

The Hexanal Project

research



Graduate student Shanthanu Krishnakumar picks nectarines as part of his research on hexanal-treated fruit.

Many farmers in developing countries around the globe can lose up to half of their produce after harvest. Much of it tends to spoil before it gets to the market, resulting in food waste and economic loss. Now, a solution has been developed: hexanal, a natural compound found in all plants, that helps prevent spoilage.

An international research team based out of the University of Guelph has developed advanced technology using hexanal to help improve the wellbeing of the environment, economy and society.

Scientific knowledge is important to this project because it has helped propel hexanal mixtures into the easy-to-use, cost-effective and beneficial products (such as sprays, dips and stickers) they

are today. The environmental and economic impact of extending fruit shelf life is that it strengthens local economies and offers a safe treatment for farmers to use on different types of produce across the world. At the forefront of this project, however, is the empowerment and leadership in the hands of farmers — especially women — who make up a large portion of workers.

With hexanal, producers and consumers everywhere can benefit from increased amounts of fresh fruit that's sold at fair prices. Going forward, U of G researchers hope to expand this project to other types of fruit, involve more countries and farmers, and fully license their products so they can enter the marketplace in the near future.

Knowledge Gained:
Making advanced use of nanotechnology to help fruit maintain its freshness

PAGE 2



Impact: Easy on the environment and minimal crop losses at the producer level

PAGE 3



Empowerment and Leadership:
Supporting farm-related decisions for women farmers

PAGE 4

Knowledge gained

What is hexanal?

Hexanal is a compound naturally found in all fruits and vegetables. It has been labelled as a Generally Recognized as Safe (GRAS) compound by the Food and Drug Administration (FDA). This means that hexanal has shown no negative health effects and is completely safe for human use.

The science of fruit

If fruit follows a normal path to ripening, it can become spoiled in a few days, especially if there are environmental factors such as warm temperatures. With hexanal, the degradation process of a fruit's membrane (similar to how human skin wrinkles with age) is delayed and the fruit stays firmer and fresher for a longer time. Tested bananas and mangos have shown significantly improved shelf life when applied with hexanal after 21 days.

Diverse products

Several products have been developed to facilitate fruit treatment, such as spray, dip, vapor, wrap, sachet and sticker. Some methods work better to extend a fruit's shelf life than others, depending on whether the fruit is climacteric or non-climacteric. Climacteric fruits continue to ripen after harvest, such as bananas, mangos and papayas. On the other hand, non-climacteric fruits, such as strawberries and citrus, do not ripen any further after they have been harvested. Having access to diverse methods of treatment helps growers meet the needs of different fruit and use hexanal more efficiently.

Making use of advanced nanotechnology

When hexanal is made into nanoparticles, or miniscule units, it has the capacity to fit into gaps found between the different cells of a fruit's membrane. The membrane then becomes more firm and rigid, maintaining its freshness. A method that can be used to infuse the nanoparticles into the fruit is nano-packing, where fruits are wrapped in material containing nanoparticles on its surface. Upon packaging the products, the hexanal is easily absorbed and the fruit can be shipped off to its destination. Like hexanal, the nanotechnology used in this project is completely safe.

