SUSCEPTIBILITY OF VIRGINIA BUNCH PEANUT TO POST-EMERGENCE APPLICATION OF 2,4-D AND RELATED HERBICIDES

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SUMMARY

Applications of 2,4-D or MCPA heavy enough to provide effective weed control may cause serious loss of yield in Virginia Bunch peanuts. Similar applications of 2,4-DB or MCPB have little effect on yield.

I. INTRODUCTION

Virginia Bunch is the main peanut variety grown on the red clay-loam "scrub" soils of the South Burnett district of Queensland. These soils support a variety of broadleaved weed species, and severe infestations frequently occur in growing peanut crops. While the bulk of these weeds are eradicated by inter-row cultivation, those which grow between the plants need to be removed by hand-hoeing. In wet seasons cultivation is sometimes impossible and it may be necessary to weed the entire area by hand-hoeing.

Before this investigation began, several growers had made trial applications of 2,4-D to peanut crops infested with susceptible weeds. It was observed that although the peanut plants suffered a severe initial setback, they appeared subsequently to recover. It was therefore considered desirable to know to what extent yields were reduced by the application of 2,4-D or MCPA to growing peanut crops. Jauffret (1954) had reported that 2,4-D could be used safely, to control a wide range of weeds, 20 days or more after emergence of peanuts, but no other information on the post-emergence use of 2,4-D on peanuts was available. The experiments reported in the present paper were therefore begun to study effect on yield under Queensland conditions.

When the phenoxy-butyric growth-regulating materials 2,4-DB and MCPB became available in 1958 they were included in the experiments, as it was expected that peanuts would be more resistant to these materials than to 2,4-D. While the experiments were in progress, Parker (1958) described a series of observation trials in Africa in which various peanut varieties tolerated heavy post-emergence applications of both chemicals and Rosher (1959) determined the effect of MCPB on yield.

This paper summarizes the results of a series of trials which were spread over the four seasons 1956-57 to 1959-60.

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II. MATERIALS AND METHODS

2,4-D was applied in the form of 50 per cent. amine salt, formulated to Queensland Department of Public Lands specifications. In 1956-57 "United Weedkiller", a 50 per cent. sodium salt formulation, was also used. MCPA was applied as "Methoxone 30", a 27·4 per cent. sodium salt. The 2,4-DB and MCPB formulations used were "Embutox" and "Tropotox" respectively, each 40 per cent. sodium salts. (In this paper all dosage rates are expressed as ounces of acid-equivalent to the acre.) In 1956-57 the spray solution was applied at the rate of 100 gal per ac, using a conventional knapsack sprayer. In 1957-58 a modified garden atomizer was used to apply the treatments at the rate of 15 gal per ac. In all subsequent trials a knapsack sprayer fitted with flat-fan jets was used to apply treatments at the rate of 20 gal per ac. Experience gained during the progress of the trials led to the variations in application rates mentioned.

A single trial in which both Virginia Bunch and Red Spanish varieties were grown was set out, for convenience of planting, as a split-plot randomized block. The remaining trials were all randomized blocks. All trials were replicated four times. The trials were established on soils normally used for peanut production in the South Burnett district. The peanuts were grown in rows 3 ft apart and received normal inter-row cultivation. Every attempt was made to keep the plots free from weeds, so that variations in weed competition would not influence the results. The peanut plants were removed at maturity, cured and threshed in the conventional manner. Yields are expressed as the weight of whole nuts produced. Plot sizes and details of the treatments are given with the results of each trial.

III. RESULTS

Trial 1, 1956-57.—This trial was exploratory, as there was at the time no information on crop susceptibility which could be used as a guide in selecting treatments. Treatments were 4, 8 and 16 oz a.e. of the amine and the sodium salts of 2,4-D, applied six weeks after emergence. The plots were single rows, 30 ft long.

Both formulations affected the crop similarly. Both 8 and 16 oz reduced yield significantly (1 per cent. level), the reductions being about 35 per cent.; 4 oz reduced yield by 3·9 per cent., but the reduction was not significant.

Trial 2, 1957-58.—Following the severe yield reductions of the previous season, a lower range of treatments was selected. These were 3, 4½ and 6 oz of 2,4-D, applied 7 weeks after emergence. The 6-oz treatment reduced yield by 23·2 per cent. and the 4½-oz treatment by 18·2 per cent., the 6-oz reduction being significant at the 1 per cent. level and the 4½-oz at the 5 per cent. level. A reduction of 11·3 per cent. by the 3-oz treatment was not significant.

