

Evaluation of DAZOMET and MITC emission, and occupational exposure estimation of two DAZOMET formulations during soil mechanical application combined with soil mulching.

Federico Ferrari¹, Andrea Minuto², Diego Bruzzone³, Luca Medini³.

¹ Aelforia Strada Faggiola 12 Podenzano (PC) - Italy
² CeRSAA Centro di Sperimentazione e Assistenza Agricola - Regione Rollo n° 98 Albenga (Sv) - Italy
³ Labcam Centro di Saggio, Regione Rollo n° 98 Albenga (Sv) - Italy



BACKGROUND

Dazomet is a granular pre-plant soil fumigant used against soil-borne fungi, nematodes and weeds. Once incorporated, it converts in soil to methyl isothiocyanate (MITC), the volatile degradation product that drives both efficacy and the inhalation risk.

STUDY DESIGN

Two walk-in tunnels (6.5 m large, 3.2 m high, 60 m length) at CeRSAA (Albenga, Italy) were treated on 22 November 2022, one per formulation. Each granular product was metered below the soil surface by a Meritano MDV mix tiller, incorporated into the top 20–25 cm, then immediately compacted and tarped with a 25 µm gas-tight film buried 20 cm along both plot edges. The product was applied from an open tractor, without cab, as required to enter the tunnel. Operator exposure to dazomet (dust) was sampled with IOM glass-fibre filters at ten body positions, two on the driver seat and two on the machine. Operator exposure to MITC was sampled with sorbent tubes in the breathing zone, over the 5-minute application task. Greenhouse air was monitored for 72 hours: six IOM samplers for dazomet and two sorbent tubes for MITC, changed every 4 hours. Soil deposition was collected on ten Petri-hosted GF-filters per trial.

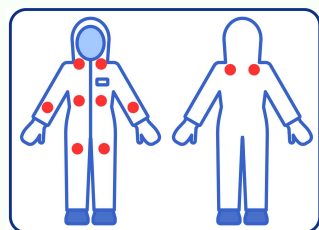


Fig. 1a. IOM dosimeters on the operator (10 positions).

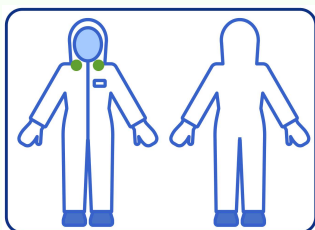


Fig. 1b. Sorbent tubes in the breathing zone.

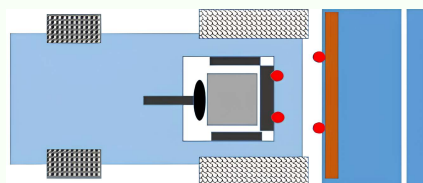


Fig. 1c. IOM dosimeters on the seat and on the machine.



Fig. 2. Tyvek 500 overall, full-face respirator, IOM in place.

OBJECTIVES

To measure operator and bystander exposure to airborne dazomet dust and to MITC vapour during and after the application of two granular formulations applied at 500 kg/ha. To compare dazomet and MITC emission and dissipation between the two formulations applied under identical field conditions, on the same day and site.

Table 1. Trial description. Both formulations were applied on the same day and site, in two walk-in tunnels at CeRSAA (Albenga, Italy).

	Trial 1	Trial 2
Formulation	DAZOMET GR	Basamid Granulat®
a.i. content	95%	98%
Nominal rate	500 kg/ha	500 kg/ha
Applied rate	484.2 kg/ha (-3.2%)	473.9 kg/ha (-5.2%)
Plot surface	145.2 m ² (66 × 2.2 m)	145.2 m ² (66 × 2.2 m)
Incorporation depth	20–25 cm	20–25 cm
Tarping film	Ecotif, 25 µm, buried 20 cm along edges	Ecotif, 25 µm, buried 20 cm along edges
Samples (IOM / GF-filter / tubes)	20 / 10 / 38	20 / 10 / 38

RESULTS

During the 5-minute application, inhalable dazomet in the driver's breathing zone was 170 µg/m³ in Trial 1 and below the limit of quantification (25 µg/m³) in Trial 2; non-detects were set at LOQ. MITC stayed below 15 µg/m³ in both trials. Dazomet deposited on the ten body dosimeters totaled 27.0 µg in Trial 1 and 6.3 µg in Trial 2, while the two machine samplers collected 66.8 and 65.3 µg. Inside the tunnels, MITC rose over two days and peaked in both trials at 51–52 hours after application.

