Tolerance of wheat to metribuzin

D. Nicoll
Bayer Australia Ltd.
P.O. Box 225, Glen Waverley 3150, Victoria

SUMMARY

This paper summarizes the results of nine trials conducted in the 1974 and 1975 cereal seasons to establish the factors influencing the tolerance of wheat to metribuzin.

Results indicated that metribuzin could be used at rates up to 200 g a.i./ha on heavier soils and 150 g a.i./ha on lighter soils provided application was made avoiding the period between 6 to 8 weeks after sowing to crops sown deeper than 2.5 cm. The influence of wheat variety and rainfall either side of the 6 to 8 week post sowing period were not found to be significant factors.

INTRODUCTION

During the 1972 and 1973 cereal seasons preliminary investigations were made of factors influencing wheat tolerance to metribuzin. It was found that wheat growing in Mallee sandy loam would not tolerate 175 g a.i./ha metribuzin when sprayed at the four to five leaf stage, but wheat growing on self-mulching Wimmera clay loam tolerated rates up to 260 g a.i./ha metribuzin when treated at the one leaf stage of growth. In a rate x time of application trial, conducted on red-brown Wimmer clay loam, wheat tolerated 175 g a.i./ha metribuzin when sprayed at the three to four leaf stage but was considerably thinned when sprayed at the tillering stage.

It was against this background that a series of nine trials was conducted in the 1974 and 1975 cereal seasons to evaluate the factors influencing wheat tolerance to metribuzin. This paper summarizes the results of these trials.

METHOD AND MATERIALS

A trial design was used which considered rate of metribuzin and time of application as the main factors. By geographical distribution of the trial sites it was possible to cover the variations in crop variety, soil type and rainfall. In the 1974 cereal season rate x time of application trials were conducted on weed-free sites at Bordertown, Lalbert, Buckrabanyule and Murtoa. In the 1975 cereal season two further trials were conducted at Henty and Wail, again on weed-free sites. The trial design used was a randomized complete block with four replicates and a split plot for time of application. A plot size of 4 m x 10 to 20 m was used according to crop and soil uniformity. As a result of experience gained by Ward (personal communication) in 1972 and 1973 metribuzin was applied at 0, 50, 100, 150 and 200 g a.i./ha on heavier soils and at 0, 50, 75, 100 and 150 g a.i./ha on lighter soils. Each treatment was repeated at four application times to previously untreated crop.

In the 1974 cereal season the first application was made pre-emergence of the crop with subsequent applications at approximately 14 day intervals. Pre-emergence treatments were omitted in 1975 because it was felt that the chemical would not be used in this way. This allowed inclusion of a late post-emergence treatment often made by farmers (if inadvisedly) when crops are 8 or more weeks old.

The influence of depth of sowing was investigated separately. Three trials were initiated. At two sites, crop was sown 1 to 3, 3 to 5 and 5 to 7 cm below the surface. At the first site (Bordertown) metribuzin was applied at 0, 50, 100, 150 and 200 g a.i./ha at the pre-emergence and tillering stages. At the second site (Sea Lake) metribuzin was applied at 0, 50, 75, 100 and 150 g a.i./ha to wheat at the two leaf stage of development. In the third trial at Waitchie a factorial design was used to measure the influence of metribuzin at 0, 75 and 150 g a.i./ha when applied to crop at the two to three leaf and four to five leaf stage of development which had been sown 1 to 3 cm and 5 to 7 cm below the soil surface.

A similar series of assessment techniques was used at each trial site. Counts were made of crop establishment following application, fertile tiller production and grain yield. Observations of crop yellowing and any abnormalities that could be linked with treatment effect were also recorded. The count of crop establishment following application was conducted after the last application of herbicide and was used to indicate any reduction in the number of plants after treatment. At Wail in 1975 crop establishment counts were taken 2 weeks following each application time and also as an overall assessment following the last application. It was found that the overall assessment was more accurate as the separate assessments were influenced by the increasing difficulty in determination of individual wheat plants as they became older. In the overall assessment the difficulty in individual plant differentiation applied equally to all treatments at each application timing.

Both the assessment of crop establishment following application and fertile head production were obtained by counting plants or tillers found in 1 m of drill row. Eight counts were made per plot. All counts were made in such a way as to avoid the stop, start and swath edge effects of application.

In the 1974 trials and the trial at Wail in 1975 yields were taken using a Hege 125 harvester. In all trials application error at the start and finish of the plot was disposed of by removing 1 m of crop from each end. A 1.25 m cut was taken from the centre of the plot. The Henty trial was not harvested due to an infestation of take-all (*Ophiobolus graminis*) which severely influenced wheat heads in many plots.

