Fact-Checked Science

PAPER CHECK · MAGNETIC FIELDS AND PLANTS

Basil in a near-zero coil had more oil per gram in one test; the same lab's two mints didn't

Three University of Turin researchers grew basil for four weeks at the centre of a coil that cut the local field to about 40 nT, six plants against six in the room's field [1 p. 2]. In the full paper, Table 1 gives the coil plants 26% more essential oil per gram of dry leaf, though it prints no n, and at the three samples per group of the oil's own analysis the total's rise isn't significant (our analysis) [1 Table 1][1 Fig. 1]. Its figures show more flavonoids, less hydrogen peroxide and lower photoprotective quenching [1 Fig. 3][1 Fig. 5H]. No growth was measured, no sham run was part of this test, and the abstract reports a fall in phenolics that the results call not significant [1 p. 4]. In the same authors' near-null tests, wild mint's oil fell, a result our mint page rates Unconfirmed [4 Table 1], and peppermint's stayed about the same [3 Table 1]. The coil's field is about 180 times weaker than the typical surface field at the deepest moment of the Laschamp excursion (our analysis) [9].

By Fact-Checked Science · Published November 21, 2026

OUR ANALYSIS marks our own reasoning and calculations, and the verdicts are our assessment. Everything else comes from the numbered sources. For the paper [1], read in full, p. gives a page of its PDF, Table and Fig. a table or figure, and S1–S9 number the abstract's nine sentences in order; values read off its figures are our readings, and approximate. For the same authors' peppermint paper [3], p. gives a page of its PDF.

Basil's oil rose per gram, but its figures show three samples per group where the methods give six; the fall in phenolics and the claim of cause go beyond the results

OUR ASSESSMENT

~40 nT

the field at the coil's centre, about 1,100 times below the controls' ~44 µT (our arithmetic) [1 p. 2][1 S2]

~7 µT

the typical surface field at the Laschamp excursion's deepest moment in the preferred global model, about 180 times the coil's (our analysis) [9]

+26%

essential oil per gram of dry leaf, coil against control, as Table 1 prints it, with no n [1 Table 1]; in the same lab's tests, wild mint's fell and peppermint's stayed about the same [4 Table 1][3 Table 1]

THE PAPER'S CLAIMS

UNCONFIRMED

"hMF significantly enhanced essential oil accumulation, with eugenol and methyl eugenol increasing 1.3- and 1.8-fold, respectively."

The paper's abstract, S3 [1 S3]

As readings, Table 1 has total oil 7.53 against 5.97 mg per gram of dry leaf (+26%), eugenol +28% and methyl eugenol +79% [1 Table 1]. Table 1 prints no n. The methods describe six plants per group [1 p. 2], but the paper's PLS-DA of these oil profiles shows three samples per group [1 Fig. 1]. At six, both compounds' rises survive a correction for multiple tests, and the total's survives the gentler one; at three, the total's rise is P = 0.14 (0.18 under Welch's test), and of the two compounds only eugenol's survives a correction under both tests (our analysis). Our mint page rated the wild mint's fall in oil Unconfirmed at P = 0.030 on three samples per group, 0.069 under Welch's test [4 Table 1]; peppermint's stayed about the same [3 Table 1]. The oil is per gram; growth wasn't measured. We rate the readings, not that the field caused them. See section 4 and section 9.

PARTLY TRUE

"Total phenolic content decreased while flavonoid content rose"

The abstract, S5 [1 S5], behind the title's "remodel flavonoid profiles" [1 Title]

Flavonoids rose, about 9% by our reading, with an asterisk [1 Fig. 3C]. Phenolics didn't: the results say total phenolic content "showed a decreasing trend under hMF but did not differ significantly from GMF controls" [1 p. 4], so the abstract states as a finding what its own test didn't find. Flavonoid genes fell while the flavonoids rose [1 p. 4]. The "shift toward more polar" conjugates is a mixed pattern across clusters of compounds: several glucuronides and rhamnosides were enriched, though other rhamnosides fell, and many arabinosides, hexosides and diglycosides fell [1 Fig. 4][1 p. 4]. A reading taken off a figure, with no P value or n printed, can be the part that holds in a Partly true, as the root peroxide was on our mint page; it isn't enough for True. See section 2 and section 4.

UNCONFIRMED

"Steady-state H_2O_2 production declined"… "markedly lower non-photochemical quenching capacity"

The abstract, S6 and S7 [1 S6][1 S7], behind the title's "associated with altered photochemical performance and ROS homeostasis" [1 Title]

Both appear in figures only: leaf H_2O_2 about 7% lower [1 Fig. 3D] and quenching 19–37% lower at the four light steps from 300 to 1,000 $\mu mol\ m^{-2}\ s^{-1}$ [1 Fig. 5H], by our readings, with no numbers, P values or n per measure printed. The methods give six plants per group [1 p. 2]; Fig. 3's multivariate panels show three samples per group [1 Fig. 3F–G]. Where the leaves were measured isn't stated [1 p. 3]. The coil plants' fluorescence amplitudes were 14–23% higher [1 Fig. 5D], as after 10 seconds in the lab's Arabidopsis test [5 p. 4], though after four weeks in the same coil peppermint's were lower [3 p. 5] and wild mint's unchanged [4 Table S2]; so whether the field at the moment of measuring plays a part stays open. See section 4 and section 5.

OVERSTATED

"hMF exposure induces coordinated changes in secondary metabolism, photosynthetic performance, and oxidative homeostasis"

The abstract's conclusion, S9 [1 S9]

The design is like the sister papers': six plants in the coil and six outside it in the room's field [1 p. 2], no sham run in this experiment, one four-week exposure, and no blinding reported. The plants were assigned at random, and the paper cites earlier runs with the coil present but not reducing the field, which found no significant responses [1 p. 2], from the lab's 2018 and 2015 papers [6 §NNMF Generation System][26]. Its own conclusion says the field "was associated with coordinated changes" [1 p. 8], and its discussion that "the present data do not allow establishment of a direct causal link" between photosynthesis and metabolism [1 p. 8]. The abstract's "induces" claims more than the study shows. It is the same verdict as on the mint paper's title. See section 3.

TRUE

"providing a framework for understanding plant responses to near-null magnetic environments relevant to space agriculture"

The abstract's conclusion, S9 [1 S9]

The paper sets its work in space: "Neither the Moon nor Mars possesses a protective magnetosphere, and long-duration deep-space travel exposes biological systems to near-null magnetic conditions (<10 nT)" [1 p. 1]. A review lists 9–300 nT on the Moon and 10 nT–5 µT on Mars [15 §1], so a greenhouse on the Moon, and in places on Mars, would sit in a field like the coil's unless one were generated for it. The conclusion that basil can "maintain or even improve bioactive output under near-cosmic magnetic conditions" [1 p. 9] goes further than per-gram readings with no growth measured. One species and one four-week exposure, and a coil copies the field, not gravity or radiation. See section 7.

