Sinha, P. R. R. & Rajendar Parshad. 1966. Source of information as related to adoption process of some improved farm practices. I.J. of Extension Education, Vol II, No. 1 & 2: pp. 86 – 90.

..ngh, Y. P and Udai Pareek. 1966. Sources of communication at different stages of adoption of farm practices. The I.J. of Social Work; Vol. XXVI, No. 4, pp. 385-89.

Desai, M. B. and R. S. Mehta. 1967. Community Development and change, published by N.I C.D., Rajendranagar, Hyderabad-30; pp. 132.

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Control of 'Dry Root Rot' – *Rhizoctonia bataticola* (Taub.) Butl. in Groundnut by Seed Treatment

by

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Introduction: 'Dry root-rot' or 'Root-rot' caused by *Rhizoctonia bataticola* (Taub.) Butl., is one of the most important diseases affecting groundnut. It is reported from Argentina that the disease caused by this pathogen is responsible for upto 70 per cent loss of the crop in humid season or in low lying areas (Macola, 1950). Infection occurs at almost any stage of development from seedling to maturity (Purss, 1962). However, infection at the pre-emergence stage is much more severe than at the post-emergence stage. It is generally found that the bunch varieties are more prone to the attack by this pathogen than the semi-spreading and spreading varieties.

It has been reported by many workers that this disease can be checked to a considerable extent and pod yield increased by pre-treatment of the seeds with suitable fungicides. In recent times many fungicides have been formulated exclusively for seed treatment and marketted. It was with the object of selecting the best suited fungicides capable of controlling groundnut seed-borne pathogens, field studies were conducted with ten selected fungicides at the Regional Agricultural Research Station, Tindivanam, Tamil Nadu during the three years 1966 to '68 and the results obtained are presented in this paper.

Materials and Methods: The short duration bunch variety TMV. 2, which is very susceptible to 'root rot' was selected for the trials, and ten seed-dressing fungicides were tested along with control – 'no fungicide' under field conditions to assess their relative efficacy in enhancing germination and minimising post-emergence root rot incidence. The commercial names of the fungicides together with the dosage applied and their active ingredients are furnished below:

1. Agrosan GN - 0.25%	Tolylmercury acetate - ethyl mercury chloride.
2. Ceresan (Dry) - 0 25%	Phenyl mercury acetate.

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3. New improved ceresan - 0.07%	Ethyl mercury phosphate.
4. Arasan - 0.28%	bis (Dimethyl thio-carbomoyl) disulphide.
5. Brassicol - 0 25%	Pentachloro nitro benzene
6. Sulphur dust - 0 50%	Sulphur.
7. Thiram - 0.45%	bis (dimethyl thio carbomoyl) disulphide.
8. Captan - 0.38%	N - (trichloro methyl thio) - 4 - cycle hexene - 1, 2 - dicarboximide.
9. Phygon XL - 0.14%	2, 3 - dichlone - 1, 4 - naphthaquinone.
10. Tillex - 0.20%	Ethyl mercury chloride.

The seeds were treated 24 to 48 hours before sowing. Other plant protection measures against 'tikka' leafspot (Cercospora personata) and leaf miner (Stomopteryx subsecivella) were taken up as per schedule.

The experiments were laid out in a randomised block design, with four replications during the rainfed season *i e.* July-December of 1966, 1967 and 1968. Plot size of 9.00 × 4.95 metres was adopted in all the three years. The crop was fertilized with Ammonium sulphate, Super phosphate and Muriate of potash over a basal dose of compost to supply 11 kg of N, 22 kg of P_2O_5 and 33 kg of K_2O/ha as per scheduled package of practices for groundnut. Routine agronomic practices were carried out as usual.

Observations on germination were recorded 20 days after sowing to assess the percentage of germination. Observations on the incidence of root rot were recorded at weekly intervals upto the first two months, the final count was taken 90 days after sowing and the same was expressed in percentage to the total number of seeds germinated. The plot-wise yield data were also collected. The data in respect of germination percentage, root rot incidence percentage and the yield of pods, collected for the three years were critically examined in order to attain the objective set out. The plot-wise germination percentage values and root rot incidence percentage values were transformed into angles (inverse sine transformation) and the data thus obtained were statistically analysed for every year and interpretted.

