University of East Anglia

DMSP: A next-generation biostimulant

Boosts crop yields

Strengthens plants against abiotic stresses

Tested in foliar and soil drenching applications in crop plants

Evaluation and Licensing Opportunities

For further information on this technology and evaluation / licensing opportunities please contact:

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Tech ID: 24.710

Patent Literature

Published: WO 2026/027888

Dimethylsulfoniopropionate (DMSP) is a naturally occurring organosulfur compound produced in remarkable quantities by marine phytoplankton, seaweeds, and certain higher plants. Within these organisms, DMSP functions as a multifunctional stress regulator—acting as an osmolyte to maintain cellular water balance, an antioxidant to neutralize reactive oxygen species, and a cryoprotectant that safeguards cells in cold environments. Its influence, however, reaches far beyond its producers: once metabolized by marine microbes, DMSP gives rise to dimethyl sulfide (DMS), a climatically active gas that drives cloud formation and plays a central role in the global sulfur cycle. First discovered in marine algae in the mid-20th century, DMSP is now recognized as one of the most abundant organosulfur molecules in the oceans, underscoring its pivotal role in marine ecosystems and even in regulating Earth's climate. Today, its unique capacity to enhance cellular resilience is placing DMSP at the forefront of innovative research and commercial applications.

Building on groundbreaking research published in Nature Communications, where the three key steps of DMSP biosynthesis were successfully identified in selected *Spartina* species, Dr. Ben Miller and colleagues at the University of East Anglia have now taken an important step toward agricultural application. Their studies show that applying DMSP directly to crop plants delivers a **long-lasting increase** in leaf DMSP levels—whether introduced via root drench (Figure 1) or foliar spray (Figures 3 and 5). Not only are the DMSP levels sustained, but there are also beneficial responses in plant stress and chlorophyll, and positive effects on growth and biomass in both stress and non-stress conditions. These effects are seen in a range of different crop species and in different environments and conditions. These findings position DMSP as a promising new biostimulant with clear potential to enhance crop resilience and performance.

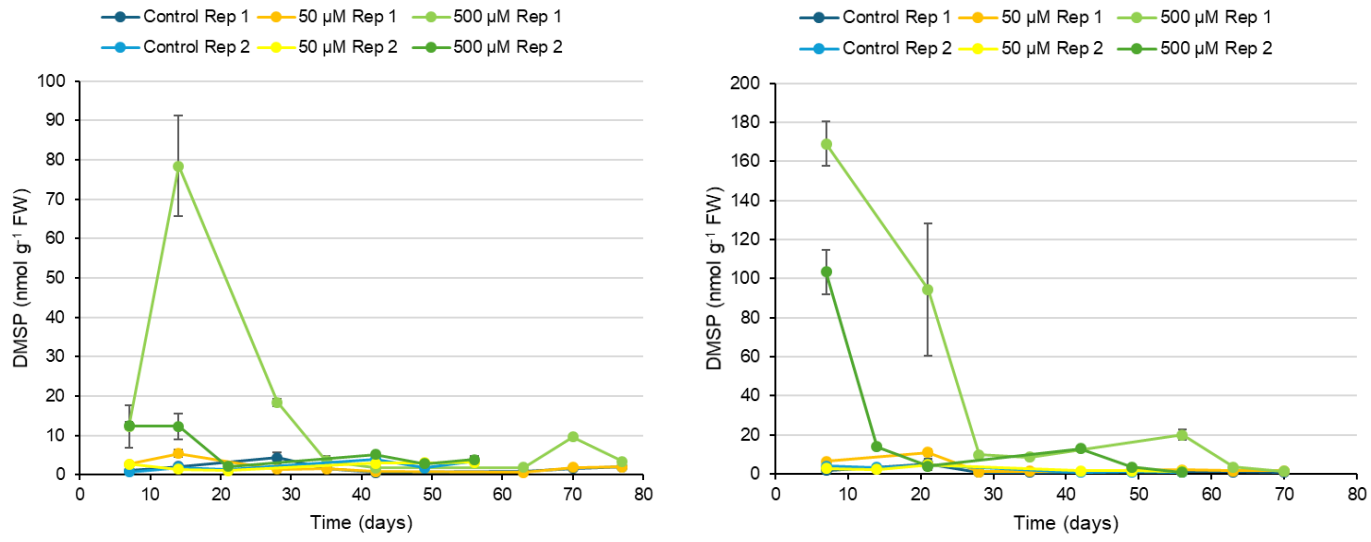

Figure 1: DMSP supplementation in soil leads to long-lasting increases in DMSP concentrations in the leaf: Single root drench applications of DMSP were made at day 0 in *Solanum lycopersicum* (tomato; left panel) and *Hordeum vulgare* cv. Golden Promise (barley; right panel). Plants were grown in controlled environment rooms.