1 · WHAT WE READ

The paper in full, without its supplement, with the same authors' peppermint paper

Three researchers at the University of Turin published the paper in the peer-reviewed *Journal of Plant Physiology* on September 3, 2026 [1]. We found no copy outside the publisher's site, which our tools don't fetch, so the site's owner supplied the publisher's open-access PDF, which we read in full; its supplement wasn't available. S0 News linked the paper on November 20, 2026 [2].

The paper

Received March 4, 2026, revised September 1, accepted and published online September 3, under a CC BY 4.0 licence. Funded by the University of Turin; the authors declare no competing interests [1]. Its data "will be made available on request" [1 p. 9]. We quote the abstract as PubMed holds it and number its nine sentences S1–S9, and cite the rest by the PDF's page, table or figure. We quote only what we rate and short phrases, and paraphrase the rest.

What else we read

The same three authors' peppermint paper, published in March 2026, read in full from the University of Turin's repository [3 p. 1]. The sister mint paper, its supplement and the lab's other work, as read for our check of the mint paper [4]. And the lab's 2018 paper on its coil, re-read for its sham and double-blind experiments [6 §NNMF Generation System].

The supplement, as the paper describes it

ITEM	WHAT IT HOLDS
Fig. S1	The spectra of the LED lights [1 p. 2]
Fig. S2	The set-up, with plants inside and outside the coils [1 p. 2]
Table S1	The primers for the genes [1 p. 3]
Table S2	How the oil's compounds were identified [1 p. 4]
Table S3	How the flavonoids were annotated [1 p. 4]

None of these holds per-plant data, n or P values, so no verdict here waits on it. When we searched on November 20, 2026, we found no open copy of the full text in the University of Turin's repository, Europe PMC or PubMed Central, and no preprint or data deposit. The funding and the dates come from the paper's records with Crossref and PubMed [1].

2 · THE ABSTRACT, CHECKED

Nine sentences against the full text: the oil and flavonoid readings stand as readings; the fall in phenolics doesn't

The abstract gives four numbers: the two fields and the two oil compounds' fold changes [1 S1–S3]. The full text prints one table of numbers, the oil's, and shows everything else in six figures.

What each sentence says, and what the paper shows

S	THE ABSTRACT, PARAPHRASED UNLESS QUOTED	THE FULL TEXT	KIND
S1	Calls fields below 40 nT "one of the least-characterised environmental stressors for plants" [1 S1]	The coil ran at about 40 nT, read at its centre [1 p. 2]	Framing
S2	Grew basil, presented as "a compact, metabolite-rich model for bioregenerative life-support systems", in the near-null field or in the geomagnetic field of about 44 µT [1 S2]	Six plants in the coil and six outside it, for four weeks [1 p. 2]; see section 3	The design
S3	More essential oil, with eugenol up 1.3-fold and methyl eugenol 1.8-fold [1 S3]	Total oil 7.53 against 5.97 mg per gram of dry leaf, 1.26-fold; eugenol 1.28-fold and methyl eugenol 1.79-fold [1 Table 1]. No n is printed, and the oil's PLS-DA shows three samples per group [1 Fig. 1]	Claim 1
S4	"Despite" that, key phenylpropanoid transcripts were lower, including those of two methyltransferases [1 S4]	All eight pathway transcripts shown were lower, by 27–68% (our reading) [1 Fig. 2]	Result, with the authors' own caveat
S5	Total phenolics down, flavonoids up, with a shift toward more polar glucuronide and rhamnoside conjugates [1 S5]	Flavonoids about 9% higher (our reading) [1 Fig. 3C]; phenolics "did not differ significantly" [1 p. 4]; the shift is a pattern across clusters of compounds [1 Fig. 4]	Claim 2
S6	Steady-state H_2O_2 down; two detoxification genes down and one up [1 S6]	Leaf H_2O_2 about 7% lower (our reading) [1 Fig. 3D]; CSD and CAT lower, FSD1 higher, APX unchanged [1 p. 4]	Claim 3
S7	Chlorophyll b up and the a/b ratio down; fluorescence "consistent with" partly inactivated PSII reaction centres, less efficient electron transport and "markedly lower non-photochemical quenching capacity" [1 S7]	Chlorophyll b about 36% higher (our reading) [1 Fig. 3A]; Fv/Fm "unaffected" [1 p. 4]; fluorescence amplitudes 14–23% higher, and quenching 19–37% lower at the four light steps from 300 to 1,000 µmol (our readings) [1 Fig. 5D][1 Fig. 5H]; operating yield higher in the figure, lower in the text (section 5)	Claim 3
S8	Three stress-responsive transcription factors and unnamed "protective genes" up [1 S8]	ICE1, CBF4, DREB5, COR47 and LT16 higher, and ERD2 in the figure; WRKY53 a "small, non-significant decrease" [1 p. 7][1 Fig. 6]	Result
S9	The field "induces coordinated changes", giving a framework "relevant to space agriculture" [1 S9]	The conclusion: the field "was associated with coordinated changes" [1 p. 8]	Conclusion: claims 4 and 5

Readings off the paper's figures are ours, and approximate; the pixel readings are hosted in section 9. The paper measured no growth, biomass or yield; "biomass" appears once, as a trait wanted in life-support systems [1 p. 2].

EUGENOL, METHYL EUGENOL
OUR ANALYSIS

+28%, +79%

coil against control, per gram of dry leaf; the abstract rounds them to 1.3- and 1.8-fold [1 Table 1][1 S3]

METHYL EUGENOL PER EUGENOL
OUR ANALYSIS

+40%

from Table 1's means, 34–46% allowing for rounding, while the two methyltransferases' transcripts fell [1 Table 1][1 S4]

THE FIELD
OUR ANALYSIS

~1,100×

the cut from the controls' ~44 µT to ~40 nT at the coil's centre, so about 99.9% of the field removed [1 S2][1 p. 2]

OUR ANALYSIS

How the wording moves, and where the authors are careful

The title's second half is the careful part: near-null fields "are associated with" altered photochemistry and ROS homeostasis [1 Title]. The body moves both ways. The introduction says exposure "is associated with marked changes" [1 p. 2]; the discussion, that it "caused a reduced photosynthetic efficiency and triggered significant changes in gene expression that ultimately remodelled secondary metabolism" [1 p. 8]; the conclusion returns to "associated", and says the causal relationships "remain unresolved and require further experimental validation" [1 p. 9]. The abstract's last sentence says "induces" [1 S9]. Its first counts the field among "stressors" [1 S1]; stress-responsive transcription factors rose [1 S8] and protein fell about 19% (our reading) [1 Fig. 3A], but H_2O_2 fell too [1 S6]. To the authors' credit, they flag their own paradox, that the oil compounds rose "Despite" lower transcripts [1 S4]; say only that fluorescence was "consistent with" partial inactivation of PSII reaction centres [1 S7]; and write that the changes, "Rather than indicating photodamage", suggest altered performance [1 p. 8]. Against that, the abstract states a fall in phenolics that its results call "a decreasing trend" that "did not differ significantly" [1 p. 4]. Transcript levels at one moment, at harvest [1 p. 2], needn't track an enzyme's activity or its product, as the same authors found in peppermint, where pathway genes rose and menthol fell [3 p. 1].

