RESPONSE OF WHITE SPANISH PEANUTS TO APPLIED SULPHUR, INOCULATION AND CAPTAN SPRAYING IN THE WET LOWLANDS OF NEW GUINEA

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ABSTRACT

White Spanish peanuts were sown at Bubia, near Lae with applications of 0, 25, 50 *and* 100 *lb per acre of elemental sulphur. At the same time inoculation and spraying treatments were imposed. There were very highly significant increases in yields of kernels to the applied sulphur up to* 50 *lb per acre. Production of shell increased only slightly. Part of the increased yield can be explained by the significant increase in nut size on sulphur-treated plots. One hundred pounds of sulphur per acre gave a slightly lower yield than* 50 *lb per acre. Responses to inoculation and captan, which both appeared to cause a slight reduction in yield, were not significant.*

INTRODUCTION

FOR some years peanut growers in the Markham Valley have been concerned by reduced yields. Work in Africa (Bockelee-Morvan and Martin 1966) has shown that the application of sulphur at levels of 10 kg per hectare was sufficient to produce significant increases in peanut yields in areas where this element was deficient. Sulphur is believed to increase the oil content of the nuts, and to increase nodulation and the number of nuts remaining attached to the vines (Feakin 1967).

Southern (1967) has reported sulphur deficiency in coconut plantations in three areas near Lae and it is possible that a deficiency of this element could also be influencing peanut yields. An experiment was conducted to determine yield response to sulphur by peanuts. At the same time a check was made on the desirability of inoculation (not commonly practised) and to determine if spraying with a fungicide post emergence could control *Cercospora* leaf spot (*Cercospora personata*).†

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† *Cercospora personata* (Berk. and Curt.) Ellis and Everhart, now *Cercosporidium personatum* (Berk. and Curt.) Deighton (perfect state *Mycosphaerella berkeleyi* W. A. Jenkins).

MATERIALS AND METHODS

The trial was sown at Bubia on a brown clay loam on the 9th to 11th October, 1968.

The treatments were elemental sulphur at 0, 25, 50 and 100 lb per acre, inoculated and uninoculated, and captan sprayed and not sprayed.

Sulphur and inoculation treatments were fully randomized within blocks. Complete blocks were split for captan spraying. There were four replicates.

The size of each plot was 11.25 ft x 33 ft, each plot comprising five rows of peanuts spaced 2.25 ft apart. Distance between seeds within the row was 4 in. This was the most common row spacing and sowing rate used by commercial growers in the Markham Valley (Vance, pers. comm.). There were 32 plots altogether and the total area occupied by the trial was 90 ft x 147 ft.

The seed used in the trial was obtained from two commercial properties in the Markham Valley and was mixed prior to sowing.

Sulphur Application

To ensure the sulphur did not kill the inoculum because of its fungicidal properties, sulphur was placed at a depth of three inches below the surface of the soil. The seed was sown above it at a depth of one inch. The sulphur was therefore not in direct contact with the germinating seed.

Inoculation

Seed sown in inoculated plots was inoculated with *Rhizobium* strain CB 756 immediately prior to sowing. Uninoculated plots were sown first and precautions were taken to make sure no inoculum or inoculated seed was allowed to fall onto these plots.

Fungicide Application

The fungicide used was captan (N-(trichloromethylthio) cyclohex-4-ene-1,2 dicarboximide). It was applied at the rate of 2 lb per acre in 40 gallons of water using a knapsack spray. The initial application was made three weeks after sowing and further applications were made at two-weekly intervals until harvest.

Harvesting

The trial was harvested on 20th January, 1969. At harvest each plot was split into two subplots 11.25 ft x 15 ft. A guard strip of 3 ft was left between captan-sprayed and unsprayed halves of each block. Within subplots three rows 13 ft long were harvested.

Whole plants were pulled and allowed to dry in the sun for three days. After this nuts were detached from the plants and further sun-dried until the kernel rattled in the shell.

Records collected were:—

(1) Yield of nuts in shell;

(2) Yield of kernels; and

(3) Mean number of kernels per ounce.

This last measurement was determined by taking the weight of five random samples of 100 kernels from each treatment and from this determining the mean number of nuts per ounce. This measurement is of importance as export quality nuts must have no more than 57 kernels per ounce.