The proven persistence of DMSP in plants, whether applied via root drench or foliar spray, means its benefits last longer, reducing the need for repeated applications across the crop cycle. Building on this extended presence, the inventors tested DMSP's impact on crop performance under stress. The results were striking: tomato plants gained stronger resistance to both salt and oxidative stress (Figure 2), barley showed a clear boost in biomass, especially under non stress conditions (Figure 4), and wheat demonstrated a significant increase in chlorophyll content and biomass even under normal growing conditions pointing to clear yield benefits beyond stress tolerance (Figure 6). Together, these findings highlight DMSP as a powerful new biostimulant capable of strengthening plants, protecting yields, and delivering consistent performance across a range of conditions.

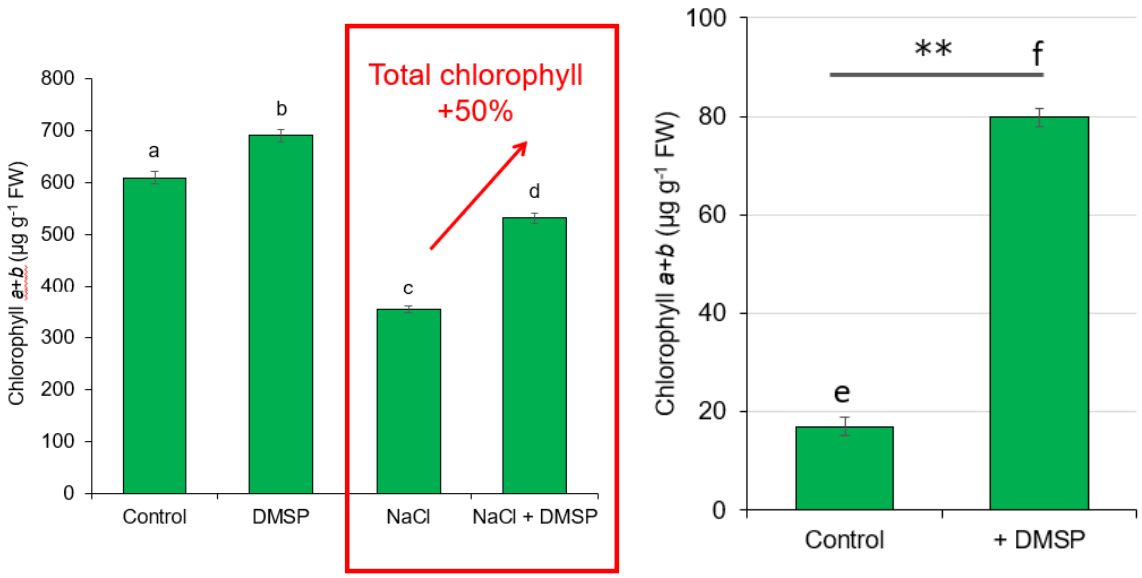

Figure 2: DMSP supplementation in soil allows plants to tolerate salt and oxidative stress: Tomato plants were grown in soil and DMSP was applied as a root drench. Columns a) and b) show that there is an increase in chlorophyll content under non stress conditions this difference is comparatively higher after salt treatment (columns c) and d)) and even more so after treatment with 1 mM paraquat (columns e) and f)).