3 · THE DESIGN

Six plants in the coil and six in the room for four weeks: the sister papers' design, with random assignment

To judge a comparison of two groups, a reader needs to know how long the plants were exposed, how many there were, where the controls stood, whether the test was repeated, and which statistics were used. The full text answers most of these [1 pp. 2–3], and its design is the one the same authors used in their two other aromatic-plant papers of 2026.

The design, as each paper gives it

ITEM	BASIL, FULL TEXT	PEPPERMINT, FULL TEXT	WILD MINT, FULL TEXT
Field	About 40 nT, read only at the coils' centre, against about 44 µT [1 p. 2][1 S2]	About a thousandth of the natural field, with no value given [3 p. 2]	About 30 nT, from about 43 µT [4 p. 2]
Coil	The lab's three-axis Helmholtz coil system, citing the 2018 paper that describes it [1 p. 2][6]	The same system [3 p. 2]	The same system [4 p. 2]
Exposure	Four weeks, continuously [1 p. 2]	Four weeks [3 p. 2]	Four weeks [4 p. 2]
Plants	"Individual potted basil plants were positioned at the coil centre and exposed continuously for four weeks. An equal number of plants (n = 6) grown outside the coils under the local GMF served as controls." [1 p. 2]	"In June 2025, eight peppermint plants, each grown in a separate pot, were placed at the geometric center of the Helmholtz coils and continuously exposed to hMF for four weeks." [3 p. 2]	Cuttings in flasks [4 p. 2], in pools of ten [4 p. 4]
The n behind each number	Not printed with Table 1 or any figure. Every multivariate panel shows three samples per group: the oil [1 Fig. 1], the assays and transcripts [1 Fig. 3F–G] and the flavonoids [1 Fig. 4B–C]; the phenolic and flavonoid assays were each "repeated in triplicate" [1 p. 3], and protein read "in triplicate" [1 p. 2]	"at least three biological replicates" [3 p. 3]	Three samples per group for the oil [4 Table 1]; not printed for the fluorescence tables [4 Table S2]
Controls	Outside the coils, in the local field; the distance isn't given [1 p. 2]	"The same number of plants was used as control for plants exposed to the normal GMF." [3 p. 2]	"Control plants were maintained under unaltered GMF conditions"; no coil around them in the photograph [4 p. 2][4 Fig. S1]
Random assignment, sham, separate runs, blinding	Plants "randomly subjected either to GMF or hMF conditions"; no sham run in this test, though earlier ones are cited; one exposure described; blinding not mentioned [1 p. 2]	None reported; one run described [3 p. 2]	None reported [4 p. 2]
Statistics	"paired t-tests with Bonferroni correction or one-way ANOVA followed by Tukey's post-hoc test, depending on experimental design", with no P values printed [1 p. 3]	One-way ANOVA with Tukey's test [3 p. 3]	ANOVA with Tukey's test, with no correction for multiple tests [4 p. 4]
Growth	Not measured [1 pp. 2–3]	Not measured; offered as future work [3 p. 8]	Not measured [4 pp. 2–4]

The peppermint and mint columns quote or paraphrase those papers' methods. The basil and peppermint papers each describe a few plants per group (six [1 p. 2] and eight [3 p. 2]) and RNA samples each pooled from ten plants [1 p. 3][3 p. 3], and neither says how the counts fit; the basil paper's figures show three samples per group [1 Fig. 1][1 Fig. 3F–G]. The basil test used the peppermint test's coil, site, lights and pots [1 p. 2][3 p. 2], and adds the random assignment.

What a stricter control looks like

An Oxford group testing Arabidopsis used doubly wound coils carrying the same current, chose the exposure coil at random each time, and kept the experimenter blind [7 §2]. The Turin lab knows such tools: its 2018 paper reports sham runs that "resulted in insignificant differences" (data not shown), and double-blind experiments [6 §NNMF Generation System]. The basil paper cites those runs and a 2015 study's to say the coil itself has no effect [1 p. 2], but ran no sham or blinding of its own. The lab's 10-second Arabidopsis test used sham transfers [5 p. 4].

OUR ANALYSIS

A coil and a bench differ in more than the field

Equal light, temperature, gravity and pressure don't make the field the only difference between plants inside a coil and plants elsewhere in a room, though the paper calls it "the only variable" [1 p. 2]; a sham run in the same test is how a study shows it. And a coil cancels the field fully only near its centre. Six plants, each in a 12 cm pot, stood "at the coil centre", and the field was read only there [1 p. 2]; if the six stood together, they couldn't all be within 10 cm of it. For an ideal coil of the 2018 paper's size, our mint page estimated at worst 100–180 nT at 10 cm from the centre and 550–790 nT at 20 cm [6 §NNMF Generation System]. The lab says its system gives a homogeneous low field in the central volume [5 p. 15], and elsewhere gives its frame as about 2 m across [26 §Representative Results], which would cut these to about 24–44 and 100–180 nT. That makes the dose uncertain; it doesn't weaken any effect.

4 · THREE AROMATIC PLANTS

In the same coil, oil rose in basil, stayed about the same in peppermint and fell in mint

The basil paper uses the peppermint paper's coil, sensor, lights and assays [1 pp. 2–3][3 pp. 2–3], and the mint paper the same coil system [4 pp. 2–4]. Their results agree on some measures and not on others.

Coil against control, as each paper reports it

MEASURE	WILD MINT [4]	PEPPERMINT [3]	BASIL [1]
Total essential oil	19% lower, at P = 0.030 on three samples per group and 0.069 under Welch's test; Unconfirmed on our mint page [4 Table 1]	About the same: 12.064 against 12.356 mg per kg dry weight, 0.98 of the controls' [3 Table 1]	26% higher: 7.53 against 5.97 mg per gram of dry leaf, with n not printed [1 Table 1]
Main compounds	Carvone 21% lower [4 Table 1]	Menthol 0.57 of the controls' [3 p. 3]	Eugenol 28% and methyl eugenol 79% higher [1 Table 1]
Pathway transcripts	Lower [4 Fig. 1B]	Higher, a "paradoxical upregulation" [3 p. 1]	Lower, all eight shown [1 Fig. 2]
Total protein	Roots about 35% lower; shoots unchanged [4 p. 9]	Higher [3 p. 5]	About 19% lower (our reading) [1 Fig. 3A]
Total phenolics	About half [4 p. 6]	Lower [3 p. 5]	About 4% lower (our reading), and "did not differ significantly" [1 Fig. 3B][1 p. 4]
Flavonoids	About 17% lower in shoots, by a colour assay [4 Fig. 3B]	Changed compound by compound; glucuronides among the sugar-bound forms that rose [3 p. 5]	About 9% higher by a colour assay (our reading) [1 Fig. 3C]; glucuronides and rhamnosides up, many arabinosides, hexosides and diglycosides down [1 p. 4]
H_2O_2	Roots about 80% higher, shoots about 15% lower [4 p. 9]	Lower in leaves [3 p. 5]	Leaves about 7% lower (our reading) [1 Fig. 3D][1 p. 3]
Maximum PSII efficiency (Fv/Fm)	Unchanged, about 0.82 [4 Table S2]	Unchanged, 0.787 against 0.792 [3 p. 5]	"unaffected" [1 p. 4]
Non-photochemical quenching	In the light, lower at all five steps, not significantly, and fast dissipation 23% lower [4 p. 5]; after dark, higher (P = 0.028 and 0.017) [4 Table S3]	Lower in the light, especially at high light, and slower to recover in the dark [3 p. 5]	19–37% lower at the four light steps from 300 to 1,000 µmol, lower after dark, where it "relaxed more rapidly" (our reading) [1 Fig. 5H][1 p. 7]
Growth	Not measured	Not measured [3 p. 8]	Not measured

