PRELIMINARY EVALUATION OF 2,6-DBN

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SUMMARY

2,6-DBN considered alone or as an indication of the possible effectiveness of other members of the nitrile group of compounds which may be developed warrants further field evaluation due to herbicidal properties already indicated in this paper.

2,6-DBN by virtue of its high toxicity toward weed seeds and bud producing plant organs can be expected to find commercial applications.

There does not appear to be a wide margin of selectivity toward herbaceous annual crops, whereas the tolerance of woody plants should be adequate to achieve effective weed control.

The control of such weeds as Californian thistle (*Cirsium arvense*), twitch (*Agropyron repens*), docks (*Rumex* spp.), and bracken fern (*Pteridium aquilinum* var. *esculentum*) may be possible by applications made during a fallow or soil preparation prior to planting, thereby overcoming the problem of selectivity in susceptible annual crops.

A trial involving the use of 2,6-DBN as a pre-emergence herbicide carried out at Raumati has indicated that the material may have possibilities for the control of weeds in potatoes, maize, peas, and white turnips.

The essential requirement at this stage in the development of 2,6-DBN is an extension of trial work involving the main crops of concern to New Zealand and various application techniques.

References to the phytotoxicity of nitriles have been made in the past, but none has shown sufficient herbicidal activity to warrant further investigation. With the discovery of the herbicidal activity of 2,6-DBN independently at the Woodstock Agricultural Research Centre in the United Kingdom and at the same time in the Netherlands a new group of compounds is shown to have possibilities in the field of herbicides. 2,6-DBN has shown the greatest promise to date.

PROPERTIES OF 2,6-DBN RELATED TO HERBICIDAL USE

2,6-DBN has low solubility in water (20 p.p.m. at 25 degrees C), is appreciably volatile (half life of the order of two days at 40 degrees C and 14 days at 25 degrees C) and of low mammalian toxicity (acute oral toxicity/1,000 mg/k.g.rat).

2,6-DBN is taken up predominantly by plants via the roots, but entry may also occur through the leaves.

There are indications (1) that 2,6-DBN is probably taken up by seeds both in the aqueous solution and as a vapour, with the possibility also that lethal amounts of the herbicide can be absorbed by a dormant seed or by vegetative organs such as tubers and rhizomes.

2,6-DBN has shown a high level of toxicity toward germinating seeds, seedlings, and bud producing organs of both monocotyledon and dicotyledon weed species at relatively low rates of application.

Woody species are reported to be more tolerant than herbaceous plants and sensitivity to the material decreases rapidly with increasing maturity.

The persistence of 2,6-DBN in the soil is affected by the method of application, formulation used, soil, and climatic conditions.

Controllable factors which increase persistence are incorporation of the material within the soil by cultivation, drenching, rainfall after application, and the use of a granular formulation.

FACTORS AFFECTING WEED CONTROL

The effective dosage of 2,6-DBN is influenced by:

1. Soil type (heavy or light).
2. Content of humus in soil. Higher rates required with increased humus content of the soil.
3. Weed species present.
4. Stage of weed growth. Higher rates are required as weed growth advances.
5. Temperature. An increased rate of loss of 2,6-DBN occurs at higher temperatures.
6. Method of application. Since 2,6-DBN is most effective when applied to the soil and taken up by roots application, methods designed to encourage this will assist weed control. 2,6-DBN may be applied as a dust, spray, or in granular form, and the surface application may or may not be followed by incorporation with the soil.

Rotovating or raking the applied material within the top 1 to 2 in. of soil achieves weed control at a lower rate than when applied to the surface only.

RESIDUAL ACTION

The residual action of 2,6-DBN depends on:

1. Rainfall.
2. Soil type.
3. Rate of initial application.

The information available at this early stage in the evaluation of 2,6-DBN does not permit an accurate account of the residual activity of 2,6-DBN within the soil nor its effects on weed and cultivated plant species under a wide range of conditions.

The indications are, however, that relative to compounds such as certain of the triazines, 2,6-DBN possesses a short persistence and land should be safe to crop within a few weeks or months, depending on the method of use.

POTENTIAL USES OF 2,6-DBN

The properties of 2,6-DBN outlined above suggest the following avenues of trial use with this material.

1. Selective application in annual and perennial crops, both pre-emergence and post-emergence.
2. Non-selective application to fallow land or to non-cultivated areas.
  1. A trial involving the use of 2,6-DBN as a pre-emergence herbicide is reported below. The effectiveness of 2,6-DBN applied post-emergence is considered to be of a lower order than when applied pre-emergence. No wide margin of selectivity has been found in herbaceous annuals, but where differences in depth of rooting and/or age of crop and weeds is present, selectivity may be obtainable from post-emergence treatments.

The tolerance of woody crops is however of a much higher order and selective applications to these crops appear to be a definite possibility.

Applications in this group are:

- a. Weed control among orchard trees and vines.
- b. Weed control among berry fruits.
- c. Weed control among ornamental species.
- d. Weed control in forest nurseries.

There are indications that the above species will tolerate upward of 4 lb a.i. per acre of 2,6-DBN, but more widespread trials are required to determine safe application rates.

