70·8	0·3	6·6	45·2	7·8
4. Chloranil ..	68·7	0·3	9·4	47·7	5·2
5. Captan ..	67·6	0·1	9·2	49·8	5·3
6. Ziram	65·8	1·1	11·0	41·0	10·3
7. Zineb	57·7	0·8	16·9	32·0	10·4
8. Untreated ..	27·9	2·3	17·1	27·4	8·4
Significant differences ..	1 ≫ 5–8 2–4 ≫ 7, 8 5–7 ≫ 8 1 > 4 ; 5, 6 > 7	5 ≪ 1, 2 3, 4 ≪ 2 5 < 8 3, 4 < 1 7 < 2	1 ≪ 4–8 2, 3 ≪ 7, 8 1 < 3 ; 2 < 6 4, 5 < 7, 8	1 ≫ 3, 6–8 2, 5 ≫ 6–8 3, 4, 6 ≫ 7, 8 4 > 6	4, 5 ≪ 1, 2, 6, 7 3 ≪ 1, 2 6–8 ≪ 2 8 < 1

V. SUMMARY OF 1956–57 EXPERIMENTS

A machine-planted trial was repeated on two farms. At one locality (Crawford) the soil was in poor physical condition, having been cropped to peanuts for many years with very little crop rotation. At the other site (Kumbia)

Table 3

Emergence, Crown Rot and Yield per Plot from Peanut Seed Treated with Different Fungicides in Field Trials at Kumbia and Crawford, 1956–57 Season

Treatment	Kumbia			Crawford		
	Mean Germination	Crown Rot (mean %)	Mean Yield (lb/plot)	Mean Germination	Crown Rot (equiv. %)	Mean Yield (lb/plot)
1. " Harvesan "	500	2·0	53·6	288	6·4	20·6
2. " Ceresan " ..	550	0·7	56·2	301	5·7	21·4
3. Captan ..	568	0·5	57·9	285	0·8	21·1
4. Thiram ..	574	0·7	55·0	291	2·5	22·2
5. Chloranil ..	540	0·5	59·4	258	1·4	22·9
6. Untreated ..	415	0·7	52·6	170	1·9	18·4
Significant differences ..	2–5 ≫ 6	Not analysed	5 > 1, 6	1–5 ≫ 6	3, 5 ≪ 1, 2 6 < 1, 2 4 < 1	5 ≫ 6 4 > 6

the soil was in good physical condition and crop rotation had been judiciously carried out for years. The rate of planting at both trials was 32 lb per acre. The plots at Kumbia were 1½ chains longer than the standard 2 chains. Results appear in Table 3.

These results demonstrate the suitability of the first four fungicides in assuring good emergence. The organo-mercurials again induced more crown rot under conditions where this disease was prevalent. Captan again showed the lowest incidence of crown rot. In Figure 1 adjacent plots at Crawford of untreated seed and seed treated with an organo-mercurial illustrate the differences in the resulting stand.

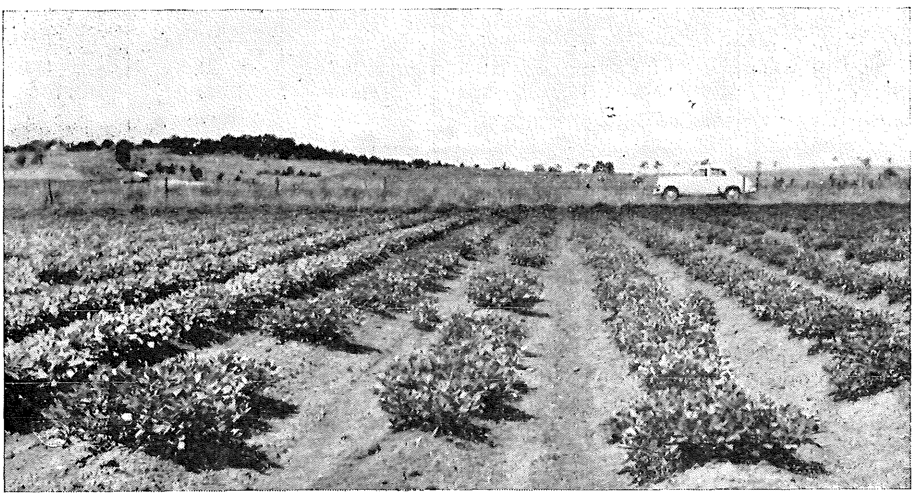

Fig. 1.—Seed treatment trial, Crawford, 1956-57 season. Left: two rows untreated. Right: treated with "Harvesan."