Results: 1. *Germination:* The results on germination indicated, that the treatment differences were significant during all the three years. All the fungicides except sulphur dust proved uniformly better than the control in all the years.

Considering the different fungicides tried, Thiram, Ceresan, New improved ceresan, Captan, Arasan and Agrosan proved significantly better than the others in bringing about better germination in all the years.

The above three years' data were combined to find out the average response for the various treatments and to rate them according to their efficiency in improving germination. The analysis of variance table thus obtained, as well as the table of means are presented in Tables 1 and 2 respectively.

TABLE 1. *Analysis of variance table – pooled data on germination (Transformed values)*

Variation due to	D.F.	S.S.	M.S.S.	F Value	
				Actuals	Table
Replications	3	65.81	21.94	—	—
Treatments	10	965.73	96.57	14.57 ** (10,20)	2.77 – P=0.05 4.41 – P=0.01
R × T	30	153.75	5.13	—	—
Years	2	7962.34	3981.17	600.47 ** (2,20)	19.44 – P=0.05 99.45 – P=0.01
Y × R	6	89.89	14.98	—	—
Y × T	20	132.61	6.63	2.72 ** (20,60)	1.92 – P=0.05 2.56 – P=0.01
Y × R × T	60	146.15	2.44	—	—
Total	131	9516.28			

TABLE 2. *Table of means – germination (Transformed values)*

Treatments	Years			Mean	S.E.	C.D.	Mean germination %
	1966	1967	1968				
Agrosan GN	76.4	60.8	76.7	71.4			89.8
Ceresan (Dry)	78.6	62.4	77.2	72.7			91.2
New improved ceresan	78.5	64.1	77.3	73.3			91.7
Arasan	77.6	61.2	76.3	71.7			90.1
Brassicol	76.2	56.2	74.2	68.8			86.9
Sulphur dust	72.2	52.0	70.8	65.0	0.74	2.2	82.2
Thiram	78.6	61.8	76.9	72.5			91.0
Captan	78.3	62.3	77.7	72.8			91.3
Phygon XL	75.0	61.7	76.4	71.0			89.4
Tillex	76.5	57.5	72.8	68.9			87.0
Control	72.0	53.0	72.4	65.9			83.3
Total	840.2	653.5	828.7				
Mean	76.4	59.4	75.3				

S.E. = 0.39
C.D. = 1.1

C.D. for interaction = 2.2

In the combined analysis, it was seen that the years 1966 and 1968 were better than 1967 with regard to germination. This low germination was probably due to inadequate rain fall during the period of germination in the year 1967.

Comparing the mean values of germination with the C.D. obtained in Table 2, the fungicides *viz.* New improved ceresan, Captan, Ceresan, Thiram, Arasan and Agrosan proved to be significantly more effective than the rest, thus confirming the results obtained in each year. Treatment with Sulphur dust did not prove to be more effective than the control.

The 'treatment × years' interaction proved to be significant, meaning thereby that the relative efficacy of the treatments varied with the years. Examining the interaction means with the relevant C.D., it was seen that the relative efficacy of the fungicides *viz.* New improved ceresan, Captan, Ceresan, Thiram, Arasan and Agrosan had not interacted with the years. In other words their relative effectiveness was fairly uniform over the three years, whereas the treatments *viz.* Brassicol, Phygon and Tillex varied in their relative efficacies over the three years.

2. *Root rot incidence:* The results on root rot incidence showed that the treatment differences were significant during all the three years. Comparing the fungicides with the control, the treatments Sulphur dust, Brassicol and Tillex were found to be on par with the control during all the three years, denoting that these fungicides were not effective enough in controlling post-emergence root rot. All the other fungicides proved to be equally effective in controlling the disease.

TABLE 3. *Analysis of variance table – pooled data on post-emergence root rot (transformed values)*

Variation due to	D.F.	S.S.	M.S.S.	F Value	
				Actuals	Table
Replications	3	1.22	0.41	—	—
Treatments	10	270 84	27.08	4.27 ** (10,20)	2.77–P=0.05 4.41=P=0.01
R × T	30	116.69	3 87	—	—
Years	2	1211.90	605.95	95.57 * (2,20)	19.44–P=0.05 99.45–P=0.01
Y × R	6	5.75	0.96	—	—
Y × T	20	126.75	6.34	5.61 ** (20,60)	1.92–P=0.05 2.56–P=0.01
Y × R × T	60	67.95	1.13	—	—
Total	131	1800.50			

The data obtained for all the three years were also combined in order to find out the average response for the various treatments on disease control. The analysis of variance table with respect to the combined data, as well as the table of means are presented in Table 3 and 4 respectively.