Dazomet (dust) collected during application

■ Trial 1 - DAZOMET GR ■ Trial 2 - Basamid Granulat

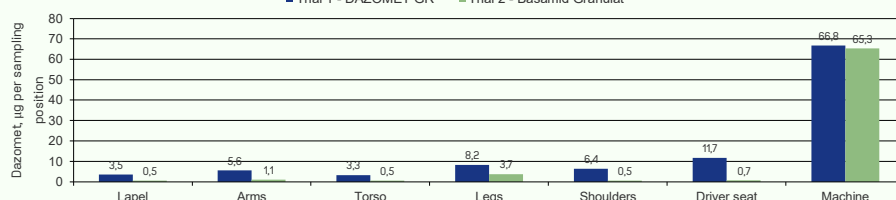


Fig. 3. Sum of the right- and left-side samplers at each position; non-detects set at LOQ (0.25 µg/sample).

MITC air concentration and air temperature

— Trial 1 - DAZOMET GR — Trial 2 - Basamid Granulat

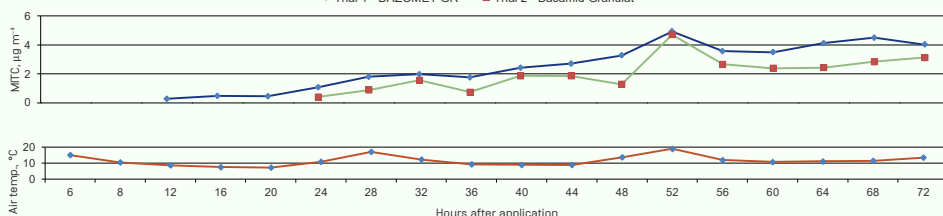


Fig. 4. Mean of the two samplers per event, with mean air temperature over the same window. Individual event times were not recorded: windows are reconstructed between the first start and the last collection.

Airborne dazomet in the tunnels

■ Trial 1 - DAZOMET GR ■ Trial 2 - Basamid Granulat

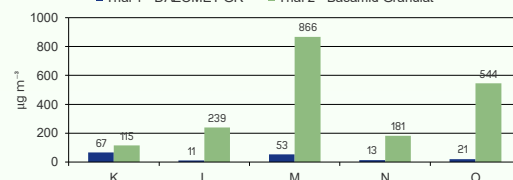


Fig. 5. Sampling points K-O; three Trial 1 values were below LOQ and are plotted at LOQ. Point P is excluded (blocked line).

DISCUSSION AND CONCLUSIONS

The two formulations released comparable amounts of dazomet at the source: the machine dosimeters collected 66.8 and 65.3 µg. What differed was what settled on the tractor – 18 times more on the seat and 4.3 times more on the body in Trial 1. Airborne dazomet inside the tunnel went the other way, being higher in Trial 2. The ranking of the two formulations is therefore not consistent across compartments. MITC rose steadily over the 72 hours in both trials, with a diurnal modulation superimposed: the highest interval, at 51–52 hours, was also the warmest of the monitoring period (19.0 and 18.8 °C). Operator MITC remained below the analytical limit throughout.

References:

- [1] EFSA Journal 2022;20(1):7032 Guidance on the assessment of exposure of operators, workers, residents and bystanders in risk assessment of plant protection products.
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- [4] C.R. Glass et al., EC BCR Information. 2002. The assessment of operator, bystander and environmental exposure to pesticide. Ctr. No. SMT4-CT96-2048