Coil against control in every cell. The mint's numbers are as read for our mint page, which gives them with their spreads and tests; what the mint paper's per-sample flavonoid file could and couldn't show is in its section 5. Total phenolics is a Folin–Ciocalteu reading in the basil and peppermint papers [1 p. 2][3 p. 3], and that reagent also reacts with proteins, thiols and some vitamins [25 Abstract].

OUR ANALYSIS

What the three show

Oil goes three ways in three aromatic plants, and transcripts don't predict it: genes down with less oil in mint, genes up with less menthol in peppermint, genes down with more oil in basil. Which result is firmer depends on the n. At three samples per group, as both oil tables appear to have [1 Fig. 1][4 Table 1], basil's rise in total oil (P = 0.14 under Student's t) is less sure than mint's fall (P = 0.030), while its rise in eugenol (P = 0.003) is surer than mint's fall in carvone (P = 0.010); Welch's test gives the same order. At six plants, as basil's methods describe, basil's total gives P = 0.027 against mint's 0.030 at three, under Student's t; under Welch's, 0.040 and 0.069 (our analysis, section 9). H_2O_2 fell in peppermint leaves, mint shoots and basil leaves, and rose in the mint's roots. In the light, quenching was lower in basil and peppermint, and lower but not significantly in mint, whose fast dissipation fell 23%. After dark the three part ways: mint kept a third to a half more quenching [4 Table S3], peppermint's recovered more slowly [3 p. 5], and basil's relaxed faster [1 p. 7]. So the three agree best on H_2O_2 in leaves and shoots, and least on the oil, the basil abstract's first result.

The lab's other plants, and other labs

H_2O_2 was lower in Arabidopsis roots and shoots [19 §3.3] and in Lima bean [20], but higher in maize roots, with shoots unchanged [21 §Results]. Tomato showed higher quenching [22 Abstract]. The senior author's 2025 review says a near-null field directly lowers reactive oxygen, so that the plant perceives less oxidative stress [23 Abstract]. Outside the lab, a 2026 preprint, not peer reviewed, finds reactive oxygen up in germinating Arabidopsis seeds [24 Abstract]. We found no repeat of the basil result by any lab.

5 · QUENCHING

Lower quenching after four weeks in the coil; in the lab's 10-second test, quenching rose

Fluorescence can change while a leaf sits in the coil, so where the leaves were measured matters. The basil paper says only that intact leaves were dark-adapted for 30 minutes [1 p. 3], as its sister papers do [3 p. 3][4 p. 3].

Ten seconds in Arabidopsis beside four weeks in three aromatic plants

TEST	NON-PHOTOCHEMICAL QUENCHING	OTHER READINGS
Arabidopsis, 10 seconds, measured inside the coil [5 p. 15]	Higher in the light; fast dissipation about doubled [5 pp. 4, 7]	"significant increases in the absolute fluorescence amplitudes"; Fv/Fm unchanged; PSII yield lower at the first light step; nothing in sham transfers [5 p. 4]
Peppermint, four weeks	Lower in the light, especially at high light, and slower to recover in the dark [3 p. 5]	Fv/Fm unchanged; F0, Fj, Fm and Fv all lower [3 p. 5]
Wild mint, four weeks	In the light, lower at all five steps, not significantly; after dark, higher (P = 0.028 and 0.017) [4 Table S3]	Fv/Fm unchanged; fluorescence amplitudes unchanged, Fm 0.9% higher [4 Table S2]
Basil, four weeks	19–37% lower at the four light steps from 300 to 1,000 µmol, and lower after dark, where it relaxed faster (our reading) [1 Fig. 5H][1 p. 7]	Fv/Fm "unaffected" [1 p. 4]; fluorescence amplitudes 14–23% higher (our reading) [1 Fig. 5D]

Basil's quenching comes from steps of light from 100 to 1,000 $\mu mol\ m^{-2}\ s^{-1}$, then three steps of dark [1 Fig. 5H], measured with the same fluorometer as its OJIP curves [1 p. 3].

OUR ANALYSIS

A question, not a finding

Where were the leaves? If the basil leaves were measured inside the coil, part of any difference could be the field at the moment of measuring; if they were carried out into the room first, a change of field happened on the way. The signs are mixed. Basil's fluorescence amplitudes rose, as after 10 seconds in Arabidopsis [5 p. 4], but after four weeks in the same coil peppermint's fell [3 p. 5] and wild mint's didn't move [4 Table S2]; and basil's quenching in the light fell, where the 10-second test found it higher [5 p. 4]. These are different species, so the comparison goes no further.

Operating yield: the figure and the text disagree

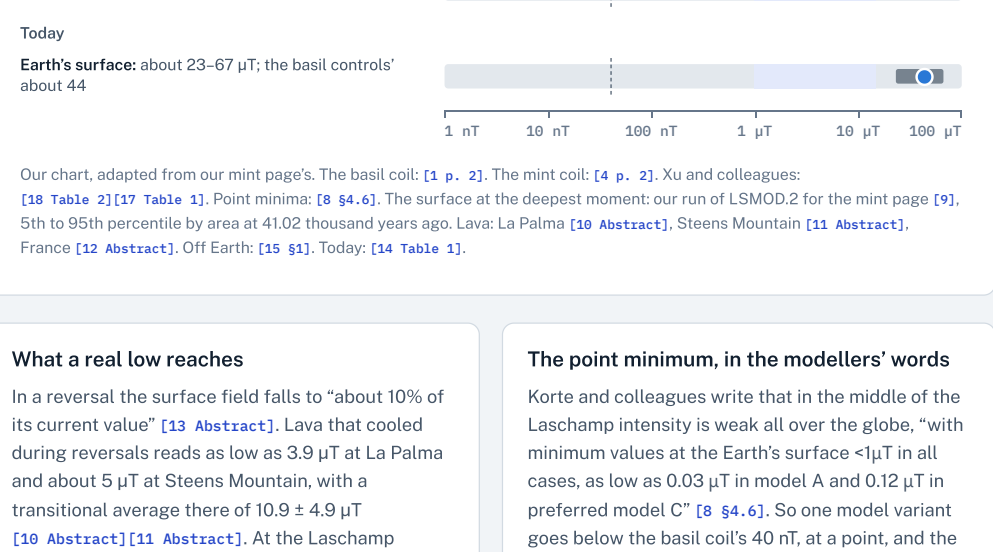
The text says operating yield (ΦPSII) "was reduced by 8–9% at moderate-to-high irradiances" in the coil plants, at 300–1,000 $\mu mol\ m^{-2}\ s^{-1}$ [1 p. 4]. By the figure's own legend, Fig. 5F shows the coil plants' bars higher at those steps, each with an asterisk: about 0.589 against 0.565 at 1,000, 0.583 against 0.554 at 500 and 0.510 against 0.487 at 300, about 4–6% higher (our pixel readings) [1 Fig. 5F]. With the colours swapped the change would be about 4–6% lower, still not 8–9%. Ordinary explanations include colours swapped against the legend, a slip our mint page found in the mint paper's Fig. 2G–J and one this paper makes in Fig. 1's caption (see the slips below); a percentage worked out some other way; or a slip in the text. It bears on "altered photochemical performance", not on any claim we rate.