The effect of crown rot on a peanut stand is shown again in Figure 2, which is taken from observation plots at Wondai. The captan plot, in which 0·9 per cent. crown rot occurred, shows unbroken rows, while the organo-mercurial plot with 18 per cent. crown rot has many large gaps.

Because of the apparent differential effect on the different fungal groups, it was considered that combinations of the organo-mercurials with captan, chloranil and thiram would be worth investigating. These and a number of fungicides hitherto untried were included in a hand-planted trial, the results of which appear in Table 4. Crown rot incidence was negligible and is not included.

While the absence of crown rot reduces the value of these results, it is clear that the mixtures of organo-mercurials and captan, chloranil and thiram had no deleterious effect on germination. Although the germination of dichlone-treated seed was satisfactory, it was noted that an abnormal amount of bacterial growth occurred on germination trays.

Fig. 2.—Observation plots, Wondai, 1956-57 season. Plot on the left treated with captan, that on the right with "Ceresan."

Table 4

GERMINATION OF TREATED PEANUT KERNELS IN HAND-PLANTED TRIAL, 1956–57 SEASON

Treatment	Germination (equiv. %)
1. Captan	90·9
2. " Ceresan "/Captan 1 : 1	90·9
3. " Harvesan "/Captan 1 : 1	90·7
4. " Drisan "	90·2
5. " Ceresan "/Chloranil 1 : 1	89·3
6. " Harvesan "/Chloranil 1 : 1 ..	88·9
7. Dichlone	86·8
8. Chloranil	84·1
9. Thiram	83·4
10. " Ceresan "	79·8
11. " Ceresan "/Thiram 1 : 1	79·1
12. " Harvesan "/Thiram 1 : 1 ..	77·1
13. " Harvesan "	75·8
14. " Agrosan "	75·8
15. Cerenox	70·9
16. Untreated	70·1
Significant differences	1, 2 ≫ 12–16 > 10, 11 3, 4 ≫ 13–16 > 10–12 5–7 ≫ 15, 16 5, 6 > 12–14 8, 9 > 15, 16

VI. SUMMARY OF 1957–58 EXPERIMENTS

Initial work was done in the laboratory, where tests were carried out to determine the limit to which captan in the organo-mercurial/captan mixture could be reduced and still give control over *A. niger* on the seed. Results appear in Table 5.

Table 5

COMPARISON OF GERMINATION AND FUNGAL INFECTION OF PEANUT SEED TREATED WITH ORGANO-MERCURIAL/CAPTAN MIXTURES IN LABORATORY TESTS, 1957–58

Treatment	Germination (%)	Percentage Kernels Infected with Fungal Colonies		
		Rhizopus spp.	*Aspergillus niger*	*Penicillium* spp.
Untreated	31	33	14	39
" Ceresan "	73	5	13	20
Captan	74	12	..	1
" Ceresan "/Captan 1 : 5	79	11	..	..
" Ceresan "/Captan 1 : 2	67	13	..	2
" Ceresan "/Captan 1 : 1	78	10	..	..
" Ceresan "/Captan 2 : 1	75	10	..	..
" Ceresan "/Captan 3 : 1	83	11	..	..
" Ceresan "/Captan 5 : 1	87	7	..	1
" Ceresan "/Captan 6·5 : 1	82	8	0·25	4·5
" Ceresan "/Captan 9 : 1	84	8	0·50	4·0
" Ceresan "/Captan 14 : 1	79	6	5·5	6·5
" Ceresan "/Captan 29 : 1	77	7	5·0	11·0

Table 6

EMERGENCE, YIELD AND CROWN ROT MEANS IN A MACHINE–PLANTED TRIAL OF TREATED PEANUT SEED AT KINGAROY, 1957–58 SEASON

Treatment	Emergence	Yield (lb/plot)	Crown Rot (%)
1. " Ceresan "/Captan 5 : 1	304	23·5	2·7
2. Captan	280	21·4	1·2
3. " Ceresan "	242	18·8	24·1
4. Thiram	234	18·7	2·6
5. Chloranil	225	19·7	0·4
6. Untreated	96	13·8	6·5
s. e.	13·4	1·20	
Necessary differences for significance 5%	40	3·6	Not analysed
Necessary differences for significance 1%	56	5·0	
Significant differences ..	1 ≫ 3–6 2–5 ≫ 6 2 > 3, 4	1, 2, 4 ≫ 6 1 > 3, 4, 5 3, 5 > 6	" Ceresan " obviously > all others

