WEED CONTROL IN FODDER BEET AND MANGOLD CROPS

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Summary

Pyrazon has given satisfactory pre- and post-emergent weed control in both fodder beet and mangolds with negligible adverse effects on either crop. Some weeds were best controlled at the pre-emergent stage and others by post-emergent treatment, but no species completely resistant at both times has been encountered. Post-emergent treatment appears generally superior to pre-emergent, but requires early and precise timing for good results.

INTRODUCTION

ALTHOUGH fodder beet and mangold crops are highly regarded as supplementary feed by most farmers, the acreages grown are very much less than those of brassicas, probably because of difficulty in maintaining crops in the weed-free conditions essential for high yields. Because of their slow initial growth, crops of the beet family are very sensitive to weed competition and, unlike brassicas, cannot be successfully grown without considerable attention to weed control.

Chemical methods of weed control have in the past usually suffered from too many limitations in crop tolerance and herbicidal efficiency to achieve general acceptance. However, the constant search for improved and more specific weedicides has produced pyrazon which has shown considerable promise in beet crops. At Marton Experimental Area, pyrazon was first compared three years ago in a sighter trial with various other materials such as "Tillam", cycluron/BiPC, CDEC and protham/endothal and, when it was found superior to these, examined in detail in the two trials described in this paper.

EXPERIMENTAL

Both trials were conducted on Marton clay loam with the treatments shown in Tables 1 and 2 applied across parallel sowings of fodder beet and mangold.

In Trial A, Daeno fodder beet and Yellow-globe mangold were sown on October 29, 1964, and pre-emergent treatments applied on November 4, 1964. There was some spread of crop emergence so that, when post-emergent treatments were applied on November 23, 1964, plants ranged in size from cotyledon to the 4-leaf stage.

Crop varieties in Trial B were Rex fodder beet and Yellow-globe mangold sown on October 27, 1965, with pre-emergent treatments applied on October 30, 1965. Post-emergent treatments were applied on November 20, 1965, when most crop plants had two true leaves.

Rainfall in the 7 days after pre-emergent treatment was 1.00 in. for Trial A and 2.30 in. for Trial B. Little rain fell in the two weeks

after post-emergent treatment of Trial A, and for one week after post-emergent treatment of Trial B. Thereafter rainfall was very adequate in both trials.

Plant counts of fodder beet only were made prior to thinning the crops in both trials. In addition to application to the crops, treatments used in both trials were applied to separate weedy areas to obtain information on species inadequately represented in the crop trial sites. Weeds present in the various trial sites were nightshade (*Solanum nigrum*), spurrey (*Spergula arvensis*), redshank (*Polygonum persicaria*), dock (*Rumex obtusifolia*), redroot (*Amaranthus hybridus*), fathen (*Chenopodium album*), hawksbeard (*Crepis capillaris*), twincreep (*Coronopus didymus*), sowthistle (*Sonchus oleraceus*).

At post-emergent treatment, most weeds ranged in size from cotyledon to the four-leaf stage. On Trial A the weed infestation initially appeared very slight but later became severe on controls and ineffective treatments, while on Trial B weed population was fairly high, particularly on the mangold section.

Treatments, which were replicated 5 or 6 times in trials of randomized block design, are quoted throughout this paper in terms of active ingredient per acre, and were applied in 32 gal of water per acre in both trials.

RESULTS

Crops in Trial A were harvested on May 28, 1965, and those in Trial B on May 11, 1966. Pre-thinning plant numbers of fodder beet and green yields of fodder beet and mangold are given in Tables 1 and 2. Results of statistical analysis are available for Trial A only.

TABLE 1: PLANT NUMBERS AND GREEN YIELD—TRIAL A

Treatment (lb)	Fodder Beet		Mangold tons/acre
	Plants/ 10 ft Row before Thinning	tons/acre	
PRE-EMERGENCE			
Propham 3/Endothal 5	54 aA	16.5 dD	18.6 dD
Pyrazon 2	55 aA	16.0 dD	18.8 dD
Pyrazon 4	51 aAB	33.9 bB	37.3 bB
Pyrazon 6	47 abAB	38.2 abAB	46.8 aA
POST-EMERGENCE			
Pyrazon 2	54 aA	25.2 cC	25.5 cC
Pyrazon 4	50 abAB	37.0 abAB	37.9 bB
Pyrazon 6	41 bB	42.9 aA	44.9 aA
Weeded control	54 aAB	38.8 abAB	37.6 bB
Control	53 aAB	9.1 eD	10.2 eE

TABLE 2: PLANT NUMBERS AND GREEN YIELD—TRIAL B

Treatment (lb)	Fodder Beet		Mangold tons/acre
	Plants/ 10 ft Row before Thinning	tons/acre	
PRE-EMERGENCE			
Pyrazon 3	29	26.2	38.9
Pyrazon 5	25	31.5	46.6
Pyrazon 3/Lenacil ¼	21	25.5	36.1
Pyrazon 3/TCA 10	28	26.6	39.2
Pyrazon 3/Endothal 5	28	30.8	41.1
POST-EMERGENCE			
Pyrazon 3	26	24.8	38.2
Pyrazon 5	24	27.9	44.6
Weeded control	27	31.2	47.7
Control	27	6.1	7.6

Yields in both trials were directly related to the level of weed control achieved. Those of Trial A illustrate the marked superiority of pyrazon over the propham/endothal mixture and also the superiority of post-emergent applications of pyrazon over pre-emergence treatment, particularly at the marginal 2 lb rate. Pyrazon 4 and 6 lb at both the pre- and post-emergence stage gave yields which, in terms of statistical significance, were equal to or better than those of weeded control.