Trial 3, 1958-59.—The purpose of this trial was to compare the effects of 2,4-D and MCPA on both Virginia Bunch and Red Spanish varieties. Both chemicals were applied at the rate of 6 oz a.e. In this and all subsequent trials

larger plots were used, improvements in harvesting facilities making it possible to deal with greater quantities of harvested material. The plot size varied from trial to trial, but was generally slightly less than one-hundredth of an acre.

2,4-D and MCPA, applied six weeks after emergence, reduced the yield of Virginia Bunch significantly (1 per cent. level) by 23·2 and 27 per cent. respectively. There was no significant difference between the effects of the two treatments. Neither treatment reduced the yield of Red Spanish.

Trial 4, 1958-59.—This trial was intended to determine the effect of 2,4-D applied at different stages of growth. The treatments were $\frac{3}{4}$, $1\frac{1}{2}$, 3 and 6 oz a.e. of 2,4-D, applied 1, 6 and 16 weeks after emergence.

The results were inconsistent, probably because of soil irregularities. In the statistical analysis the only comparisons which were attempted were between the means of the three stages and control, and between the means of the four rates of application and control. Both 6 oz and 3 oz reduced yield significantly, at 1 per cent. and 5 per cent. levels respectively. Applications 16 weeks after emergence reduced yield more severely than applications 6 weeks after emergence, the difference being significant (1 per cent. level). The general level of yield reduction was lower than in previous trials.

Trial 5, 1958-59.—Following favourable results in observation plots, the phenoxy-butyric compounds were used in this exploratory yield trial. The treatments were 2,4-DB at 8, 16 and 24 oz a.e. and MCPB at 16 oz a.e., applied 6 weeks after emergence.

2,4-DB at 24 oz and MCPB at 16 oz reduced yield 15·9 and 14·5 per cent. respectively, both reductions being significant at the 1 per cent. level. 2,4-DB at 16 oz reduced yield by 11·4 per cent. (significant at 5 per cent. level) and at 8 oz by 4·5 per cent. (not significant).

Trial 6, 1959-60.—The purpose of this trial was to compare the effects of 2,4-D and 2,4-DB at three stages of growth. The treatments were 8 oz of 2,4-D, and 8 oz of 2,4-DB and 16 oz of 2,4-DB applied 1, 6 and 12 weeks after emergence.

The 2,4-DB treatments caused small but not significant reductions in yield. The mean yield of the three 2,4-D treatments was lower than the control, by 11·8 per cent. (significant at the 1 per cent. level). The mean of all treatments applied 6 weeks after emergence was significantly (5 per cent. level) lower than the control. This difference was caused almost entirely by variations in the effect of 2,4-D, the actual yield reductions produced by this material being 7·1, 15·3 and 13·1 per cent. at the 1, 6 and 12-week stages respectively.

Trial 7, 1959-60.—In this trial 2,4-D, 2,4-DB and MCPB were applied 6 weeks after emergence. The treatments were 4 and 8 oz of 2,4-D and 4, 8 and 16 oz of 2,4-DB and of MCPB.

2,4-D at 4 and 8 oz reduced the yield significantly (1 per cent. level) by 15·7 and 22·2 per cent. respectively. 2,4-DB and MCPB did not significantly reduce the yield. However, the yields from the 4-oz treatments in each case were slightly higher than the control, and there was a significant difference (at the 5 per cent. level) between the means of the 4-oz and of the 16-oz treatments. There was no significant difference between the effects of 2,4-DB and MCPB.

IV. DISCUSSION

Despite occasional inconsistencies, probably caused by variations in the soil and in seasonal conditions, the results of these trials follow a definite trend.

Figure 1 shows the percentage yield reductions produced by all the 2,4-D treatments applied 6 or 7 weeks after emergence. It illustrates graphically the main principles established by this series of trials, as follows:

(1) 2,4-D and 2,4-DB both reduce yield.

(2) The reduction in yield varies in proportion to the rate of application.

(3) The mean yield reduction is about 3·5 per cent. for each ounce (a.e.) of 2,4-D, and 0·45 per cent. for each ounce (a.e.) of 2,4-DB. 2,4-D is therefore roughly eight times as harmful as 2,4-DB.