These results bring out clearly the differential effect on the fungal groups of the organo-mercurials and captan. *Penicillium* spp. apparently have the same general reaction to fungicides as *A. niger*. The combination of the two dusts in the right proportion achieves the best results.

The combination 5:1 was selected for use in the machine-planted field trial, which was planted at Kingaroy on light gravelly soil where crown rot had been a problem in previous years. Results appear in Table 6. Rate of planting in this trial was 42 lb per acre.

Under these conditions captan was superior to organo-mercurials. A mixture of the two gave outstanding results both in emergence and in yield. Crown rot incidence was slightly greater than with captan straight. Thiram was inferior to captan in all respects.

In a hand-planted trial on two sites, various untested materials and combinations of organo-mercurials with captan and thiram were compared.

Table 7

EMERGENCE AND CROWN ROT INCIDENCE IN HAND-PLANTED PEANUT TRIALS AT KINGAROY AND KUMBIA, 1957–58

Treatment	Kingaroy				Kumbia		
	Emergence		Crown Rot		Emergence		Crown Rot (mean %)
	ϕ	Equiv. %	ϕ	Equiv. %	ϕ	Equiv. %	
1. "Agrosan"	51·7	61·6	16·6	8·2	52·0	62·1	2·5
2. "Ceresan"	49·4	57·7	16·9	8·5	47·7	54·8	4·75
3. "Drisan"	49·6	58·0	13·7	5·6	47·5	54·3	3·75
4. P.C.N.B.	50·4	59·3	15·3	7·0	47·2	53·8	1·75
5. Captan	46·3	52·3	1·4	0·1	41·8	44·5	1·25
6. Captan A (20%) ..	42·4	45·4	6·8	1·4	39·2	39·9	0·50
7. Captan B (20%) ..	44·1	48·5	6·8	1·4	41·2	43·4	0·75
8. Thiram	42·5	45·7	7·0	1·5	45·1	50·2	0·75
9. Chloranil	37·2	36·6	7·0	1·5	33·5	30·5	0·25
10. "Ceresan"/Captan 1 : 1	47·9	55·0	7·5	1·7	43·4	47·2	0·25
11. "Ceresan"/Captan 2 : 1	49·7	58·1	3·5	0·4	47·9	55·0	0·25
12. "Ceresan"/Captan 5 : 1	49·2	57·4	8·7	2·3	42·8	46·2	0
13. "Ceresan"/Thiram 1 : 1	48·3	55·8	10·6	3·4	44·6	49·2	0·75
14. "Ceresan"/Thiram 2 : 1	51·2	60·8	10·5	3·3	45·3	50·5	0·75
15. "Ceresan"/Thiram 5 : 1	50·2	59·1	11·4	3·9	43·7	47·8	1·0
16. Untreated	27·3	21·0	8·7	2·3	32·6	29·0	1·25
Necessary differences for significance 5%	4·5		5·1		4·7		Not analysed
1%	6·0		6·8		6·2		

Results appear in Table 7. The plots at Kingaroy were on a poor gravelly loam, while at Kumbia a good scrub soil was used.

These results show the organo-mercurials as slightly superior to captan for pre-emergence control. The combined treatments all show better crown rot control than the organo-mercurials, although the captan combinations are better than the thiram combinations in this regard. The performance of P.C.N.B. is interesting in that its effect on crown rot is similar to that of the organo-mercurials, causing an actual increase in disease over untreated seed. The effect of site is also emphasized. A reduction to a 20 per cent. concentration of captan reduces the advantageous effect of this fungicide.

In co-operation with the Peanut Marketing Board, observation plots were planted on various properties during the season. Three grades of seed each treated with "Ceresan," captan and a mixture of these two fungicides were compared. Each grade was sown on two different properties with each treatment replicated twice on each farm. These plots were sown as part of the general commercial crop by the growers concerned and were of variable size. Disease determinations were made on small areas, 2 chains long and 4 rows wide, within the larger plots. Only one count of plants affected with crown rot was made two weeks after the initial emergence count. Results appear in Table 8.

