

Saccharum officinarum

Tissue culture protocol profile built from the published literature



Family	Poaceae
Common names	sugarcane; noble cane; Cavameneñu; Ko; Sugar Cane; Sugarcane; Tö; caen
Authority	Saccharum officinarum L., 1753
Literature scanned	16 Oct 2026

VERIFIED RECORDS

120

11 from full text

PAPERS

83

2004 - 2026

EVIDENCE

Strong

85 protocols graded

GRADE A / B / C

4 / 11 / 70

A = 3+ papers agree

Every figure below was extracted from a published sentence by a rule-based reader, re-derived by a second independent reader, and kept only if both agreed. Unclear sentences were skipped, not guessed. Check the cited paper and validate on your own material before relying on any protocol.

Key findings

- Callus induction: MS with 3 mg/L 2,4-D. Median response 91% (grade A, 5 papers).
- Shoot regeneration & multiplication: MS (0.5× strength) with 5 mg/L NAA. Median response 92% (grade B, 2 papers).
- Rooting: Medium not stated with 5 mg/L NAA (grade A, 3 papers).
- For shoot regeneration & multiplication, BAP is the most reported regulator (23 papers; typical 0.75–1.75 mg/L, median 1).
- For callus induction, 2,4-D is the most reported regulator (13 papers; typical 3–4 mg/L, median 3).
- For rooting, NAA is the most reported regulator (19 papers; typical 1–5 mg/L, median 3).
- 6 atypical doses flagged for a second look.

Recommended workflow

1

Surface sterilization

Evidence C

70% ethanol · 30 s -> 1% NaOCl · 1 min

1 paper. Reported by a single paper; treat as a lead to check, not an established protocol.

2

Callus induction

Evidence A

MS with 3 mg/L 2,4-D. Median response 91%

5 papers. Three or more independent papers report this protocol with consistent outcomes. Hormone balance: auxin only.

3

Somatic embryogenesis

Evidence C

MS with 4 mg/L 2,4-D. Median response 40%

1 paper. Reported by a single paper; treat as a lead to check, not an established protocol. Hormone balance: auxin only.

4

Shoot regeneration & multiplication

Evidence B

MS (0.5× strength) with 5 mg/L NAA. Median response 92%

2 papers. Two independent papers report this protocol. Hormone balance: auxin only.

5

Rooting

Evidence A

Medium not stated with 5 mg/L NAA

3 papers. Three or more independent papers report this protocol with consistent outcomes. Hormone balance: auxin only.

6

Acclimatization

Evidence A

Not specified substrate; survival 91%

14 papers. Three or more independent papers report this protocol with consistent outcomes.

Surface sterilization

#	Grade	Steps	Aseptic	Papers
1	C	70% ethanol · 30 s -> 1% NaOCl · 1 min	-	1
2*	C	75% ethanol · 30 s -> 5% NaOCl · 4 min	-	1
3*	C	70% ethanol · 30 s -> 10% NaOCl · 10 min	-	1
4*	C	4% NaOCl · 60 min -> 95% ethanol · 5 min	-	1
5*	C	0.1% HgCl ₂ · 30 min	-	1
6	C	0.1% HgCl ₂ · 10 min	-	1

Rank 1 evidence [8]: "Surface sterilization involved 70% ethanol (30 s), 1% sodium hypochlorite (1 min), rinsing twice in sterile distilled water, and drying on sterilized filter paper ()."

Callus induction

#	Grade	Growth regulators	Explant	Medium	Outcome	Papers
1	A	2,4-D 3 mg/L	-	MS	91%	5
2	A	2,4-D 3 mg/L	-	-	95% (92-97)	3
3	B	BAP 1 mg/L	-	MS	100%	2
4	C	BAP 2 + NAA 1 mg/L	-	-	100%	1
5	C	2,4-D 5 mg/L	-	MS	85%	1
6	C	GA3 1 + Kinetin 0.5 mg/L	-	MS	70%	1
7	C	2,4-D 2.5 mg/L	-	-	50%	1
8	C	2,4-D 4.5 mg/L	-	MS	80%	1

Rank 1 evidence [1]: "Immature cutting cane stems after 10 days of putting on MS medium (Murashige and Skoog) supplemented 2,4-dichlorophenoxyacetic acid (2,4-D) 3 mg/L triggered the highest rate of explants inducing callus (91.11%)."

Rank 1 evidence [2]: "Callus formation was the maximum on MS + 3 mg/l 2,4-D."

Somatic embryogenesis

#	Grade	Growth regulators	Explant	Medium	Outcome	Papers
1	C	2,4-D 4 mg/L	-	MS, 30 g/L sucrose	40%	1

Rank 1 evidence [3]: "The results are showed that the optimal induction of embryogenic callus on medium MS + sucrose 30 g / L + CH 300 ppm + 300 ppm PVP + 2,4-D 4 ppm as indicated by the high percentage of explants forming embryogenic callus that is equal to 40% and the respective concentration 2 ppm and 3 ppm is 33,3% and 37,5%."