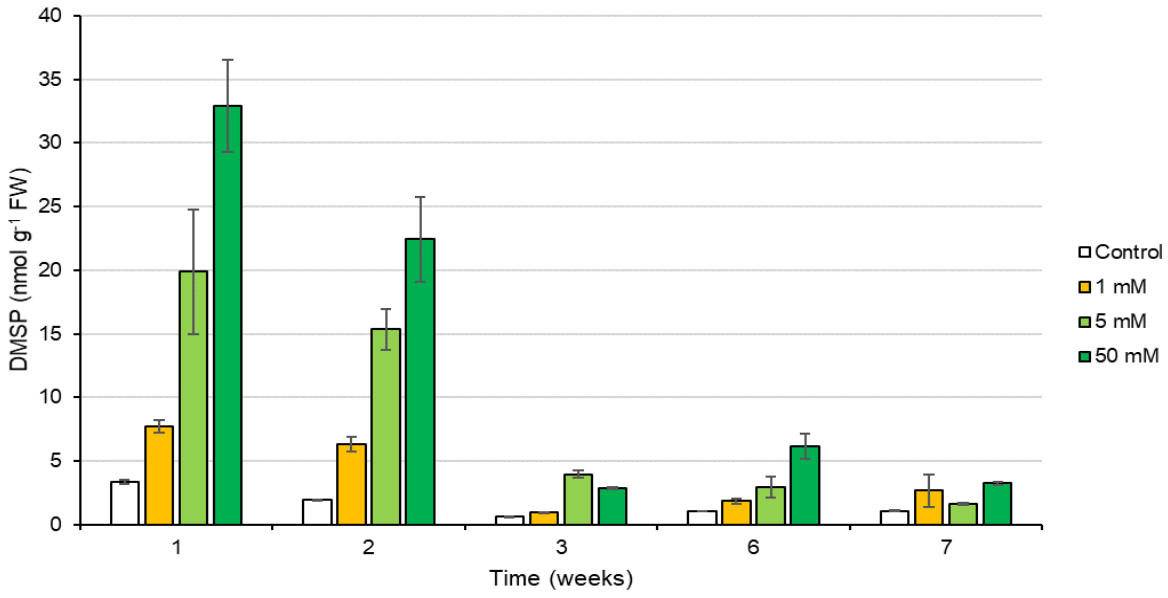

Figure 3: Spray application of DMSP to barley leads to long-lasting increases in DMSP concentrations in the leaf: A single spray application of DMSP solution was made to *Hordeum vulgare* cv. Golden Promise (barley) plants at week 0 and grown in controlled environment rooms. DMSP concentrations were monitored in non-sprayed leaf tissue at the indicated timepoints after the initial spray application.