In Trial B, weed control by pyrazon 3 lb pre-emergent was slightly inadequate, with a consequent reduction in yields. Of the three materials added to pre-emergent pyrazon to improve grass weed control, only endothal gave evidence of yield improvement while lenacil appeared to reduce yields, particularly of mangolds. The poor yields from post-emergent pyrazon compared with Trial A were largely the result of competition from sowthistle which is unaffected by pyrazon at this stage.

CROP TOLERANCE

As no difference could be seen between fodder beet and mangold in tolerance to any of the treatments, the rather laborious plant counts were confined to fodder beet only.

Trial A confirmed the high degree of crop tolerance to the propham/endothal mixture which had been noted in earlier trials.

In the widely varying conditions of the two trials described and of the earlier sighter trial, pyrazon at rates up to 4 lb either pre- or post-emergent had little or no adverse effect on crop numbers or growth. Both 5 and 6 lb pre-emergent caused a slight reduction in seedling numbers but this was of little consequence. Post-emergent applications of these higher rates appeared to be rather more damaging, plant counts in Table 1 indicating a 20 to 25% mortality where 6 lb was applied at this stage. However, the plants which suffered damage were mainly late emerging seedlings still in the cotyledon stage at treatment. Plants which had reached the two-leaf stage were unaffected.

When used as additives to pre-emergent pyrazon, trichloroacetic acid and endothal had no effect on either crop, but the lenacil

appeared to reduce both numbers and yield. With this one exception, yields reductions in both trials were the result of weed competition rather than treatment toxicity.

WEED CONTROL

The propham/endothal mixture has given consistently good control of redshank, spurrey, dock and redroot but is ineffective on fathen and nightshade, with often only fair to poor control of hawksbeard, sowthistle and twincress.

When applied pre-emergent under suitable moist soil conditions, pyrazon controlled spurrey and sowthistle at the low rate of 2 lb. Under average conditions, at 3 to 4 lb control of redshank and twincress was good and that of dock and hawksbeard adequate, but 5 lb was required for good pre-emergence control of fathen, nightshade and redroot, although some of all these latter species survived even at 6 lb if the soil tended towards dryness.

Post-emergent application of pyrazon at an early stage of weed growth—cotyledon to two-leaf—was generally superior to pre-emergent treatment, particularly under drier soil conditions. Observations indicate good control of the more competitive species, such as redshank, nightshade, spurrey, redroot, fathen and hawksbeard, with 3 lb at this early stage. But susceptibility of many species, particularly spurrey, fathen, redroot and nightshade, declined rapidly with even slight development beyond the early two-leaf stage, and these species were often inadequately controlled by 5 lb once the four-leaf stage was reached. Sowthistle and twincress appeared unaffected by post-emergence pyrazon at 5 lb, and the yield reductions in the post-emergence treatments of Trial B were mainly due to competition from an uncontrolled infestation of sowthistle.

Lenacil, trichloroacetic acid and endothal were combined with 3 lb pyrazon pre-emergent primarily to improve grass weed control but no grasses occurred in the trial area. Lenacil and trichloroacetic acid had little effect on broadleaved weeds but endothal definitely improved control of most species other than fathen and nightshade.

DISCUSSION

When work on beet and mangold weed control at Marton was last reported (Thompson, 1963) the most suitable weedicide then available was the propham/endothal mixture. This material is extremely well tolerated by all the beet crops and gives adequate control of a fair range of weeds, but the resistance of such highly competitive species as fathen and nightshade render it of little value where these species are dominant.

Trial evidence over a period of three years shows that pyrazon at herbicidally efficient rates either pre- or post-emergence is adequately tolerated by fodder beet and mangolds and is capable of controlling most of the common weeds of these crops. The minimum rate for positive pre-emergent control of a mixed weed population on the Marton soil with average moisture appears to be 4 to 5 lb, although spurrey, redshank, twincress and sowthistle would be well controlled by about 3 lb under suitable moist soil conditions. When applied pre-emergence to dry soil, pyrazon is largely ineffective, but is immediately activated by adequate rainfall, when a rate of 5 lb will control emerged weeds up to the late two-leaf stage.

Post-emergent treatments of pyrazon have usually proved superior in overall weed control, particularly with drier soil conditions, and 3 to 4 lb at this stage should give adequate control of most weeds, provided treatment is made at the earliest possible stage of weed growth consistent with satisfactory crop tolerance. When conditions for crop growth are good, no particular difficulty should be experienced in achieving treatment of weeds at the optimum cotyledon to two-leaf stage, as plant counts and observations indicate seedlings of both fodder beet and mangold to be adequately tolerant of rates up to 4 lb at the early two-leaf stage which, in good growth conditions, is reached 2 to 3 weeks after sowing. When treatment is delayed until the majority of weeds have four leaves, a rate of 5 lb is necessary, but application of this rate should be avoided until crop plants have two fully developed true leaves, probably 3 to 4 weeks after sowing.

No information on grass weed control was obtained from these trials, but manufacturers' literature indicates that pyrazon will control *Poa annua*, crabgrass (*Digitaria sanguinalis*) and barnyard grass (*Echinochloa crusgalli*). However, a further recommendation in the same literature to include trichloroacetic acid where grasses are a problem suggests that the material should be considered as weak on grasses.

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REFERENCE.

Thompson, A., 1963: *Proc. 16th N.Z. Weed Control Conf.*: 60-4.