Shoot regeneration & multiplication

#	Grade	Growth regulators	Explant	Medium	Outcome	Papers
1	B	NAA 5 mg/L	-	MS x0.5, 50 g/L sucrose	92%	2
2*	B	BAP 1 + IBA 0.5 mg/L	-	MS	43.4 shoots/explant	2
3	B	BAP 2 + NAA 0.5 mg/L	-	MS	optimum reported, no figure	2
4	B	NAA 2.5 mg/L	-	MS x0.5	90%; 30 d	2
5	C	BAP 2 mg/L	-	-	91%	1
6	C	NAA 10 mg/L	-	MS	93%; 33.3 shoots/explant	1
7	C	TDZ 10 mg/L	-	-	80%	1
8	C	NAA 9 mg/L	-	-	90%; 25.5 shoots/explant	1

Rank 1 evidence [4]: "Maximum 92% shoot cultures developed vigorous root system on ½ strength MS liquid medium containing 50 g/l sucrose and 5.0 mg/l NAA."

Rank 1 evidence [5]: "Maximum 92% shoot cultures developed vigorous root system on 1/2 strength MS liquid medium containing 50 g/l su-crose and 5.0 mg/l NAA."

Rooting

#	Grade	Growth regulators	Explant	Medium	Outcome	Papers
1	A	NAA 5 mg/L	-	-	13.5 roots/shoot	3
2	B	NAA 5 mg/L	-	MS x0.5, 60 g/L sucrose	87% (80-94)	2
3	B	NAA 1 + IBA 2 mg/L	-	-	97%	2
4	B	NAA 1 + IBA 2 mg/L	-	MS	100%	2
5	B	NAA 5 mg/L	-	MS	optimum reported, no figure	2
6	B	NAA 3 mg/L	-	-	1%	2
7	C	IBA 2.5 mg/L	-	MS x0.5, 60 g/L sucrose	87%	1
8	C	BAP 2 mg/L	-	-	89%	1

Rank 1 evidence [6]: "Rooting was most successful with 5.0 mg/L Naphthalene acetic acid (NAA) which resulted in an average of 9.36 roots per shoot in Isd 40."

Rank 1 evidence [7]: "For C86-12 genotype 5 mg/l-1 NAA alone has gave best number of roots (17.8) and root length (3.2 cm)."

Acclimatization

#	Grade	Substrate	Survival	Papers
1	A	Not specified	91% (88-100)	14
2	B	Soil	88% (85-90)	2
3	C	Compost + soil (2:8)	100%	1
4	C	Compost + garden soil (2:8)	96%	1

Rank 1 evidence [9]: "The hardened plants were transferred to green-house conditions where they survived with 90% frequency."

Rank 1 evidence [10]: "Rooted shoots were transplanted in the green house for hardening and their survival rate was 90% in the field condition."

Typical growth regulator doses

One value per paper. Range = interquartile range with 3+ papers, otherwise min-max.

Shoot regeneration & multiplication

Regulator	Papers	Typical range, mg/L	Median	Most common
BAP	23	0.75 - 1.75 (IQR)	1	1
NAA	20	0.5 - 3.5 (IQR)	1.5	0.5
Kinetin	8	0.5 - 1 (IQR)	0.75	1
IBA	5	0.5 - 0.5 (IQR)	0.5	0.5
TDZ	3	1 - 5.5 (IQR)	1	1
GA3	2	0.5 - 0.5 (min-max)	0.5	0.5
IAA	1	0.1 - 0.1 (min-max)	0.1	0.1

Callus induction

Regulator	Papers	Typical range, mg/L	Median	Most common
2,4-D	13	3 - 4 (IQR)	3	3
BAP	6	0.813 - 2 (IQR)	1.5	2
Kinetin	4	0.5 - 0.625 (IQR)	0.5	0.5
Picloram	2	1.087 - 4 (min-max)	2.543	1.087
GA3	1	1 - 1 (min-max)	1	1
NAA	1	1 - 1 (min-max)	1	1

Rooting

Regulator	Papers	Typical range, mg/L	Median	Most common
NAA	19	1 - 5 (IQR)	3	5
IBA	8	1.375 - 2 (IQR)	2	2
BAP	3	1.5 - 2 (IQR)	2	2
IAA	2	1 - 5 (min-max)	3	1
GA3	1	1 - 1 (min-max)	1	1

Somatic embryogenesis

Regulator	Papers	Typical range, mg/L	Median	Most common
2,4-D	1	4 - 4 (min-max)	4	4

Dose-response trends

Median outcome by dose band, one vote per paper. Different papers use different media and explants: read as a trend, not a controlled optimum.

Shoot regeneration & multiplication - NAA (moderate confidence)



Outcome keeps rising up to the highest dose reported; the optimum may lie above what papers have tested. Outcome: response (%).