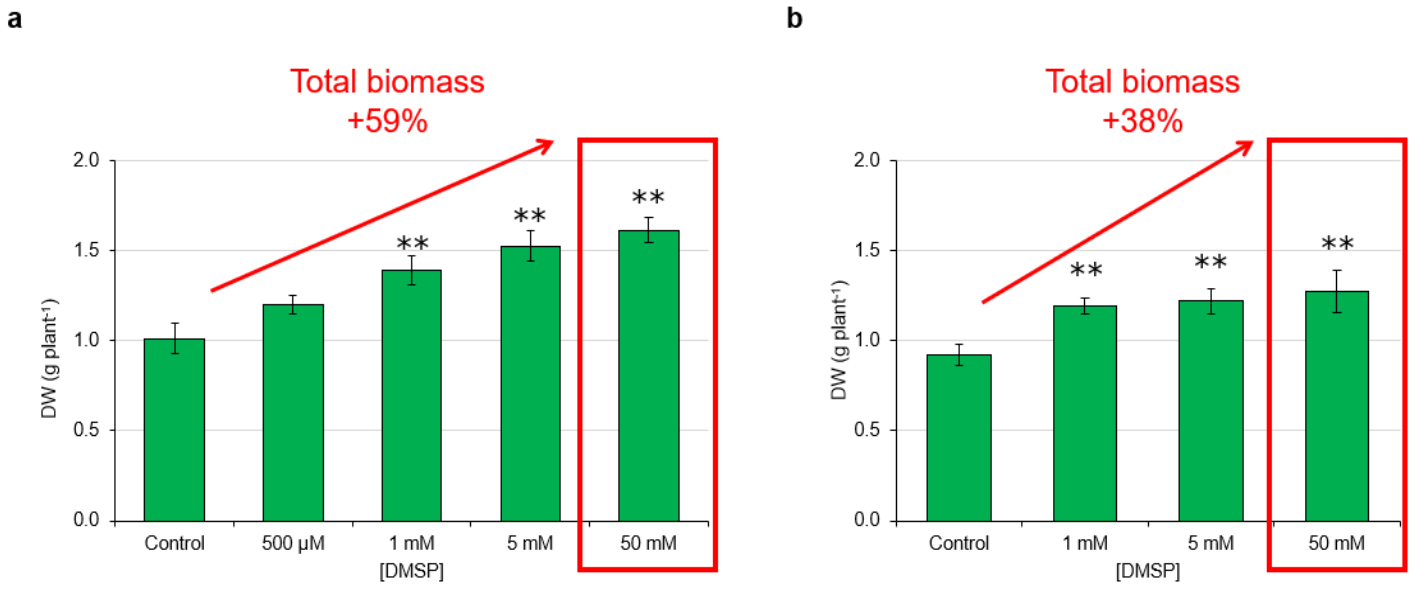

Figure 4: Spray application of DMSP to barley allows plants to tolerate salt stress: A single spray application of DMSP solution was made to *Hordeum vulgare* cv. Golden Promise (barley) plants grown in controlled environment rooms. Plant biomass was measured after 15 weeks of growth under normal conditions (watering with fresh water; panel a) or salt stress (watering with 100 mM NaCl; panel b). Stars indicate significant difference ($p<0.05$) relative to control samples.

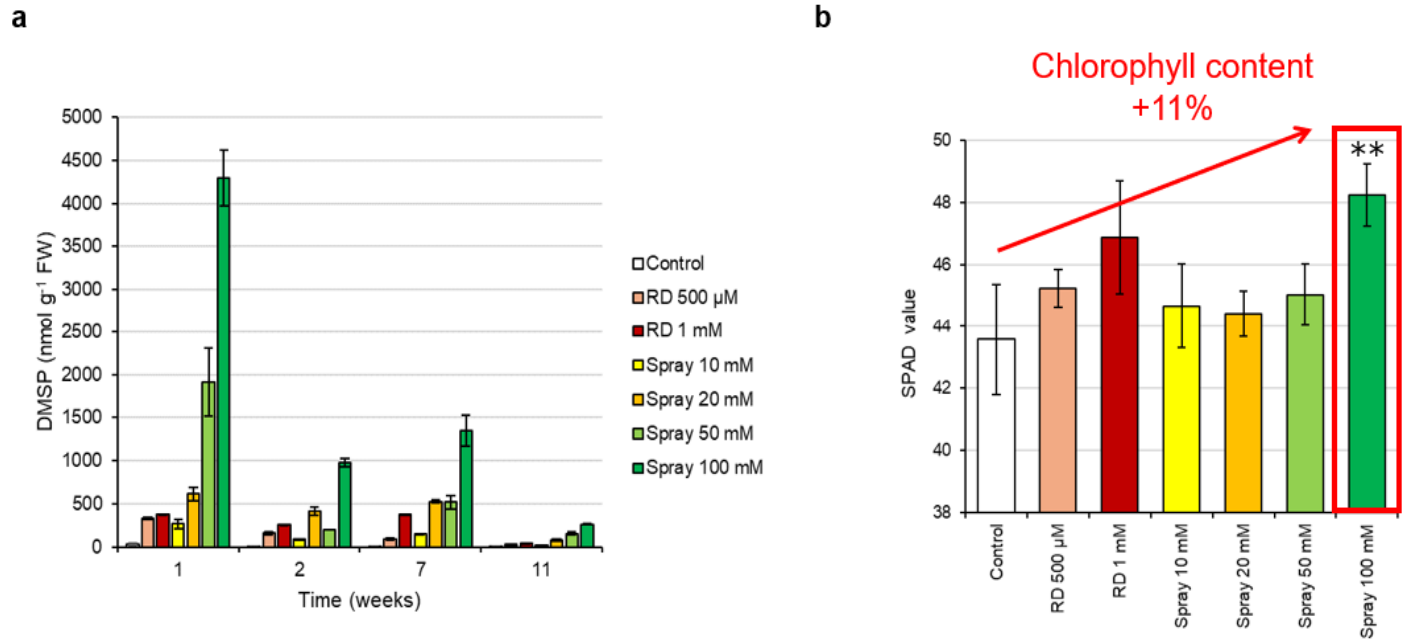

Figure 5: Spray application of DMSP to wheat leads to long-lasting increases in DMSP concentrations in the leaf in the glasshouse: a, Three spray applications or three root drench (RD) applications of DMSP solutions (given three weeks apart) at the indicated concentrations were made to *Triticum aestivum* cv. Bamford (wheat) plants grown under glasshouse conditions. DMSP concentrations was monitored in non-sprayed leaf tissue at the indicated timepoints after the final application (week 0). b, Chlorophyll content was measured in plants 7 weeks after the final DMSP application. Stars indicate significant difference ($p<0.05$) relative to control (untreated) samples.