RESULTS AND DISCUSSION

Visual observations indicated a range of phytotoxicity symptoms in wheat due to metribuzin. Mild phytotoxicity was observed as a general yellowing of wheat leaves 2 weeks after application which disappeared within a further 2 weeks. In more severe cases there was increased yellowing in association with leaf tip necrosis followed by complete leaf necrosis and plant death.

Assessments of crop establishment following application, fertile tiller production, and grain yield suggested that a small reduction

in crop establishment did not necessarily reduce grain yield. Hence it was necessary to differentiate between a no-visible-effect situation and a level of phytotoxicity which caused no reduction in grain yield. It was found that a mild yellowing of the crop had no effect on crop establishment following application and consequently no effect on yield. A more distinct yellowing together with some leaf tip necrosis was invariably associated with a reduction in crop establishment, although this was not reflected in grain yield. Thus wheat yielded normally even after moderate metribuzin injury. However it was considered that even mild leaf tip necrosis would be unacceptable to growers, regardless of the lack of yield reduction associated with this appearance, and as a result it was decided that a treatment would be considered unacceptable if leaf necrosis occurred. It was on this basis that the influence of the following parameters on wheat tolerance to metribuzin were assessed.

Rate of application

The rate x time of application trials demonstrated that wheat could tolerate metribuzin at rates up to 200 g a.i./ha on heavier soils and up to 150 g a.i./ha on lighter soils. This corresponded with earlier work conducted by Ward (personal communication) during 1972 and 1973.

Time of application

In trials conducted on heavier soils metribuzin at rates up to 200 g a.i./ha was tolerated by wheat when applied within 6 weeks of sowing. It was found that rates at, and above, 150 g a.i./ha caused phytotoxicity when applied in the period 6 to 8 weeks after sowing. This period coincided with the development of roots between the wheat seed and the soil surface. Applications at times greater than 8 weeks after sowing appeared equally safe as those applied within 6 weeks of sowing. The same critical period was found on light soils and this occurred with metribuzin at rates above 100 g a.i./ha (Table 1).

Table 1. Effect of age of crop and metribuzin application on tolerance in wheat

Place	Soil type	Wheat leaf stage	Age in days	Rate causing phytotoxicity
Buckrabanyule	loam	3-4	36	> 200 g a.i./ha
Lalbert	sandy loam	3-4	41	> 150 g a.i./ha
Murtoa	red clay loam	4-6	49	175 g a.i./ha
Henty	loam	4-6	50	150 g a.i./ha
Wail	self mulching Wimmera clay loam	6-8	55	200 g a.i./ha
Buckrabanyule	loam	5-6	57	> 200 g a.i./ha
Lalbert	sandy loam	8-10	62	> 150 g a.i./ha

Soil type

In the rate x time of application trials wheat tolerated metribuzin at rates up to 200 g a.i./ha on heavier soils and 150 g a.i./ha on light soils. In Victoria this meant that crops in the Mallee and North Central districts would be restricted to 150 g a.i. metribuzin/ha while the remainder of the State, in particular the North East and Wimmera, would be restricted to 200 g a.i. metribuzin/ha provided the 6 to 8 week post-sowing period was avoided.

Depth of sowing

Phytotoxic symptoms were not observed in all depth of sowing trials. However in the factorial trial at Waitchie statistical analysis demonstrated that rate and time of metribuzin application had a greater significant effect on phytotoxicity in the shallow sown crop than they did on the deeper sown crop. In a trial conducted by Reeves (personal communication) at Rutherglen Research Station where metribuzin was applied at 100 and 200 g a.i./ha to wheat sown at 2.5 cm and 8 cm below the soil surface it was found that the shallow sown crop was more susceptible to metribuzin, particularly at 200 g a.i./ha.

Wheat variety

In the rate x time of application trials, Halberd, Olympic, Summit and Pinnacle varieties were treated. Within the limits of this method of assessing varietal effect no differences could be found in their tolerance of metribuzin.

Rainfall

None of the rate x time of application trials demonstrated phytotoxic symptoms which could be attributed to rainfall. The 1974 cereal trials were conducted in ample soil moisture conditions while the 1975 trials were subjected to an abnormally dry June. The Bordertown trial in 1974 demonstrated a rainfall effect on metribuzin. An application of 150 g a.i./ha was made within the 6 to 8 week post-sowing period on crop growing in sandy soil. This application failed to cause crop phytotoxicity expected as a result of experience in other trials. It is believed that 30 mm of rain over 8 days following the application leached the metribuzin past crop roots or alternatively prevented the metribuzin concentration in the soil from reaching a toxic level.