TABLE 4. *Table of means – Root rot incidence (transformed values)*

Treatments	Years			Mean	S.E.	C.D.	Mean percentage values
	1966	1967	1968				
Agrosan GN	2.5	6.5	8 9	6 0			1.1
Ceresan (Dry)	2.1	5.3	8.3	5.2			0.8
New improved ceresan	2.7	5.3	9.0	5.7			1.0
Arasan	2.8	5.0	8.6	5.5			0.9
Brassicol	4.0	7.1	14.9	8.7			2.3
Sulphur dust	4.5	7.4	15.7	9.2			2.6
Thiram	3 0	5.3	9.1	5.8	0 73	2.1	1.0
Captan	2 5	5.9	7.9	5.4			0.9
Phygon XL	2.5	5.9	8.3	5.6			1.0
Tillex	3.5	6.1	12.1	7.2			1.6
Control	4.8	7.5	13.3	8.5			2.2
Total	34.9	67.3	116.1				
Mean	3.2	6.1	10.6				

S E. = 0.38
C.D. = 1.1

C.D. for interaction = 1.5

It was seen from the combined analysis that with respect to the intensity of infection, there was extreme variation among the years and during 1968 maximum infection was recorded.

The treatment differences also proved to be significant on testing against 'Y × T', Sulphur dust, Brassicol and Tillex did not prove to be more effective than the control. The fungicides *viz.* Ceresan, Captan, Arasan, Thiram, New improved ceresan, Phygen and Agrosan were equally efficacious in controlling post-emergence root rot. These treatments had also not interacted with the years, meaning thereby their effectiveness was not materially affected by the seasonal variations.

3. *Yield*: The yield data obtained for the three years were statistically scrutinised. Only during the year 1967, the treatment differences were significant. The fungicides *viz.* Captan, New improved ceresan and Ceresan had recorded significantly higher yields, closely followed by Arasan and Thiram.

The plot-wise yield data obtained every year were pooled and analysed to find out the average response of the treatments on yield. The analysis of variance table with respect to the combined data as well as the table of means are presented in Tables 5 and 6 respectively.

TABLE 5. *Analysis of variance table – pooled data on yield of pods in gms*

Variation due to	D.F.	S S.	M.S.S	F Value	
				Actuals	Table
Replications	3	13158002	4386000.6	—	—
Treatments	10	4558056	455805.6	2.06 (10,20)	2.77—P=0.05
				2.86* (10,80)	2.61—P=0.05 4.05—P=0.01
R × T	30	9024981	300832.7	—	—
Years	2	125022562	62511281.0	281.96** (2,20)	19.44—P=0.05 99.55—P=0.01
Y × R	6	2521405	420234.2	—	—
Y × T	20	4434012	221700.6	1.65 (20,60)	1.92—P=0.05
Y × R × T	60	8284008	138066.8	—	—
Pooled error	80	12718020	158975.3	—	—
Total	211	179721046			

TABLE 6. *Table of means – Yield of pods in gms*

Treatments	Years			Mean	S.E.	C.D.	Mean percentage of yield
	1966	1967	1968				
Agrosan GN	1915.5	4226.3	3577.5	3239.8			107.2
Ceresan (Dry)	1939 3	4722.5	5603.8	3421.8			113.2
New improved ceresan	2271.8	4733.8	3926.3	3643.9			120 5
Arasan	2428 5	4455.0	4288.8	3724.1			123.2
Brassicol	1866.0	4008.0	4002.5	3292.4			108.2
Sulphur dust	2102.3	3908.8	4158.8	3389.9			112.1
Thiram	2136.8	4431.3	3801.3	3456.4	115.1	325.5	114.3
Captan	2075.5	4752.5	3898.8	3575.6			118.3
Phygon XL	1863.0	4200.0	4093.8	3385.6			112.0
Tillex	2271.8	4051.3	3741.3	3354.8			111.0
Control	1742.3	3813.8	3512.5	3022.8			100.0
S.E.	216.3	200.6	239.3				
C.D.	—	579.2	—				

A perusal of Table 5 showed that the interaction 'Y×T' did not prove significant, showing that the treatment effect on the yield are not influenced by the seasonal variations. The sum of squares for 'Y×T' and the three

factor interaction 'Y×R×T' were, therefore pooled and on testing the treatment M.S., against this pooled error, it was found to be significant. Thus, the fungicides were significantly difierent in their effect on the yield, irrespective of the seasonal variations. The treatment Arasan had recorded the best yield. New improved ceresan and Captan rated next, closely followed by Thiram, Ceresan and Sulphur dust. The results on germination root rot incidence and yield are presented graphically in Figure 1.

