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Weed control efficacy of a novel dicamba-based nano-herbicide formulation

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Introduction

Dicamba is one of the most widely used auxin-mimic herbicides for broadleaf weeds control.
Due to its chemical traits, dicamba can cause environmental problems, such as off target movement due to volatilization and water contamination.
A new mineral-based dicamba nanoformulation (DNF) was developed in order to increase weed control duration by preventing the premature degradation of the active substance, while limiting the dispersion in the environment. The aim of the study was to assess weed control efficacy of DNF versus a reference commercial dicamba formulation (COM).

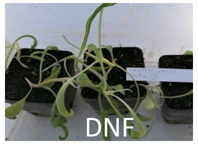
Materials and Methods

PRE emergence test was performed in Petri dishes sowing 20 seeds of *Amaranthus retroflexus* L. (AMARE) and *Centaurea cyanus* L. (CENCY on a filter paper.
Four replicates were imbibed with 5 ml dicamba solutions at 0, 0.24, 0.85, 1.46 $g_{a.s.}$/L concentration of either DNF or COM (as Mondak 21S) and kept in a climatic chamber at constant 25° C. Germination % and radicle+ipocotile length were measured.

POST emergence greenhouse tests were performed on seedlings of AMARE, CENCY, *Abutilon theophrasti* Medik. (ABUTH), and *Chenopodium album* L. (CHEAL).
At 3-4 leaf stage the plants were treated with either DNF or COM at 0, 98, 195, 293 $g_{a.s.}$/ ha.
The efficacy was assessed by measuring fresh aerial biomass.

POST1 test compared the efficacy of fresh DNF vs stored DNF (3 months) and COM.
POST2 test assessed the potential increase of DNF (and COM) efficacy by adding a commercial adjuvant (ADJ) (Dash HC, BASF).

All tests had three replications and treatments were arranged according to a completely randomized design.



Results

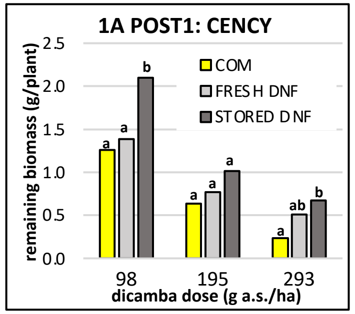
PRE test: no significant differences were found on CENCY; significant differences at medium and maximum doses betweem DNF and COM were found on AMARE (Table 1)

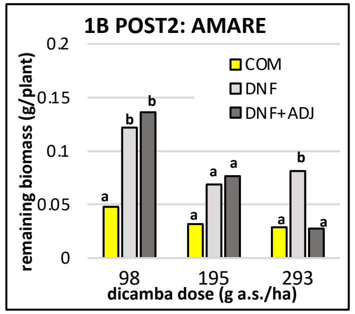
Table 1: AMARE germination percentage in PRE test. Same letters represent non-significant differences between COM and DNF at each concentration according to t test (α ≤ 0.05).

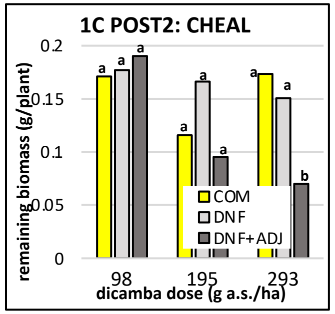
	Treatment concentration (g/L)			
Products	0.24	0.85	1.46	control (0 g/L)
COM	42% a	16% b	17% b	58%
DNF	35% a	0% a	1% a	

POST1 test - CENCY: at lower dose fresh DNF (1.39g) and COM (1.26g) showed similar results. Plants treated with stored DNF had higher biomass (2.10 g) (Figure 1A). At maximum dose, stored DNF was less effective than DNF and COM (0.68 and 0.23 g/plant, respectively). Aerial biomass in untreated control averaged 1.65 g/plant.
ABUTH: no differences between treatments (0.31, 0.34, 0.45 g/plant at medium dose in COM, fresh DNF, and stored DNF, respectively).

POST2 test - AMARE: COM showed a higher efficacy a low dose, while DNF and DNF+ADJ were not significantly different to each other (0.05, 0.12, 0.14 g/plant, in COM, DNF and DNF+ADJ, respectively); at maximum dose, ADJ significantly increased efficacy of DNF (Figure 1B); aerial biomass in untreated control averaged about 0.30 g/plant.
CHEAL: no differences between treatments (0.27 g/plant on average), except at the maximum dose, where DNF+ADJ showed lower biomass (Figure 1C).







Treatments sharing same letters are not significanlty different (RGWF, α ≤ 0.05)

Conclusions

DNF showed good weed control efficacy at medium and high doses compared to COM.
Nanoformulation is affected by storage duration.
Adjuvants can increase nanoformulation efficacy, allowing DNF to reach comparable results to reference commercial formulation.

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