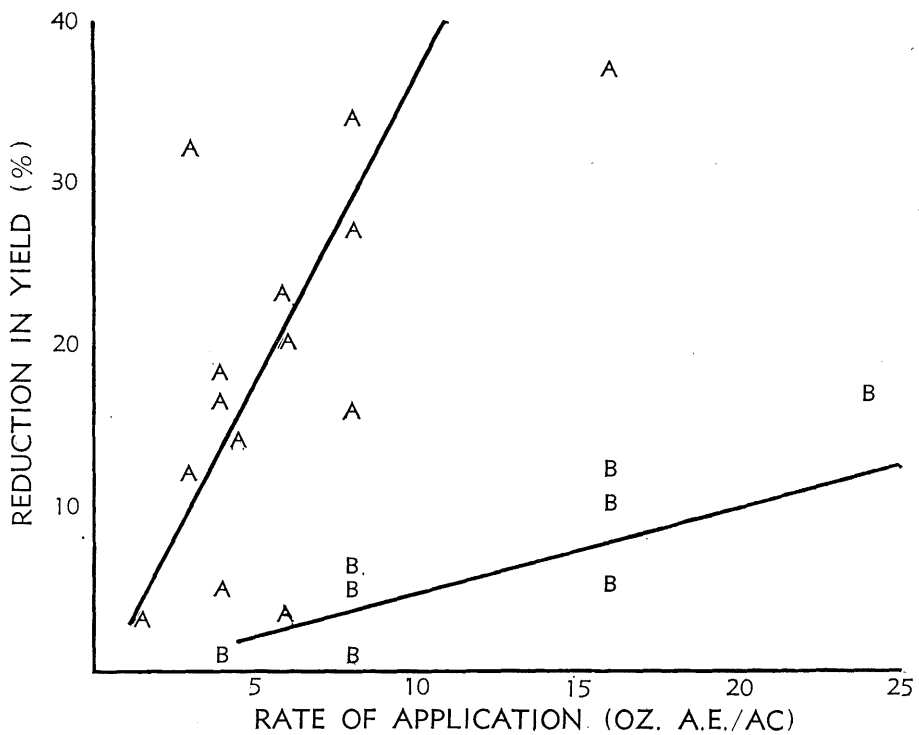

Fig. 1.—Effects of 2,4-D (line A) and 2,4-DB (line B) applied 6-7 weeks after emergence of the yield of Virginia Bunch peanuts.

The attempts to determine the relationship between stage of growth and crop susceptibility have not been entirely satisfactory. Susceptibility is probably also influenced by climatic and soil conditions, and it is unlikely that these external factors will be the same at all stages of growth. Visible crop injury suggests that susceptibility is lowest 1 week after emergence and highest 6 weeks after emergence. The applications 12 weeks after emergence do not produce particularly severe visible injury. At all stages the most obvious injury is caused by 2,4-D treatments. These observations are confirmed by the results of Trial 6. In Trial 4, however, plots which received 2,4-D 16 weeks after emergence suffered a more severe loss of yield than those treated 6 weeks after emergence. Further information on this aspect would be useful. It is possible that 2,4-D could be used very early or very late in the growing season without serious loss of yield. The low toxicity of 2,4-DB might also be further reduced by correct timing.

The trials did not reveal any striking differences in the susceptibility of the crop to closely related formulations. In Trial 1, the sodium and amine salts of 2,4-D behaved similarly. In Trial 3, there was no significant difference between the effect of 2,4-D and MCPA. In Trial 5, MCPB was slightly more injurious than 2,4-DB, but this was not confirmed in Trial 7. The visible effects of similar applications of 2,4-DB and MCPB are indistinguishable.

Although this paper is concerned with the Virginia Bunch variety, it is interesting to note that in Trial 4 the Red Spanish variety was not injured by 6 oz (a.e.) of 2,4-D or MCPA. In another trial, not recorded in this paper, 8 oz (a.e.) of 2,4-D did not reduce yield.

These trials were not intended to provide information on the effects of the treatments on weeds. Occasional observations were, however, possible. It was generally observed that the phenoxy-butyrics were slightly less effective than the phenoxy-acetics. However, it is considered that many of the common weeds, if treated early enough, could be effectively controlled with 8 oz of 2,4-DB or MCPB. Particularly good control of Noogoora burr (*Xanthium pungens*) has been observed.

2,4-DB and MCPB are regarded as reasonably safe herbicides for the selective control of susceptible broadleaved weeds in Virginia Bunch peanut crops. In heavily infested crops, increased yields could be expected to result from the elimination of competition.

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