Further, in the year 1967, all the aspects under investigation viz., germination, post-emergence root rot and yield were significantly influenced by the treatments or in the other words, the treatment effects on the above characters were well pronounced. A correlation study was therefore attempted among the different pairs of characters (viz., germination-yield, germination-post-emergence root rot incidence and root rot incidence-yield) with the available 44 values for each character.

Significant relationship was detected only in the case of the pair germination-yield. The value of the correlation coefficient (r) obtained was 0.483, which was highly significant. The regression coefficient (b) for the regression of yield on germination was found to be 63.10 which also proved significant. Thus, yield was found to increase at the rate of 63.10 grams per plot (14.15 kg per ha) for unit increase in the germination index. The regression line obtained is shown in Figure 2.

The values of 'r' for the relationship between germination-root rot incidence and root rot incidence-yield were very small and not significant.

Combining the results of the above trials it could be seen that the seed dressing fungicides viz., Arasan, New improved ceresan, Captan, Thiram and Ceresan had consistantly established good germination of groundnut, had controlled post-emergence root rot to a considerable extent, at the same time had also recorded increased yields.

The quantity of seed dressing fungicides used for treating the seeds being very small, the cost of the chemical was almost negligible. No special equipment was also necessary for treating the seeds which could be done easily at the time of sowing or a few days prior to sowing without involving much labour. But treating the seeds with suitable fungicides alone had resulted in increasing the yield upto 23 2% over control as evidenced from the above trials.

Discussion & Conclusion: The most apparant factor which can influence the effectiveness of seed treatment is the chemical itself. The basis of selecting suitable fungicides against seed-borne pathogens of groundnut are that the chemicals should be able to establish good germination, control post-emergence wilting to the maximum extent and enhance the yield ultimately. In accordance

Figure.1:Effect of treatments on germination, root-rot incidence and yield.