2. The relatively short persistence of 2,6-DBN relative to such compounds as simazine and the activity it has shown in killing or inhibiting bud growth from stolons, rhizomes, and tubers when applied in the early stages of bud growth suggest that 2,6-DBN may have application for the control of such species as twitch (*Agropyron repens*), Californian thistle (*Cirsium arvense*), docks (*Rumex* sp.) and bracken fern (*Pteridium aquilinum* var. *esculentum*) on fallow land. Application rates of $\frac{1}{2}$ to

2 lb a.i. per acre of 2,6-DBN appear to be worthy of trial for this application.

The use of 2,6-DBN in uncultivated areas for the purposes of total weed control must be considered a possibility, though the volatility of the material would appear to be a disadvantage where incorporation of the material with the soil is impractical.

The use of granular formulations or development of application techniques may offer means of achieving maximum residues of the active material for total weed control purposes.

TRIAL INVOLVING THE USE OF 2,6-DBN AS A PRE-EMERGENCE HERBICIDE

Location: Raumati, New Zealand.

Soil type: Sandy peat.

Soil temperature at 4 in.: 29/9/60, 55 degrees F. 30/9/60, 52 degrees F.

Trial laid down: 29/9/60.

Rainfall: 29/9/60, 0.26 in. 30/9/60, 0.28 in. 1/10/60, 0.23 in. 2/10/60, Nil.

GENERAL

The trial area was rotary hoed and lightly rolled prior to laying down the treatments.

The soil was in excellent seedbed condition with regard to tilth and moisture content.

Spray application of 2,6-DBN 50 per cent wettable powder was made by knapsack, using equivalent of 44 gallons of water per acre as carrier.

Incorporation of the material with the top 1 in. of soil was obtained by hand raking.

CHEMICAL TREATMENTS

1. 2,6-DBN applied at rate of 1 lb a.i. per acre as a surface spray only.
  2. 2,6-DBN applied at the rate above followed by immediate incorporation with top 1 in. of soil.
  3. 2,6-DBN applied at rate of 2 lb a.i. per acre as a surface spray only.
  4. 2,6-DBN applied at rate above followed by immediate incorporation with top 1 in. of soil.
  5. 2,6-DBN applied at rate of 3 lb a.i. per acre as surface spray only.
  6. 2,6-DBN applied at rate above followed by immediate incorporation with top 1 in. of soil.
  7. 2,6-DBN applied at rate of 4 lb a.i. per acre as surface spray only.
  8. 2,6-DBN applied at rate above followed by immediate incorporation with top 1 in. of soil.
  9. Control.
- A 1 ft control strip also separated each treatment.

SOWING TREATMENTS

1. Crop seeds sown immediately after chemical treatment: chou moellier, turnips, swedes, rape, lettuce, carrot, celery, silver beet, peas, maize, potatoes.
2. Crop seeds sown five days after chemical treatment. Crops as above.
3. Crop seeds sown 10 days after chemical treatment. Crops as above.

WEED SPECIES PRESENT

Shepherd's purse (*Capsella bursa-pastoris*)

Willow weed (*Polygonum persicaria*), abundant.

Fathen (*Chenopodium album*), abundant.

Twin cress (*Coronopus didymus*), abundant.

Poa annua abundant.

Nettle (*Urtica dioica*), abundant.

Wireweed (*Polygonum aviculare*), present but scarce.

Chickweed (*Stellaria media*), present but scarce.

Scarlet pimpernel (*Anagallis arvensis*), present but scarce.

SUMMARY OF RESULTS

Potatoes and **Maize** were normal at an application rate of 2 lb a.i. per acre applied as a surface spray. **Peas**, **turnips**, and **chou moellier** were slightly affected, but to a degree which appeared acceptable.

Two pounds a.i. per acre applied as a surface spray only achieved good weed control.

Delaying sowing for five days increased the tolerance of **peas**, **turnips**, and **chou moellier**. A 10-day delay showed no further improvement.

Lettuce, **carrots**, **celery**, **silver beet**, **rape**, and **swedes** appear to be susceptible to 2,6-DBN applied at the above rates as a surface spray and the material appears unsuitable for use on these crops.

Delayed sowing five and 10 days following chemical treatment showed no improvement in these crops.

Potatoes and **maize** sown immediately after 2,6-DBN application and incorporation tolerated 1 lb a.i. per acre. **Peas**, **chou moellier**, and **turnips** were slightly affected, but to a degree which may be acceptable.

Delaying sowing for five days after chemical application increased the tolerance of **peas**, **chou moellier**, and **turnips**. Sowing after 10 days showed no further improvement.

Lettuce, **carrots**, **celery**, **silver beet**, **rape**, and **swedes** were susceptible to 1 lb a.i. per acre surface sprayed and incorporated with the top 1 in. of soil.

Delaying sowing to five days following chemical treatment increased the tolerance of **peas**, **chou moellier**, **turnips** and **swedes**. **Swedes** were still affected to an unacceptable degree.

Increasing the sowing delay to 10 days did not increase the tolerance of the above crops.

One pound a.i. per acre incorporated with the top 1 in. of soil did not achieve good weed control, but this may be considered adequate under conditions of average weed seed infestation. This trial area contained an above average weed infestation as shown by controls.

Acknowledgments

Shell International Chemical Company Limited, London, and Shell Research Limited, Woodstock Agricultural Research Centre.

References

1. An assessment of the new Herbicide 2,6-Dichlorobenzonitrile. G. E. Barnsley, 5th British Weed Control Conference, 1960.