Rooting - NAA (moderate confidence)

1–2 mg/L		100 n=3
2–4 mg/L		36.3 n=2
4–8 mg/L		87 n=2
>= 8 mg/L		76 n=1

No clear dose pattern: outcomes go up and down between dose bands, so differences between papers (medium, explant, genotype) probably matter more than dose. Outcome: response (%).

Points to double-check

- Surface sterilization - close competitor: 75% ethanol · 30 s -> 5% NaOCl · 4 min (1 paper).
- Surface sterilization - close competitor: 70% ethanol · 30 s -> 10% NaOCl · 10 min (1 paper).
- Surface sterilization - close competitor: 4% NaOCl · 60 min -> 95% ethanol · 5 min (1 paper).
- Surface sterilization - close competitor: 0.1% HgCl2 · 30 min (1 paper).
- Shoot regeneration & multiplication - close competitor: MS with 1 mg/L BAP + 0.5 mg/L IBA (2 papers).
- Shoot regeneration & multiplication - atypical dose: NAA at 9.5 mg/L (high; usual 0.5-3.5).
- Shoot regeneration & multiplication - atypical dose: IBA at 1 mg/L (high; usual 0.5-0.5).
- Shoot regeneration & multiplication - atypical dose: IBA at 0.2 mg/L (low; usual 0.5-0.5).
- Callus induction - atypical dose: BAP at 4 mg/L (high; usual 0.813-2).
- Rooting - atypical dose: NAA at 20 mg/L (high; usual 1-5).
- Rooting - atypical dose: IBA at 0.2 mg/L (low; usual 1.375-2).

References for quoted evidence

[1] Ha Van Tran, Phuong Hoang Phi Cung, Bui Van Le (2013) Transformation of callus sugarcane (*Saccharum officinarum* L.) using *Agrobacterium tumefaciens* – Mediated method and regeneration of transgenic shoot. *Science and Technology Development Journal*. doi:10.32508/stdj.v16i1.1398

[2] Mohashweta Roy, Md Shakhawat Hossain, Avrodip Biswas, et al. (2011) Plant Regeneration through Somatic Embryogenesis from Leaf Sheath Derived Callus of Sugarcane (*Saccharum officinarum* L.) var. Isd -16. *Plant Tissue Culture and Biotechnology*. doi:10.3329/ptcb.v21i2.10237

[3] Wardatus Sholeha, Bambang Sugiharto, Dwi Setyati, et al. (2015) Induction Somatic Embryogenesis Used 2,4-Dichlorophenoxyacetic Acid (2,4-D) and Kinetin in Spindle Leaf Explant Sugarcane. *Jurnal ILMU DASAR*. doi:10.19184/jid.v16i1.1387

[4] Yukti Hari Gupta, Archana, S. Malhotra, et al. (2024) Hormonal Manipulation for Rapid Micropropagation of a New Sugarcane Variety CoS 17231. *Agrica*. doi:10.5958/2394-448x.2024.00016.5

[5] Yukti Goel, Mohan Lal, B.L. Sharma (2015) Hormonal manipulation for rapid micropropagation of sugarcane varieties CoS 99259 and CoSe 01235. *Biotech Today*. doi:10.5958/2322-0996.2015.00029.0

[6] Rebina Ferdous, Md. Jakir Hossain, A. K. M. Nazmul Huda, et al. (2025) In vitro regeneration of some promising genotypes of sugarcane (*Saccharum Officinarum* L.) in Bangladesh. *Plant Science Today*. doi:10.14719/pst.9027

[7] Dereje Shimelis (2015) Interaction Effect of Indole-3-Butyric Acid and ?-Naphthalene Acetic Acid on In Vitro Rooting of Two Sugarcane (*Saccharum officinarum*) Genotypes. *Advances in Crop Science and Technology*. doi:10.4172/2329-8863.1000s1-001

[8] Verma R, Kushwaha KPS, Kumar S, Rawat S (2026) Evaluation of organic vinegar treatments and black gram [*Vigna mungo* (L.) Hepper] genotypes for the management of pod rot disease caused by *Fusarium humuli*. *Frontiers in plant science*. doi:10.3389/fpls.2026.1647478

[9] Arjun, Rao Srinath (2015) Callus Induction and Organogenesis in Sugarcane (*Saccharum officinarum* L.) var 93v297. *International Letters of Natural Sciences*. doi:10.18052/www.scipress.com/ilns.48.14

[10] B H Kambaska, S Santilata (2009) Rapid In vitro Micro propagation of Sugarcane (*Saccharum officinarum* L. cv- Nayana) Through Callus Culture.

How to read this report

- Summaries combine different papers. Media, explants, genotypes and culture conditions differ, so trends are associations, not controlled comparisons.
- Grades reflect how many independent papers agree, not how good the science is. Always read the cited sentence and its paper.
- Papers without open-access full text are read from abstracts only, so some protocols will be missing.
- * close competitor: score within 15% of the leader. Doses are in mg/L after unit conversion.