6 · A REVERSAL IN A COIL?

The coil goes far below any measured low of Earth's field we found

In the preferred global model of the Laschamp excursion, the typical surface field at its deepest moment was about 7 µT, about 180 times the basil coil's (our analysis) [9]. The paper names no reversal or excursion; "reversal" appears only in the title of a cited paper [1 p. 9][26]. Its frame is space (section 7). The numbers here are those of our mint page, with the basil coil's 40 nT in place of the mint coil's 30 nT.

The coil beside Earth's field at its lows, and beside fields off Earth, on a logarithmic scale



Our chart, adapted from our mint page's. The basil coil: [1 p. 2]. The mint coil: [4 p. 2]. Xu and colleagues: [18 Table 2][17 Table 1]. Point minima: [8 §4.6]. The surface at the deepest moment: our run of LSMOD.2 for the mint page [9], 5th to 95th percentile by area at 41.02 thousand years ago. Lava: La Palma [10 Abstract], Steens Mountain [11 Abstract], France [12 Abstract]. Off Earth: [15 §1]. Today: [14 Table 1].

What a real low reaches

In a reversal the surface field falls to "about 10% of its current value" [13 Abstract]. Lava that cooled during reversals reads as low as 3.9 µT at La Palma and about 5 µT at Steens Mountain, with a transitional average there of 10.9 ± 4.9 µT [10 Abstract][11 Abstract]. At the Laschamp excursion the field was weak all over the globe [8 §4.6], yet lava in France from that time reads 12.9 ± 3.3 µT [12 Abstract].

The point minimum, in the modellers' words

Korte and colleagues write that in the middle of the Laschamp intensity is weak all over the globe, "with minimum values at the Earth's surface <1µT in all cases, as low as 0.03 µT in model A and 0.12 µT in preferred model C" [8 §4.6]. So one model variant goes below the basil coil's 40 nT, at a point, and the preferred model's published low is three times it. A model built from smoothed sediment records can't say where such a point was or how deep [8 §2.2.2].

The preferred model of the Laschamp, 44,000–38,000 years ago

FIELD BELOW	SHARE OF EARTH'S SURFACE EVER THERE	LARGEST SHARE AT ONE MOMENT	LONGEST UNBROKEN SPELL AT ONE PLACE
30 nT	0.0071%	0.0020%	4 years, indicative only
40 nT, the basil coil	Between the rows above and below: under 0.1%	Under 0.01%	Between 4 and 17 years, indicative only
100 nT	0.074%	0.0083%	17 years, indicative only
300 nT	0.57%	0.092%	59 years
1 µT	5.5%	0.96%	202 years
5 µT	69%	25%	941 years
10 µT	90%	76%	3,023 years

Our analysis of LSMOD.2 [9], run for our mint page: 1° cells weighted by area, at yearly steps. This page computes nothing new from the model: the 40 nT row is bracketed by the 30 nT and 100 nT rows of the mint page's hosted lsmod2_sampling.json. The mint page's main table uses 10-year steps, which give smaller shares for the lowest rows. Point values are indicative only, as the mint page explains.

OUR ANALYSIS

How the coil compares

Against the basil coil's ~40 nT, the typical surface field at the Laschamp's deepest moment in the preferred model is about 180 times as strong, and 58–400 times across the 5th to 95th percentiles. The lowest lava readings across reversals are about 98 and 120 times as strong, and today's surface field about 575–1,700 times [14 Table 1]. In that model under 0.1% of the surface ever went below 40 nT, at moving points. One model variant's published point minimum does go below it [8 §4.6]. So no measured record we found comes near the coil's field, and a model reaches it only at isolated points. Long exposure isn't what's missing, since a place could sit under 5 µT for centuries. Strength and area are.

7 · SPACE

Fields this low are found off Earth, and that is where the paper points

The paper presents basil as "a compact, metabolite-rich model for bioregenerative life-support systems" [1 S2], opens with the Moon, Mars and deep space [1 p. 1], and offers its results as a framework for "near-null magnetic environments relevant to space agriculture" [1 S9].

Where fields like the coil's occur

A review from another lab lists 2–8 nT in interstellar space, 9–300 nT on the Moon and 10 nT–5 µT on Mars [15 §1]; the paper puts deep space below 10 nT [1 p. 1]. The coil's field lies within the Moon's and Mars's ranges (our analysis), so a greenhouse on the Moon, and in places on Mars, would sit in a field like it unless one were generated for it. The paper cites a review of providing artificial fields on long spaceflights [1 p. 9]. The lab's own maize paper concludes that survival depends on the regolith's chemistry "rather than reduced gravity or lack of magnetic field" [21 Title].

Reversals, elsewhere in the lab's work

The basil paper names no reversal; its reference list includes the lab's 2015 test that reversed the field's direction in a coil [1 p. 9][26]. The same authors' peppermint paper opens with them: the field undergoes "periodic reversals over geological timescales (Occhipinti et al., 2014)", and "Living organisms, including plants, can perceive variations in the GMF as a form of abiotic stress (Hafeez et al., 2023; Paponov et al., 2021)." [3 p. 1] Our mint page weighs the lab's argument that reversals shaped plant evolution.

OUR ANALYSIS

What the result would mean, if it held

A chemical response to a field cut about 1,100-fold: more oil per gram, more flavonoids, less H_2O_2, changed transcripts and fluorescence [1 Table 1][1 Figs. 2–6]. The paper reports no damage and measured no growth; it does report partly inactivated PSII centres and, by our reading, about 19% less protein [1 S7][1 Fig. 3A]. If the result holds, it bears on crops grown on the Moon or Mars, or in transit, where fields this low are real; but the paper's "maintain or even improve bioactive output" [1 p. 9] would need yield per plant, not per gram. It says little about Earth's field in a reversal or excursion, which stays far stronger almost everywhere (section 6), and neither supports nor rules out a plant response to that field (section 8).

