Dazomet Use for Seedbed Fumigation at the PFRA Shelterbelt Centre, Indian Head, Saskatchewan[1]

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Abstract.--Testing was conducted at the Shelterbelt Centre to allow selection of a suitable fumigant for use in bareroot conifer seedbeds. The major concern was control of damping-off; weed control was secondary. Results of the trials, product handling hazards and ease of application were considerations when final selection took place. The chemical of choice was dazomet and the product currently in use is Basamid. The effectiveness of this product is dependent on careful adherence to application instructions.

INTRODUCTION

Bareroot conifers and hardwoods are produced at the PFRA Shelterbelt Centre, Indian Head, Saskatchewan. The trees go to clients throughout the prairies: primarily in Manitoba and Saskatchewan. Annual production ranges between seven and ten million, of which eight hundred thousand are conifers.

Dazomet is the fumigant currently used to control soil fungi in both the conifer and shrub seedbeds. It was tested in eight trials, over a number of years, at Indian Head. Few problems have been encountered, however, weed control has been inconsistent. Control of soil-borne fungi, especially those which cause damping-off, has been good.

DAZOMET TESTING 1963 - 1969

Dazomet, along with other soil fumigants, was tested during a six year period. Conifer species included Colorado spruce, white spruce and Scots pine.

The first two trials involved testing of dazomet, metam sodium, methyl bromide and allyl alcohol. This number was further reduced to include only damomet and metam sodium in four subsequent trials.

Summaries for the first two trials do not clearly outline the procedure used for fumigant application (ie. application method and incorporation) Morgan (1963 and 1964). The plots were irrigated after treatment and a waiting period of two to three weeks was allowed between application and sowing.

Allyl alcohol at 110-225 litres per hectare and metam sodium at 170-505 kg/ha provided excellent weed control with good conifer germination. Dazomet at 110 kg/ha provided poor weed control one year, excellent the next. At 225 and 335 kg/ha it provided fair weed control one year, excellent the next. Further to this variability, the stand of Colorado spruce and Scots pine was reduced by the two higher rates the first year, but not the second. Methyl bromide application rates seemed to be excessively high, based on current application rates at several nurseries. They ranged from 490 to 1465 kg/ha and this could account for the reduced conifer stands in the first trial. Seedling vigor and growth, in the second year trial, was generally greater in handweeded checks, than in fumigated plots. This could be attributed to reduced seedling density resulting in greater water and nutrient availability per check seedling. Similar conclusions have been drawn by Campbell and Kelpsas (1988).

Due to a concern over the acute toxicity and handling hazards of methyl bromide and the lack of availability of contract applicators, a decision was made to eliminate it from future trials and to concentrate on dazomet and metam sodium.

Rates of testing for metam sodium were initially 170 to 505 kg/ha, later increased to 240 to 575 kg/ha. The range of dazomet rates was increased from 110 to 335 kg/ha initially to 110 to 450 kg/ha. Application methods were inconsistent as summaries indicated that sometimes only irrigation was used for incorporation and sealing; on one occasion the metam sodium was injected and the dazomet was incorporated by tillage; on two occasions the plots were covered, once using burlap and once with polyethylene. The one consistent aspect of all the fumigant treatments was

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the application of irrigation, following treatment, to seal the soil surface.

Weed control in the fall fumigated, spring sown Colorado spruce and Scots pine seedbeds ranged from satisfactory to excellent. Weed control results in the fall sown white spruce were not as good. This could possibly be attributed to the longer period between treatment and the next growing season. The period between treatment and sowing was shorter than for Colorado spruce and Scots pine, but it is unlikely that would have a negative effect on weed control.

All of the fumigant treatments, with one exception, increased emergence and reduced seedling losses, due to damping-off, as compared to the handweeded checks. The single exception was the high rate of dazomet, in one trial, which failed to increase the emergence of Scots pine and white spruce over that in the handweeded check.

Additional Trials 1972 and 1978

Dazomet was adopted for use at the Shelterbelt Centre based on results of the preceding trials and on ease of handling and application. After a few years use, a couple of additional trials were conducted: one to assess polyethylene covered versus non covered plots and one to assess two product formulations, Mylone (50D) versus Basamid (98G) Anonymous (1972 and 1978). Weed control was better in plots where a polyethylene cover was used to provide a seal during treatment than in non covered plots. There was no difference in results between the two product formulations.

OPERATIONAL DAZOMET APPLICATION AT THE SHELTERBELT CENTRE

Application Equipment

As practical experience was gained in the use of dazomet, a refinement in application equipment took place. Originally a 'Gandy' granular spreader was used to apply dazomet (Mylone), followed by raking or shallow cultivation plus harrowing to provide incorporation. Irrigation was then applied to seal the soil surface. Polyethylene covers, to hold in the gases and to prevent the entry of fresh weed seeds, were not adopted for use due to the additional materials and labor costs.

With an innovative machinist on staff, and experience gained through practical application, improvements in application equipment were made. An applicator which applied and incorporated the Mylone in one pass, leaving a prepared seedbed, was designed and fabricated. It was used for a number of years, but gave way to a new applicator when the product Basamid replaced Mylone in the Centre's program. The new applicator was designed along the lines of its predecessor, but incorporated a custom lathed roller instead of a chain link floor mat to distribute the dazomet product. This change was necessitated due to the much finer particle size of Basamid compared to Mylone.

Application Procedure

Current fumigation practices, at the Centre, involve the use of Basamid for both conifer and deciduous shrub seedbeds. The interval between fumigation and sowing varies depending on species: the shortest interval is four weeks for choke cherry (Prunus virginiana melanocarpa (A. Nels.) Sarg.), red elder (Sambucus racemosa L.) and white spruce (Picea glauca (Moench.) Voss.); four to six weeks for Siberian crabapple (Malus baccata (L.) Borkh.), red-osier dogwood (Corpus stolonifera Michx.), Ussurian pear (Pyrus ussuriensis Maxim.), Tatarian honeysuckle (Lonicera tatarica L.) and sea-buckthorn (Hippophae rhamnoides L.); and eight to ten months for Colorado spruce (Picea pungens Engelm.) and Scots pine (Pinus sylvestris L.).

The seedbeds are prepared and left reasonably level. Five days before Basamid application, the moisture content of the soil is brought to at least 507 of field capacity. The Basamid is applied at 350 kg of product per hectare and incorporated to a depth of ten centimetres by means of the shop built equipment previously mentioned. Following application and incorporation, the seedbeds are lightly packed using a roller. Light irrigation, approximately six millimetres, is then applied to complete the seal. For a three to five day period following treatment, sufficient moisture is provided to prevent the soil surface from drying out. After the active fumigation period, the soil can be tilled to aid in the dissipation of any remaining gases. Care must be taken to avoid tilling to a depth greater than that of original application.

In order to be certain that no toxic methyl isothiocyanate or formaldehyde gases are present in the soil at sowing time, a germination test should be performed using a susceptible species such as lettuce or cress (fig. 1).

Figure 1.-- Germination test to detect the presence of methyl isothiocyanate and formaldehyde gases.

CONCLUSION

Basamid, correctly applied, can provide an acceptable degree of weed control and more importantly, at the Shelterbelt Centre, control of soilborne fungi such as pythium, fusarium, phytophtora and rhizoctonia. This is especially important in the conifer seedbeds where seedling losses can be significant.

Seedbed fumigation programs need to be reviewed periodically to determine if they are meeting the original objectives and if they are required.

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