RESULTS AND DISCUSSION

Response to Inoculation

No visual response to inoculation was apparent at any stage. Two months after sowing three plants from each treatment were pulled from each treatment block and observations made on the number and size of nodules present. All plants were well nodulated and there was no indication that nodules on inoculated plants were any more efficient than those on uninoculated plants. The mean yield of kernel from inoculated plots was 1836 lb acre and that from uninoculated plots was 1882 lb per acre. Analysis showed that the values were not significantly different.

Response to Fungicide

All plots, sprayed and unsprayed, showed evidence of *Cercospora,* to the extent of two or three spots per leaf. On visual assessment of the incidence of disease it was not possible to separate sprayed and unsprayed split blocks. Bockelee-Morvan and Martin (1966) suggest that the application of sulphur increased the general health of the plants by limiting *Cercospora* attack. This may have occurred in this trial; however plots with no sulphur did not show increased infection within unsprayed subblocks.

The mean yield from sprayed plots was 1843 lb kernels per acre, while that from unsprayed was 1874 lb. The difference between the two treatments was not significant.

Response to Sulphur

(i) *Yield*

The mean yield of nuts in shell and kernel for the various sulphur treatments is shown in the *Table.* Response to the applied sulphur in production of kernels was very highly significant ($P<0.001$). It is also of interest to note that beyond an application of 50 lb of sulphur per acre there was a slight decline in yield. This would indicate that for the soil concerned the applications had gone beyond the region of maximum response.

Fitting of polynomials to the kernel yield showed that the results were best described by a quadratic equation which was:—

$$Y = 1688.216 + 8.708x - 0.0641x^2$$

where Y=yield of kernel and x=lb of sulphur applied. By differentiating the equation when $\frac{dy}{dx} = 0$, the point of theoretical maximum response to sulphur is obtained; this is with an application of 70 lb of sulphur which should give a yield of 1984 lb of kernel. This point is not necessarily the most economic. This will depend on the relative price of sulphur and peanuts.

Apart from the response to sulphur the yield of the no-sulphur plots is also of interest. Vance (pers. comm.) had found that growers' yields

had declined from 1200 lb kernel per acre to 600 lb. It was popularly believed by the growers that the seed had suffered "genetic decline". The yields from the control plots indicate that under suitable conditions the seed currently being used by Markham Valley peanut growers still has the potential for high yields. It would appear therefore that the reduced yields were related to factors other than decline of seed quality.

(ii) *Seed size*

The mean number of seeds per ounce for the various sulphur treatments is shown in the *Table*. Analysis indicated that overall sulphur treatments were not significant. However partition of the degrees of freedom to compare S— with the three levels of S+ indicated that the comparison was significant ($P<0.05$). The sulphur treatment had therefore significantly increased the size of the nuts.

(iii) *Threshing percentage*

The threshing percentage for the sulphur treatments is shown in the *Table*. Although the differences appear to be very small, analysis showed the sulphur treatment to be significant ($P<0.05$). Partitioning of the degrees of freedom for the sulphur treatments showed that the comparison S— with S+ was very highly significant ($P<0.001$). This means that, in addition to the increased yield overall, the grower would obtain on average over all sulphur treatments an extra 1.6 lb of kernel per 100 lb of nuts threshed.

It would appear therefore that the increased yield can be explained almost entirely on the basis of increased kernel production, part of which was due to the increase in kernel size with sulphur application. There was only a slight increase in amount of shell produced over all treatments (*Table*).

It is apparent that the results cannot be fully explained on the basis of more nuts remaining attached to the vines as a result of sulphur treatments, as threshing percentage can only be determined on the nuts actually harvested.

CONCLUSIONS

The high yield of peanuts from the control plots indicates it is most unlikely that there has been a "genetic decline" of White Spanish peanuts grown in the Markham Valley. Application of sulphur, even at 25 lb per acre, increased significantly nut size and threshing percentage. Response to sulphur treatment of yield of kernels was very highly significant. Most of this was due to an increase in production of kernel, while production of shell increased only slightly over all treatments.

In this experiment sulphur was applied in the form of powdered elemental sulphur. Further work is required to determine the best form of sulphur to use, and to check if similar responses can be obtained on other soil types in the Markham Valley.

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Table.—Response of White Spanish peanuts to applied sulphur

Sulphur Levels (lb per acre)	Yield (lb per acre)			Threshing Percentage	Nuts per Ounce
	Nuts in Shell	Kernels	Shells		
0	2340	1679	661	71.8	49.69
25	2567	1889	678	73.4	47.44
50	2660	1946	714	73.3	47.88
100	2617	1921	696	73.4	47.19