8 · THE FAIR CASE

Near 1 µT, independent work reports less seed; from 1 to 15 µT, growth and yield are close to untested

This is the strongest evidence we found that a reversal's weaker field could affect plants, as our mint page sets out. We found no test of what a real reversal's field does to plants over a life cycle, in either direction.

Xu and colleagues: Arabidopsis near 1 µT

A group in Beijing grew Arabidopsis for its whole life in a near-null field, and reports biomass suppressed around the switch to flowering, about 22% fewer siliques, about 19% less seed and about 20% lower harvest index [16 Abstract]. That is growth and yield, from a lab independent of Turin's. Its field lies a little below the 2.3–16 µT most of the surface saw at the Laschamp's deepest moment, and about 5% of the surface went below 1 µT at some time in that model (our analysis) [9]. Two reviews differ on the field value: one lists under 1 µT [18 Table 2], the other 1,300 nT [17 Table 1].

Other near-zero-field experiments on our pages

We have checked near-zero-field experiments in wild mint from the same lab, in fruit flies, in brown planthoppers, in mice, in mole-rats and in human volunteers.

OUR ANALYSIS

Not shown, and not ruled out

Across all organisms, an analytical review found that "There is no statistically significant correlation of the effect size with the HMF value or the exposure time" [17 §Results], and a later one that "The vast majority of biological effects in HMC occur at inductions below 300 nT" [18 §7]. Neither review's table holds a whole-plant experiment between 2 µT and the local field, though both reviews selected weak-field work by design, and our own search wasn't exhaustive [17 Table 1][18 Table 2]. So growth and yield over a life cycle at about 1–15 µT, the field a real reversal or excursion would bring to most places, are close to untested. The nearest test, Oxford's 72-hour seedlings at 0 ± 10 µT against 50 µT, found no significant difference in hypocotyl length [7 §3.4]. The evidence doesn't show that a reversal's field harms plants, and it doesn't show that it can't.

9 · REPEAT OUR NUMBERS

Three scripts, their rules and their output; the paper stays with its publisher

Each rules file was written, and its hash recorded, before its script's first run; the addendum for the rounding check came after a fresh review of this page, and says so. `table1_recheck.py` needs nothing else; `read_bars.py` reads the bars of the paper's figures from your own copy of its PDF; `abstract_arithmetic.py` fetches PubMed's record and our mint page's field-model file by URL under a plain client name, and checks both against the copies we used.

PY	**table1_recheck.py** Table 1 re-checked from its printed numbers: its arithmetic, two-group tests at six and three plants per group, the paper's significance marks against those tests, corrections for multiple tests, and how far rounding could move them; plain Python · 11 KB
JSON	**table1_recheck.json** Its output · 11 KB
TXT	**RULES_table1_fulltext.txt** Its rules, written after reading the full text and before the first run · 4 KB
TXT	**RULES_table1_addendum.txt** The rules for C6, the rounding check, written after a fresh review of this page, so post hoc · 2 KB
PY	**read_bars.py** Bar heights read by pixels off Figs. 3 and 5, from your copy of the paper's PDF, which it checks against ours by SHA-256; needs Pillow · 6 KB
JSON	**bar_readings.json** Its output, from our copy · 10 KB
PY	**abstract_arithmetic.py** The arithmetic on the abstract's numbers and the field comparisons, rules A1–A6, run before the full text was in hand; plain Python · 7 KB
JSON	**abstract_arithmetic.json** Its output · 3 KB
TXT	**RULES_abstract_arithmetic.txt** Its rules, written before the first run · 4 KB
TXT	**rules_sha256.txt** The rules files' hashes, with the times they were recorded · 1 KB

What the scripts give

RULE	RESULT
C1	Table 1's arithmetic holds: the compounds' masses sum to the printed totals, their shares to 100.0% and 100.3%, and every printed ratio fits its means but one. Total identified's 1.29 against 1.292–1.298, a matter of rounding [1 Table 1]
C2	Student's and Welch's tests for two independent groups, from the printed means and SDs, at six and at three plants per group, for the ten compound rows whose SDs are printed as numbers and the two totals
C3	The paper's bold marks agree with P < 0.05 at six plants per group in every testable row but one, linalool; at three per group, the n of the oil's PLS-DA [1 Fig. 1], six rows disagree, total oil among them
C4	At six per group, eight compounds, eugenol and methyl eugenol among them, survive Benjamini–Hochberg and Holm corrections under both tests, though β-elemene, β-cubebene and T-cadinol could fail either correction on rounding alone, and cis-ocimene and trans-α-bisabolene Holm's (C6); Total identified survives both, and total oil, at P = 0.027 (Student) and 0.040 (Welch), survives Benjamini–Hochberg but not Holm. At three per group, total oil gives P = 0.14 (Student) and 0.18 (Welch); eugenol still survives both corrections under either test, and nothing survives Welch's test once the totals are included
C5	Linalool, 0.89 ± 0.17 against 0.82 ± 0.12 mg per gram, gives P = 0.43 at six per group, and would need 36 plants per group to reach 0.05 under Student's t
C6	Added after a fresh review, post hoc, as a check on C4: each printed mean and SD moved by up to 0.005, whichever way worsens the test, taking Table 1's "0.2" and "±0.1" as 0.20 and 0.10. At six per group, eugenol, methyl eugenol and 1,8-cineole survive both corrections whatever the rounding, and cis-ocimene and trans-α-bisabolene the gentler one; total oil's survival of the gentler one holds under Student's test but not Welch's. At three, even eugenol's survival under Welch's test turns on the rounding, at P up to 0.006
Bars	Read by pixels, control against coil, in the figures' units: protein 99.0 against 80.4, phenolics 291.8 against 281.2, flavonoids 115.6 against 126.4, and H_2O_2 1.67 against 1.55 [1 Fig. 3]; quenching as in section 5 [1 Fig. 5H]; operating yield as in the box there [1 Fig. 5F]. Good to a few pixels
A1	The field cut about 1,100-fold, about 99.9% of it removed. The rules took the abstract's "< 40 nT" as an upper bound, so the script calls these lower bounds; the methods give ~40 nT [1 S1][1 p. 2]
A2	Eugenol +30% (25–35% allowing for rounding) and methyl eugenol +80% (75–85%), from the abstract's folds [1 S3]; Table 1 gives +28% and +79%
A3	Methyl eugenol relative to eugenol ×1.385, a rise of 38% (30–48%), from the abstract's folds; Table 1's means give ×1.40 (our arithmetic)
A4	Each field value in section 6 as a multiple of 40 nT, to two figures: 180× for the typical surface field at the Laschamp's deepest moment, 98× for the lowest lava, 580–1,700× for today's surface
A5	Share of the surface ever below 40 nT, 44,000–38,000 years ago: between 0.0071% and 0.074% [9]
A6	40 nT lies inside the ranges a review lists for the Moon and Mars, and above interstellar space's [15 §1]

Marks we can't reproduce

At six per group, one bold mark fails, linalool's: its 9% rise, 0.89 ± 0.17 against 0.82 ± 0.12 mg per gram [1 Table 1], gives P = 0.43, and Student's t would need 36 plants per group to reach 0.05 (our analysis, C5). At three per group, the n in the oil's own PLS-DA shows [1 Fig. 1], five more fail, total oil's among them (our analysis, C3). Ordinary explanations include these: Table 1's SDs may come from six plants, with the PLS-DA run on three pooled or selected samples; the three may be technical repeats, as the phenolic and flavonoid assays were "repeated in triplicate" [1 p. 2]; the test may not be one of two independent groups, since the methods name "paired t-tests with Bonferroni correction" without saying what was paired [1 p. 3]; or the bold type may have been set with slips. At six, the rises in total oil, eugenol and methyl eugenol are all significant; at three, total oil's isn't, and only eugenol's survives a correction under both tests.

