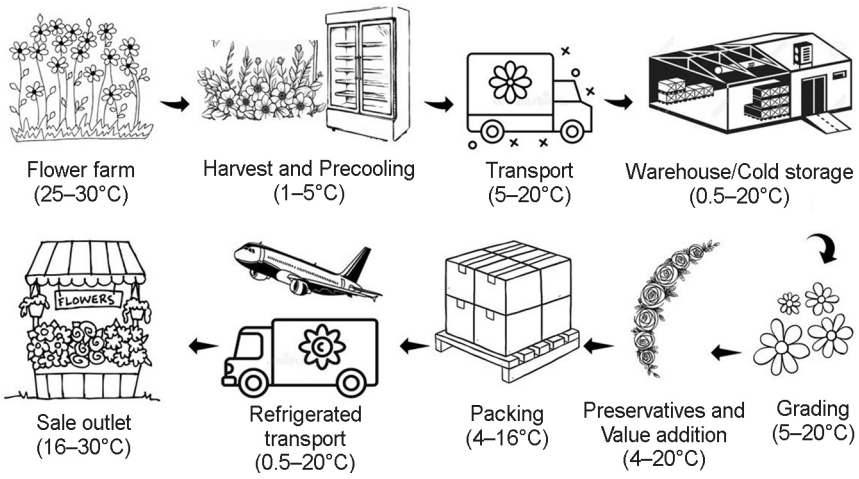

Supplementary Fig. 1 Cold chain management of fresh flowers (A conceptual diagram).

Supplementary Table 1 Effect of floral preservatives on qualitative attributes of fresh flowers

Flower crop	Treatment details	Remarks	Reference
Chrysanthemum	p-phenylene diamide (10 mM)-5 h	Delayed leaf wilting	Doorn and Vaslier (2002)
	Ascorbic Acid-200 ppm+ Salicylic Acid-100 ppm	Enhanced flower longevity, delayed chlorophyll degradation	Budiarto *et al.* (2022)
	Ascorbic acid (50 and 100ppm)	Spraying ascorbic acid extended shelf life and reduced leaf yellowing.	Varun *et al.* (2018a,b), Varun and Jain (2018, 2021)
	Citric acid (150 and 300 ppm), Aluminium Sulphate (500 or 100ppm) and 2% Sucrose	Improved flower longevity upto 19 days in cv. Kundan and 25 days in cv. White Regan with minimum leaf wilting and yellowing	Jain *et al.* (2014), Jain and Janakiram (2016)
	Citric acid and sucrose	Extended life of cv. Kanchil, cv. Shyamal and cv. Korcon Small	Jain *et al.* (2008 and 2009)
	400 ppm 8HQ + 400ppm citric acid + 3% sucrose	Minimum weight loss, maximum flower diameter, maximum chlorophyll, and no leaf yellowing	Jain *et al.* (2016)
Jasmine	Silver nano-particles (20 ppm)	Extended fragrance and shelf life	Mohanasundari *et al.* (2018)
Jasmine	4% Boric Acid + Cold Storage (5°C)	Extended shelf life to 174.6 h	Manimaran *et al.* (2018)
Rose	Graphene Oxide (GO) 0.15 mg/L	Reduced xylem vessel blockage, delayed ageing, and extended the vase life	Wu *et al.* (2023)
	50 ppm 8-HQC + 1.5% sucrose	Enhanced life upto 18.66 days compared to control	Jain *et al.* (2006a, b), Thakur *et al.* (2006)
	200 ppm 8-HQC + 3% sucrose and packed in cellophane	Improved post-harvest life (20.28 days)	Jain *et al.* (2007)
Spider flower (*Grevillea* spp.)	S-carvone (0.636 mM) and 4-hexylresorcinol (2.5 mM)	Prevented stem end blockage by inhibiting suberin deposition	He *et al.* (2006)
Spider Lily	salicylic acid @50 mg/L as spray and polypropylene packaging	Improved all quantitative and qualitative parameters of flower buds.	Mangave (2014)
Tuberose	0.5% sucrose + 15 ppm nano-silver	Maximum chlorophyll content and lowest electrolyte leakage under 15 ppm nano-silver.	Asgari *et al.* (2013)
	4% Boric acid and packaged in muslin cloth bags	Longest shelf life, larger floret diameters, reduced respiration rates, and lowest physiological loss in weight	Singh *et al.* (2022) Priya *et al.* (2022 a, b)

Supplementary Table 2 Overview of advanced treatments to enhance post-harvest quality and longevity in flower crops

Classified treatment	Emerging treatments	Flower crops	Treatment	Findings	References
Physical treatments	Artificial light (LED)	Cut Roses (*Rosa* spp.)	UV + LED light	Extended vase life, inhibited bacterial proliferation at stem ends.	Ha *et al.* (2020)
		Rose cv. Jumilia' and cv. 'Samurai'	LED (Red: Blue: Far red)	Improved post-harvest longevity, quality and delayed senescence.	Rezai *et al.* (2023)
	Ozone	Lanzhou lily (*Lilium davidii*)	Ozone treatment	Significant reduction in disease incidence from *Penicillium gladioli* and *P. polonicum* and controlled patulin accumulation.	Zhang *et al.* (2023)
	Plasma	Chrysanthemum	Plasma-activated water (PAW)	PAW had higher efficiency due to its higher acidity, enhanced oxidizing ability, and increased formation of reactive species.	Arcega *et al.* (2022)
		Roses	Cold plasma treatment	Plasma irradiation at 20 kV for 4–8 min and 15 kV for 8 min completely suppressed graymold.	Jahromi *et al.* (2023)
	Gamma radiation	Tuberose	γ-irradiation	Prolonged the shelf life of flowers.	Ghosh *et al.* (2016)
	Electrolysed water	Cut roses	Slightly acidic electrolyzed water	30µL/L HOCl treatment reduced *Botrytis cinerea* by 71%, extended vase life, and maintained petal colour.	Kim *et al.* (2023)
Chemical treatments	Essential oils	Rose	Paper coated with a matrix of bay, fenugreek, and lemon extract (1:1:1 ratio) with 3% sucrose	Extended shelf life by 8–10 days and reduced spoilage microorganisms.	Shinde *et al.* (2023)
	Citronella oil	Gerbera	Citronella oil @400 ppm	Enhancing the vase life by reducing the bacterial load.	Shravan (2017)
	Melatonin	Rose	Melatonin (MT) solutions for 30 minutes	0.2 mM MT nearly doubled vase life; increased phenol and glutathione content; improved membrane stability.	Mazrou *et al.* (2022)
	Polyamines	Tuberose	Putrescine and spermidine @20 mg),	Exogenous supply reduced PLW, spoilage, delayed flower opening and extended vase life.	Allwin and Krishna (2024)
		Rose	Foliar spray of spermine and spermidine @10 ppm	Enhanced flower production, and improved flower quality in terms of bud size and vase life.	Tatte *et al.* 2016
	Silver Nano Particles(SNP's)	Chrysanthemum	Pulse treatment of Nanosilver 10 mg/L	Reduced vascular occlusion and prevented water stress.	Kazemipour *et al.* (2013)
		Tuberose	Pulse treatment of Nanosilver 5 mg/L	Increased total protein content and decreased lipid peroxidation.	Beni *et al.* (2013)
	Sodium benzoate	Tuberose	Loose flowers treated with 50 ppm Sodium benzoate	Enhanced shelf life upto7.0 days, reduced PLW with more flower acceptability.	Baidya *et al.* (2020)