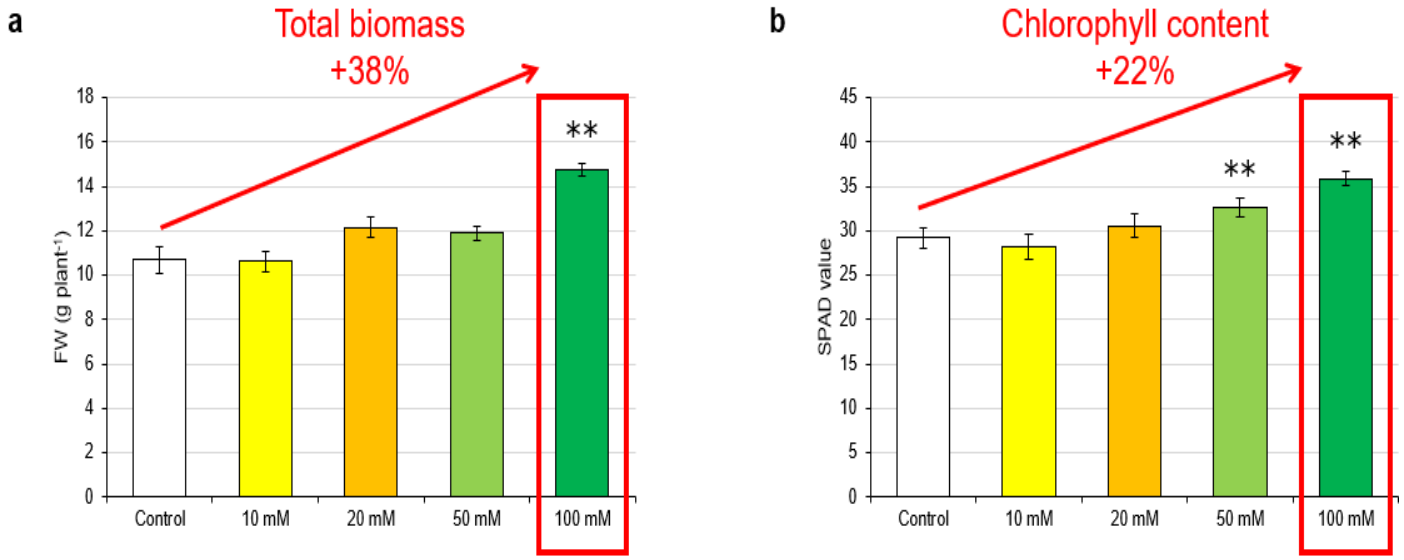

Figure 6: Spray application of DMSP to wheat allows plants to tolerate drought stress: Three spray applications of DMSP solutions (given three weeks apart) were made to *Triticum aestivum* cv. Bamford (wheat) plants grown under glasshouse conditions. Plants were subjected to drought stress by decreased watering regime (50% watering relative to normal conditions). Plant biomass (panel a) and chlorophyll content (panel b) was measured after ~29 weeks of growth. Stars indicate significant difference ($p<0.05$) relative to control samples. Bars represent mean ± SE from three independent replicates.

In summary dimethylsulfoniopropionate (DMSP) is a powerful, naturally derived biostimulant that enhances crop resilience, boosts yield, and delivers long-lasting protection against stress:

- **Proven persistence:** Single root-drench or foliar spray applications maintain elevated DMSP levels in leaves for extended periods, reducing the need for reapplication.
- **Stress tolerance:** Tomato plants treated with DMSP showed significantly higher resistance to salt and oxidative stress.
- **Yield benefits:** Barley demonstrated increased biomass under both normal and stress conditions, highlighting broad growth advantages.
- **Performance under normal conditions:** Wheat showed marked increases in chlorophyll content and biomass even without stress—pointing to real yield gains in standard farming environments.
- **Commercial potential:** With consistent results across species and delivery methods, DMSP stands out as a versatile new tool to safeguard productivity and improve agricultural sustainability.

Further characterisation of the biology and testing of DMSP in plants is ongoing at UEA. For more information or licensing interest, please contact PBL.

References:

Payet, R.D., Bilham, L.J., Kabir, S.M.T. et al. Elucidation of *Spartina* dimethylsulfoniopropionate synthesis genes enables engineering of stress tolerant plants. Nat Commun 15, 8568 (2024). https://doi.org/10.1038/s41467-024-51758-z