Run it

`python3 -I table1_recheck.py <out.json>` needs nothing else. `python3 -I read_bars.py <the paper's PDF> <out.json>` needs Pillow and the PDF from the publisher. `python3 -I abstract_arithmetic.py <out.json>` fetches about 10 KB from PubMed and our mint page; given saved copies, `python3 -I abstract_arithmetic.py <out.json> <efetch.xml> <lsmod2_sampling.json>` runs without a network. Any Python 3 will do.

What we don't host

The paper, its text, tables and figures: it is CC BY 4.0, with credit to Mannino, Caldo and Maffei, but read it at the publisher [1]; read_bars.py takes the figures from your copy. PubMed's record, which the first script reads in memory. LSMOD.2 itself, which our mint page's script fetches by URL [9].

10 · LIMITS

What this check could and couldn't see

No supplement

It wasn't available. By the paper's description it holds spectra, a photograph, primers and annotations, and no data [1 pp. 2–4]; the photograph would show how far from the coil the controls stood.

The n behind each number

Six plants per group in the methods [1 p. 2]; three samples per group in every multivariate panel, the oil's included [1 Fig. 1][1 Fig. 3F–G]; n printed with Table 1 or any figure. At six, eugenol's and methyl eugenol's rises survive both corrections under both tests, and the total's survives Benjamini–Hochberg. At three, the total's isn't significant; over the compound rows, eugenol's survives both corrections under both tests and methyl eugenol's only Benjamini–Hochberg under Student's t, and with the totals included nothing survives Welch's test. Rounding could undo some of these (C6, section 9).

Readings off figures

Every basil value from a figure is our reading: good to a few pixels on the bars we measured, rougher where read by eye. Only Table 1 prints numbers [1 Table 1].

Where the leaves were measured

Not stated [1 p. 3], so whether the field at the moment of measuring plays a part stays open (section 5).

Data on request

The paper's data are "available on request" [1 p. 9]; we haven't asked for them.

Papers read as abstracts

Xu and colleagues, the tomato paper, the senior author's 2025 review and others, as the source list marks.

Field models

A model truncated at degree 10, from smoothed records, can't resolve small-scale field. The area shares are a rough guide to one excursion's preferred model, not a measurement at any place [8 §2.2.2].

A limited search

"We found no" and "we found" mean in the indexes, repositories and reviews we searched on November 20, 2026.

Small slips we noticed

None of these changes a verdict. The results call eugenol and methyl eugenol "the two major compounds" [1 p. 4], though by Table 1 methyl eugenol is fourth, after eugenol, linalool and 1,8-cineole [1 Table 1]. The control field is "~44 µT" in the abstract [1 S2], 44.4 µT at the nursery the plants came from [1 p. 2] and "~43 µT" as the local field in the results [1 p. 3]. The methods express total flavonoids as "quercetin equivalents (QE)" [1 p. 2], but Fig. 3C's axis reads "mg RUE" [1 Fig. 3C]. The text cites Fig. 3G for the PLS-DA [1 p. 4], which the caption puts in panel F [1 p. 5]. Table 1's caption says "hMG/GMF" [1 S7], though it came from the light-step protocol [1 Fig. 5H]. Fig. 1's caption gives "hMF; red" and "GMF; green" [1 p. 4], the reverse of the plot [1 Fig. 1]. And the nursery's coordinates have 79 and 66 minutes of arc, where a degree has 60, probably decimal degrees (44.79°, 7.66°) written as minutes and seconds [1 p. 2]; the peppermint paper's field site has 76, in the same form [3 p. 2]. We haven't asked the authors about these points, or about the plant counts, the operating yield and the marks above.

What would change these verdicts

01

Per-plant data. Readings become True on this site when their numbers and tests hold up, as the mint paper's photosynthetic readings did on our mint page; its oil result stayed Unconfirmed there, because no row survived a correction. These, with the n behind Table 1 and Figs. 3 and 5, could move "More essential oil in the coil" and "Less peroxide, lower quenching" to True.

02

A repeat with a sham coil, blinding and separate runs, ideally in another lab, would support "The field induces the changes"; a significant fall in phenolics in it would make "Flavonoids up, phenolics down" True.

03

Growth and yield measured, and a dose series between 30 nT and 10 µT.

What a reversal would do to plants turns on a different test: a whole-plant experiment at 1–15 µT, with growth and yield measured, or a tested plant record through a reversal or excursion (section 6 and section 8).

Sources

Bracketed numbers refer to this list. For the paper [1], read in full, p. gives a page of the publisher's PDF, Table and Fig. a table or figure, S1–S9 number the abstract's nine sentences in order, PubMed gives them, and Title is its title; values read off its figures are ours, and approximate. For the same authors' peppermint paper [3], read in full, p. gives a page of its PDF and Table a table. For the other sources, p. gives a page of the copy named in the entry, § a section, Fig. a figure, Table a table, and Abstract or Title that part of the cited work; where only an abstract was read, the entry says so. nT is the nanotesla and µT the microtesla, 1,000 nT; hMF is the authors' hypomagnetic, or near-null, field and GMF the geomagnetic field. Years are those of the printed issue where there is one, otherwise of online publication. Links checked November 21, 2026.

1. Mannino, G., Caldo, F., and Maffei, M. E. (2026). Near-null magnetic fields remodel flavonoid profiles and essential oil content in *Ocimum basilicum* and are associated with altered photochemical performance and ROS homeostasis. *Journal of Plant Physiology* 326, 154872. Received March 4, 2026, revised September 1, accepted and online September 3, as PubMed's record gives them. Peer reviewed. CC BY 4.0. Full text: the publisher's PDF, which the site's owner supplied on November 20, 2026; its supplement (Figs. S1–S2, Tables S1–S3) wasn't available. p. gives a page of the PDF; Table and Fig. a table or figure; S1–S9 number the abstract's sentences, quoted as PubMed holds the abstract (PMID 42705124). The funding (University of Turin, RILO2025) is from the record deposited with Crossref; the competing-interests statement is from PubMed's.