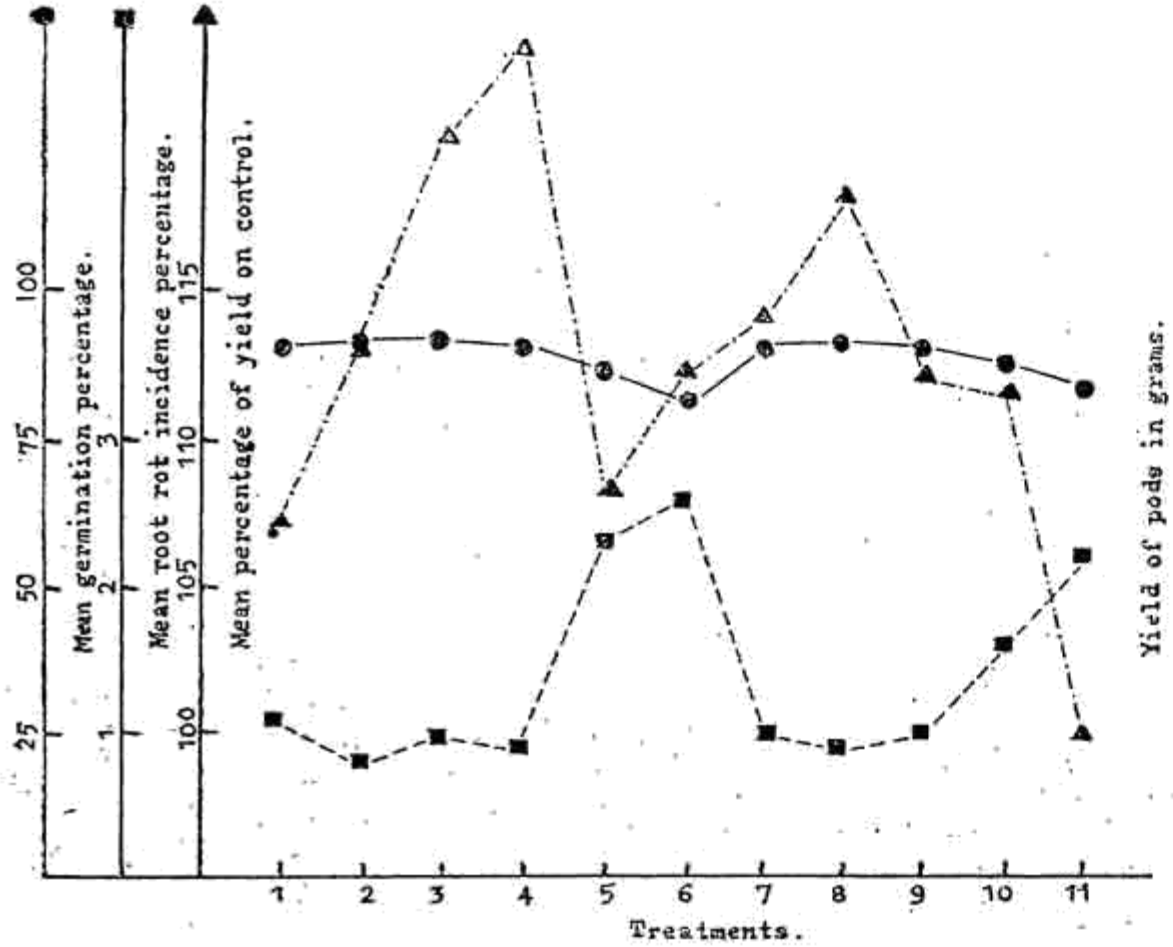
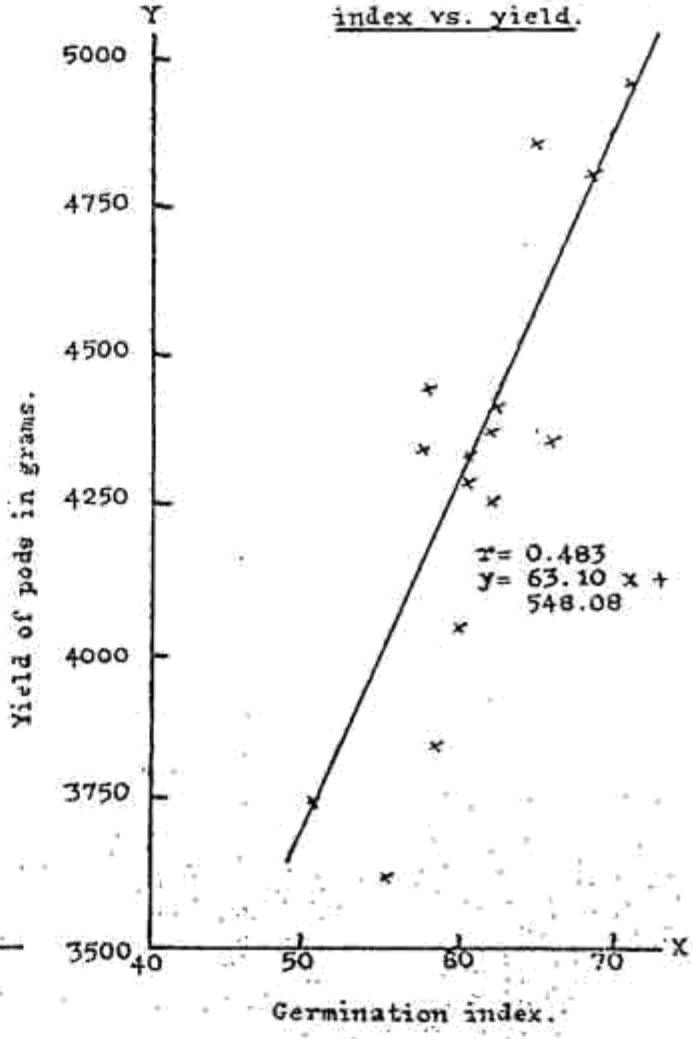


Figure.2:Regression line of Y on X - germination index vs. yield.



with these basic requirements, in the present trials also, the fungicides viz., Arasan, New improved ceresan, Captan, Thiram and Ceresan have recorded significantly higher germination percentage, which may be attributed to the control of pre-emergence root rot. According to Wilson (1948), most of the beneficial results of seed treatment of peanuts is due to prevention of decay prior to germination. Arasan, Spergon and Dow 9-B have given increased germination by 28, 24 and 18% respectively (Anon, 1948). Similarly Bell (1968), has reported that a blend of Captan+Ceresan has proved to be superior in enhancing laboratory germination of seed and promoting increased emergence of seedlings in the field.

