

# Researchers developing nanotechnology-based applications of hexanal for agriculture

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Spraying hexanal formula on mango trees. Credit: Vijay Kutty/IDRC

Bananas, mangoes and papayas: these tender tropical fruits are in high demand in export markets and an important livelihood source for producers. But freshness is key because these fruits spoil quickly and damage easily. The challenge is especially daunting where refrigeration is lacking. Estimates suggest that up to 40% of produce in tropical countries is lost in post-harvest handling.

Breakthrough research by Canadian, Indian and Sri Lankan partners points to a promising innovation: nanotech applications of a natural plant extract called hexanal can be used to delay fruit ripening. Hexanal inhibits a plant enzyme that is responsible for breaking cell membranes during a fruit's ripening process. In initial research in India and Sri

Lanka, scientists used a hexanal-impregnated formula to test the product on mangoes. Spraying orchards with a low concentration of the compound slowed fruit ripening by three weeks. The team is also developing "smart packaging" systems, made from materials such as banana fibre, that slowly release hexanal to extend storage life after fruit is harvested.

These applications can boost farmers' incomes. "Let's say a mango farmer sprays half or one third of the orchard with the formulation," explains Jay Subramanian, a professor at Canada's University of Guelph. "He gets that same mango production but spread out over a three- to four-week window instead of just one week, which causes a major rush and a glut in the market, leading to low prices." In field trials, farmers were able to earn up to 15% more for their crop. Once harvested, the sprayed mangoes remained fresh for up to 26 days in cold storage and 17 days at room temperature.

Researchers at the University of Guelph, India's Tamil Nadu Agricultural University and Sri Lanka's Industrial Technology Institute are building on this early success. Under a second phase of funding through the Canadian International Food Security Research Fund, a joint initiative of Canada's International Development Research Centre and Global Affairs Canada, they are taking their investigations beyond Asia.

Together with institutions in Kenya, Tanzania, and Trinidad and Tobago, they are looking at hexanal applications with other fruits under different growing conditions. The research teams are testing a variety of sprays, coatings and packaging on [bananas](#), citrus, papayas and even some Canadian tender fruits and berries. Each fruit presents its own unique challenges, such as ripening along different timelines, requiring fine-tuning of the application process.

Biosafety testing shows promise. Already approved as a food additive in

the United States, hexanal leaves no harmful residues. "It's a very natural compound," says Dr Subramanian. "In our academic research we have found that if you spray or dip the fruit with it, within 48 hours it's all gone; you can't find even a trace using a microscope."

A range of new materials is being developed, including wraps containing electro-spun or sprayed nanoparticles infused with hexanal for slow release of hexanal vapours. While exploring ways to delay ripening and improve shelf life, scientists are looking for opportunities to commercialise these technologies so they can be scaled up. The aim is to ensure the technology has a global reach and benefits low-income farmers, not just large producers.

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