Table 8

EMERGENCE AND CROWN ROT MEANS IN THREE GRADES OF SEED TREATED WITH DIFFERENT FUNGICIDES AND SOWN ON DIFFERENT FARMS, 1957–58

Grade	" Ceresan "		Captan		" Ceresan "/Captan	
	Emergence	Crown Rot	Emergence	Crown Rot	Emergence	Crown Rot
1 ..	483	42	485	3	554	4
2 ..	442	28	419	1	508	3
3 ..	560	18	549	1	582	2
Mean ..	495	29	484	2	548	3

These results indicate that over a range of soil types and seed grade a combination dust of an organo-mercurial and captan gives the best results. Emergence figures show little difference between the organo-mercurials and captan.

VII. SUMMARY OF 1958–59 EXPERIMENTS

A machine-planted trial was conducted comparing two combinations of captan with organo-mercurials having a 1 per cent. and 1·5 per cent. Hg content. The seed used carried no apparent *Aspergillus niger* and the rate of planting was 42 lb per acre. Results appear in Table 9.

Little difference was shown between any of the combined seed dressings in control of pre-emergence and crown rot. It is interesting to note that although there are no significant differences in yield, the combined seed dressings and captan are all superior to the organo-mercurial in this regard.

Table 9

Comparison of the Control of Pre-emergence and Crown Rot of Peanuts by Various Fungicidal Combinations in a Machine-planted Trial, 1958–59 Season

Treatment	Mean Emergence	Crown Rot		Mean Yield (lb per plot)
		ϕ	Equiv. %	
1. Captan	360	11·4	3·9	18·9
2. "Agrosan"/Captan 2 : 1	363	11·9	4·2	18·8
3. "Agrosan"/Captan 5 : 1	383	12·2	4·5	19·8
4. "Ceresan"/Captan 5 : 1	371	12·4	4·6	20·2
5. "Ceresan"/Captan 2 : 1	362	12·9	5·0	21·4
6. Untreated	322	18·5	10·0	17·4
7. "Agrosan" (1·0% Hg)	358	25·4	18·4	17·3
8. "Ceresan" (1·5% Hg)	377	27·2	20·9	15·4
s. e.	10·8	1·39		1·77
Necessary differences for significance 5%	31·8	4·1		
Necessary differences for significance 1%	43·3	5·6		
Significant differences	3, 8, 4 $\gg$ 6 2, 5, 1, 7 $>$ 6	1–4 $\ll$ 6–8 5, 6 $\ll$ 7, 8 5 $<$ 6		No sig. diff.

During this season a machine-planted trial was done comparing different seed lines for disease incidence. These lines were each treated with captan, "Agrosan" and a mixture of these two. Results appear in Table 10.

It can be noted that the emergences in the organo-mercurial and combined dust treatments are significantly better than in the captan treatment, which in turn is better than the untreated. Crown rot in the organo-mercurial plots is significantly greater than in all the others, including the untreated, while there is little difference in the effect of captan and the combined dust treatments on this disease.

Table 10

COMPARISON OF EMERGENCE AND CROWN ROT MEANS IN DIFFERENT SEED LINES OF PEANUTS TREATED WITH FUNGICIDAL DRESSINGS, 1958–59 SEASON

Grade	Emergence (equiv. %)					Crown Rot (equiv. %)				
	Untreated	" Agrosan "	Captan	" Agrosan "/ Captan	Mean	Untreated	" Agrosan "	Captan	" Agrosan "/ Captan	Mean
69 ..	53·3	63·0	54·5	68·2	59·8	0·8	4·6	0·5	0·1	1·1
Ath. 28 ..	29·9	59·2	48·4	63·0	50·0	1·0	7·0	0·2	1·8	1·8
107 ..	52·5	72·7	67·5	72·7	66·6	2·8	2·9	0·0	0·6	1·2
115 ..	59·3	74·5	68·4	76·2	69·8	1·5	4·2	0·9	0·3	1·5
Mean	48·6	67·5	59·8	70·2		1·5	4·6	0·3	0·6	
Significant differences	Grades :—107, 115 ≫ 69 ≫ Ath. 28 Fungicides :—" Agrosan," " Agrosan "/Captan ≫ Captan ≫ Untreated					Grades :—No significant differences Fungicides :—Captan ≪ Untreated, " Agrosan " " Agrosan "/Captan ≪ " Agrosan " " Agrosan "/Captan < Untreated Untreated ≪ " Agrosan "				