It is also evident from the 1967 year's trial, that germination and yield are positively correlated. Establishing good germination and stand is associated with increased yields. The fungicides viz., Arasan, New improved ceresan, Captan, Thiram and Ceresan which have recorded higher germination percentage have also recorded increased yield ranging from 23 2 to 13 2% over control. These fungicides have also minimised post-emergence root rot to a considerable extent, According to Garren (1951), the fungicides Arasan, Ceresan, and Spergon have been tested so frequently that their effectivenesss is definitely established. Ceresan treatment proved to be the most reliable one against seed-borne pathogens of groundnut along with Arasan, Spergon, U. S. Rubber Co. No. 604, Dow 9-B and du Pont 1452 F (Anon, 1946). Negi *et al*, (1957), have reported that treatment of groundnut seeds with Ceresan gives an effective protection against seed-borne diseases during the pre and post-germination period and has also given significantly higher yields.

It is interesting to note that the treatment Sulphur dust has not proved to be effective in enhancing germination or in reducing post-emergence root rot, but has recorded increased yield over a few other fungicides and control. This may be attributed to the nutritional effect of Sulphur, as it is considered to be one of the micro-nutrients essential for plant growth. However, in case the seeds are highly contaminated or if the disease occurs in a severe form, Sulphur may not prove to be an efficient seed dresser as the other fungicides.

The findings in the present trials are in conformity with the findings of many other workers and seed treatment of groundnut with any one of the fungicides viz, Arasan, New improved ceresan, Captan, Thiram or Ceresan may be adopted on large scale to establish higher germination and emergence, to control post-emergence root rot and consequently to increase pod yield in the groundnut growing tracts of the State.

Snmmary: Fungicidal seed treatment trials for the control of 'root rot' of groundnut caused by *Rhizoctonia bataticola* (Taub.) Butl. were conducted

during three consecutive years (1966-'68) at the Regional Agricultural Research Station, Tindivanam, Tamil Nadu. Of the 10 seed dressing fungicides tested, Arasan, New improved ceresan, Captan, Thiram and Ceresan which have established higher germination and emergence, have minimised post-emergence root rot incidence to a considerable extent and have also recorded increased yield ranging from 23.2 to 13.2% over control. The treatments were also found to be highly economical.

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REFERENCES

*Anon. 1946. *Botany Rep. Ga. Exp. Sta.* 1945-1946. 68-77. (c.f. RAM. 27, 1948 : 65).

*Anon. 1948. Annual Report of the Agricultural Expt. Sta , Florida for the year ending June 30, 1947—266 pp. (c.f. RAM. 28, 1949 : 326).

Bell. D. K. 1968. Relationships of peanut seed treatment fungicides to seed microflora and germination and seedling emergence. *Pl Dis. Reptr* , 52 (3) : 240-3.

Garren, K. H. and Coyt Wilson. 1951. Peanut diseases. The peanut. The unpredictable legume. A symposium. The National Fertilizer Association. Washington, D. C. 333 pp.

*Macola, T. 1950. Report of the first groundnut and sun flower conference, 31st August and 1st September, 1950 at Manfredi Expt. Sta., 163 pp. Republica Argentina Ministeria de Agricultura Y—Ganaderia de la Nacein, 1950. (c.f. RAM. 32, 1953 : 120).

Negi, L. S., J L. Dalal and P. S. Rajput. 1957. Treatment of groundnut seed with 'Ceresan' as a control measure against seed borne diseases. *Indian Oil Seed J* , 1 (3) : 158-62.

Puss, G. B. 1962. Peanut diseases in Queensland. *Qd. agric. J* , 88 : 540-53.

Wilson Coyt. 1948. Seed treatments for peanuts. *Ala. Agrl. Expt. Sta Leaflet (Revised)*, 23 : 4 pp.

*Originals not seen.