2. SpaceWeatherNews (S0) (November 20, 2026). Solar/Pole Shift Impact: Insects, Plants, Humans | S0 News Nov.20.2026. YouTube video, https://www.youtube.com/watch?v=FEn1ymGXMF0. Linked the source; no transcript was available, so nothing the episode said is rated here.

3. Mannino, G., Caldo, F., and Maffei, M. E. (2026). Reduced geomagnetic field modulates photosynthetic electron flow, menthol yield, flavonoid photoprotection and ROS homeostasis in peppermint (*Mentha × piperita* L.). *Plant Physiology and Biochemistry* 233, 111213. Received December 15, 2025, revised January 28, 2026, accepted March 11, online March 12. CC BY 4.0. Full text: the publisher's PDF in the University of Turin's repository; p. gives its page.

4. Mannino, G., Caldo, F., and Maffei, M. E. (2026). Geomagnetic field reduction induces abiotic stress in *Mentha longifolia* through coordinated changes in photosynthesis, phytohormone networks, flavonoids and essential oil biosynthesis. *Plant Stress* 24, 101593. CC BY 4.0. Full text and supplement, as read for our check of the mint paper; p. gives a page of the journal's PDF, and Tables S2 and S3 the supplement.

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6. Agliassa, C., Narayana, R., Bertea, C. M., Rodgers, C. T., and Maffei, M. E. (2018). Reduction of the geomagnetic field delays *Arabidopsis thaliana* flowering time through downregulation of flowering-related genes. *Bioelectromagnetics* 39(5), 361–374. CC BY 4.0. Full text, through Europe PMC, as read for our mint page and re-read for this one; the lab's reference for its coil.

7. Harris, S.-R., Henbest, K. B., Maeda, K., Pannell, J. R., Timmel, C. R., Hore, P. J., and Okamoto, H. (2009). Effect of magnetic fields on cryptochrome-dependent responses in *Arabidopsis thaliana*. *Journal of the Royal Society Interface* 6(41), 1193–1205. Full text, through Europe PMC, as read for our mint page.

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14. Chulliat, A., Brown, W., Nair, M., et al. (2025). The US/UK World Magnetic Model for 2025–2030: Technical Report. NOAA National Centers for Environmental Information. CC0. As read for our guide to the field.

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16. Xu, C., Wei, S., Lu, Y., Zhang, Y., Chen, C., and Song, T. (2013). Removal of the local geomagnetic field affects reproductive growth in *Arabidopsis*. *Bioelectromagnetics* 34(6), 437–442. Abstract only, through Europe PMC, as read for our mint page; paraphrased. The abstract gives no value for the near-null field, and two reviews differ on it [17][18].

17. Binhi, V. N., and Prato, F. S. (2017). Biological effects of the hypomagnetic field: An analytical review of experiments and theories. *PLOS ONE* 12(6), e0179340. CC BY 4.0. Full text, as read for our mint page.

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20. Parmagnani, A. S., Betterle, N., Mannino, G., D'Alessandro, S., Nocito, F. F., Ljumovic, K., Vigani, G., Ballottari, M., and Maffei, M. E. (2023). The Geomagnetic Field (GMF) Is Required for Lima Bean Photosynthesis and Reactive Oxygen Species Production. *International Journal of Molecular Sciences* 24(3), 2896. CC BY 4.0. Full text, as read for our mint page.

21. Servetto, G. P., Botta, P., Rossi, G., Bernasconi, A., Caldo, F., Vigliaturo, R., and Maffei, M. E. (2026). Maize (*Zea mays* L.) survival on Mars depends on regolith's chemical composition rather than reduced gravity or lack of magnetic field. *Scientific Reports* 16, 19504. CC BY 4.0. Full text, as read for our mint page.

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METHOD

How this was checked

On November 20, 2026, we checked every statement on this page about the paper against its full text, the publisher's PDF, which the site's owner supplied and we read in place, and against its records with Crossref, PubMed, Europe PMC and OpenAlex. The supplement wasn't available; by the paper's own description it holds spectra, a photograph, primers and annotations, and no data. Table 1's numbers were typed from the PDF, its bold type, which marks significance, was read from the PDF's fonts, and the bars of Figs. 3 and 5 were read by pixels from the PDF's own images; the other figures were read by eye. The page also rests on the same authors' peppermint paper, read in full from the University of Turin's repository; on 19 sources read for our mint page, in full or as abstracts, as the source list marks, and reused here, with the lab's 2018 paper re-read in Europe PMC; on three read for our other pages; and on the LSMOD.2 field model, as our mint page ran it. With the S0 News episode that linked the paper, cited only for its date [2], these are the 26 sources listed. Every quotation was checked word for word against its saved source, and the reused ones against our mint page.

The verdicts and the items tagged "Our analysis" are our own assessment, built on the cited sources. They cover our re-check of Table 1, our readings of the paper's figures, the comparison with the same authors' other papers, and the comparison of the coil's field with Earth's in section 6, which reuses our mint page's run of LSMOD.2 with 40 nT in place of 30 nT. As on our mint page, a reading is rated True only if its printed numbers, a stated or recoverable n and tests that reproduce and survive correction hold up. The oil readings don't, because Table 1's n is in doubt (Fig. 1 shows three samples per group), and nor do the readings taken off figures, with no P value or n printed, though such a reading can be the part that holds in a Partly true. No verdict here restates an earlier check's.

We re-checked Table 1 from its printed numbers under rules written and hashed before the first run, and read the bars of Figs. 3 and 5 by pixels; both scripts are hosted, and the bar reader runs on the reader's own copy of the PDF, which we don't host. A check of how far Table 1's rounding could move those results was added after a fresh review of this page, post hoc, with a dated addendum to the rules. The earlier arithmetic on the abstract's four numbers stays hosted too. Comparing the paper's significance marks with those tests, we found one we can't reproduce at six per group, and six at three (section 9). The paper's data are "available on request" [1 p. 9]; we haven't asked the authors for anything.

This page was researched and written with Claude, an AI assistant made by Anthropic, and then re-checked against its sources in a separate verification pass.

The verdicts on this page

OVERSTATED	Has some basis but claims much more than the evidence supports.
UNCONFIRMED	Rests on a preliminary result that hasn't been confirmed.
PARTLY TRUE	Part of the claim holds up and part doesn't.
TRUE	The evidence supports the claim.

All ten verdicts, and how we check

CORRECTIONS

Corrections and changes

If we get something wrong, we fix it and record the change below with the date. If a correction changes a verdict, the log says what the old verdict was.

Change log

Nov 21, 2026	Published on factchecked.science after a full check against the sources. Built from the paper in full, the publisher's PDF supplied by the site's owner, without its supplement; with the same authors' peppermint paper in full, their other work, the literature on near-zero fields in plants, our re-check of the paper's Table 1, with a check of its rounding added after a fresh review, and our readings of its figures, whose scripts and rules are hosted on the page: five of the paper's claims rated on the site's scale. No transcript of the S0 News episode that linked the paper was available, so nothing it said is rated.

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