VIII. DISCUSSION

It is clear from laboratory tests that *Aspergillus niger* and *Penicillium* spp. possess greater tolerance to organo-mercurial compounds than *Rhizopus* spp. Under field conditions there is an increased incidence of crown rot, caused by *A. niger,* when such compounds are used as seed dressings. These findings confirm those previously reported for East Africa (Gibson 1953b). In some cases this effect is very pronounced, as in the machine-planted trial of 1957-58 when crown rot affected 24·1 per cent. of the plants in the organo-mercurial treatment and only 6·5 per cent. of the plants from untreated seed. It is not implied that all seed treated with these fungicides will suffer severely from crown rot. Other conditions, particularly those of soil type, cropping history and seed damage, play an important role in the incidence of the disease, as has already been pointed out by Morwood (1953). The use of organo-mercurial compounds accentuate the disease when it is prevalent. It is likely that P.C.N.B. has a similar effect, as revealed in the hand-planted trial of 1957-58. Other fungicides, such as captan, thiram and chloranil, give good control of crown rot when used as seed dressings, though thiram is slightly inferior to the other two. A concentration of 20 per cent. captan gives inferior results to a 50 per cent. dust, which is the highest concentration available in Australia.

Pre-emergence rot is controlled by a number of fungicides but the organo-mercurials and captan appear to behave consistently better than the other compounds. It is interesting to observe that under some conditions organo-mercurials give better emergence while in other cases captan is superior. This appears to bear out the findings in the United States of America with regard to specificity of fungicides and variation of results from year to year with different treatments (Wilson 1950). These differences could possibly be explained by the differential effect of the two fungicides on *Rhizopus* spp. and *A. niger* and differences in the relative abundance of these organisms.

It is evident that a combined dust of organo-mercurial and captan achieves the most consistent results. In all trials incorporating this treatment, at least one combination of the two fungicides gave outstanding control of pre-emergence rot and crown rot. While the combinations of organo-mercurials with thiram were good for pre-emergence rot, they were slightly inferior to the combinations with captan for crown rot control. Captan used as a straight dressing was slightly superior to any of the combinations for crown rot control, but the differences were negligible.

The proportion of 50 per cent. captan can be reduced to as low as one part to five of organo-mercurial and still give good control of crown rot.

The effect of plant stand on yield is confusing. This relationship, of course, depends largely on weather conditions experienced throughout the growing season. In these trials significant differences between different fungicides were obtained in only one year despite rather large differences in plant stands. It is obvious from these limited trials that increasing plant stands beyond a certain point does not result in increased yield. It is a fact, however, that most growers plant much more than the recommended 30 lb per acre in order to compensate for possible crown rot losses (Kerr and Cartmill 1951).

IX. CONCLUSIONS

The use of straight organo-mercurial compounds on peanut seed should be avoided because of the increase in crown rot often associated with this practice.

Seed dressings of captan and thiram could be used to advantage and of these two captan is preferred because of its slightly better control of crown rot. It is possible that a captan preparation in excess of 50 per cent. active ingredient would be even more effective if such was available on the Australian market.

The ideal seed dressing is one incorporating both an organo-mercurial and captan. Although 1 part in 5 is satisfactory it is felt that a 1:2 combination would give additional protection under conditions very favourable to crown rot.

The immediate value of an improved seed dressing which ensures reasonable control of crown rot would be to reduce the seeding rates down to the recommended level and give even, unbroken stands.

X. ACKNOWLEDGEMENTS

The Peanut Marketing Board gave considerable assistance in the conduct of these experiments by providing seed and facilities. Many growers allowed trials to be planted on their properties, often at considerable inconvenience. Officers of the Agriculture Branch and the Field Officer of the Peanut Marketing Board assisted in the conduct of the experiments. The statistical analyses were carried out by Mr. P. B. McGovern, Senior Biometrician in the Department. All this assistance is gratefully acknowledged.

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(Received for publication September 21, 1959)