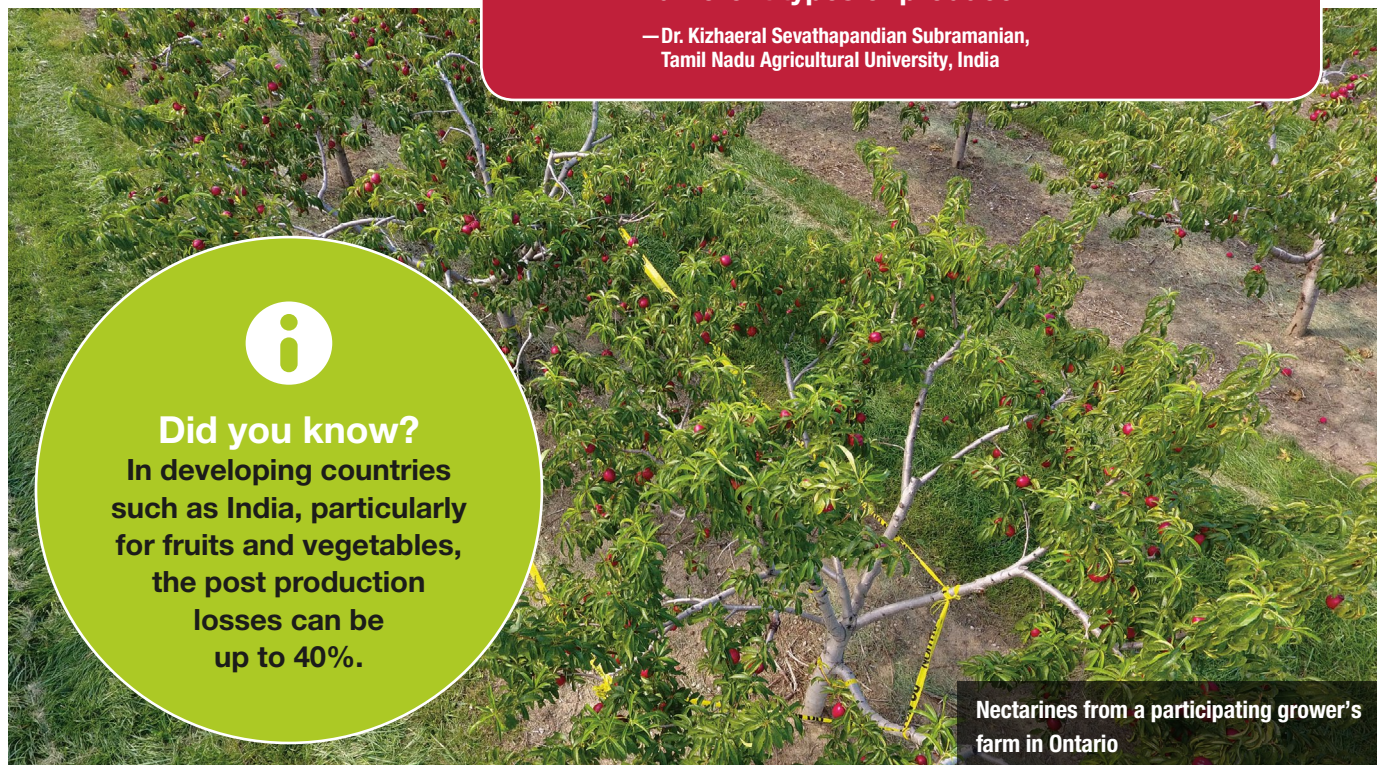


“We don’t put all our fruits in one basket. With the hexanal project, we use several technologies to improve the shelf-life of different types of produce.”

—Dr. Kizhaeral Sevathapandian Subramanian,
Tamil Nadu Agricultural University, India



Did you know?
In developing countries such as India, particularly for fruits and vegetables, the post production losses can be up to 40%.



Nectarines from a participating grower's farm in Ontario

Impact



Everyone wins

Fruits that stay fresh or remain on trees longer throughout the growing season create more income per hectare of land. Hexanal is a low-cost method that minimizes crop losses at the producer level and extends the time fruits can be sold for — so farmers can rely on more consistent income and fairer prices.

Minimizing trade deficits

In many developing countries, there's more money leaving the country to foreign markets than money entering the country, resulting in a trade deficit that affects quality of work and life. Hexanal can minimize trade deficits by increasing the value and quantity of fruit exports and creating additional employment for small scale farmers.

Extra money in the pockets of local farmers is then put towards purchasing

goods and services from members of the community, ultimately strengthening the local economy. For individuals or families that invest in healthcare and education, the cycle of poverty can be broken.

Environmentally friendly

Hexanal is a compound that occurs naturally in fruit to protect against insects and other herbivores. When applied to fruits as a spray, dip or sticker, hexanal evaporates into air leaving no residue.

Researchers tested hexanal thoroughly for environmental safety. They found no mortality in cultured human cells, microorganisms, insects or fish exposed directly to elevated concentrations of hexanal.

In fact, trees sprayed with hexanal display greener leaves and thicker canopies than their counterparts. Sprayed trees also have a higher disease and pest resistance, and attract more beneficial insects, like honeybees and parasites that feed on harmful pests.



“The biggest gain from the project is 15 to 20 years of research reaching millions of people around the world.”

— Prof. Gopi Paliyath, University of Guelph, Canada

Empowerment and leadership

Empowering women

In many countries, women make up a large portion of the agricultural workforce. Researchers have found that when women make important farm-related decisions — on topics such as production, harvesting, grading and packaging — they not only feel more empowered in their roles on the farm, but in their homes as well. They are able to spend more time with their families, focus on money for schooling and medical costs and for providing more nutritional foods to their children.

Building stronger communities

Hexanal has helped to improve the lives of entire communities, as well as other farmers and producers in the area. Producers who use hexanal have seen a significant reduction in post-harvest losses. With less produce lost, both income and livelihood for small fruit farmers vastly improves.

Increasing local economic independence

One of the most beneficial aspects of hexanal is its ability to extend the shelf life of fruit. This means that producers can sell their products at a more fair price — without hexanal, they had to sell their produce as soon as possible, typically having to take the first offer that came along (typically, 15 to 20 per cent of market value). Now that produce can last much longer, farmers are able to wait for a better price. This provides farmers with an average of 15–25 per cent more per acre, depending on the crop



Working together to strengthen the local economy

When people are healthy, the economy, farmers, business and communities at large are generally better able to succeed both short term (sustainable work, healthy families) and long term (putting money towards better education and housing). The number of hours producers have to be away from work decreases because family members aren't getting sick as often. They are physically and mentally stronger from better nutrition. In addition, they have spending money to support local businesses. By spending their money locally, small businesses and farmers can continue the cycle of paying workers a fair price.



“We are very excited about the potential impacts, as it impacts women, because women are the ones who do most of the food preparations, service and so on, so their jobs will also be secured, and their children will benefit as well.”

—Dr. Margaret Hutchinson,
University of Nairobi, Kenya

The hexanal project is led by researchers from the University of Guelph, Dept. of Plant Agriculture. The project is undertaken with the financial support of Canada's International Development Research Centre (IDRC), www.idrc.ca, and the Government of Canada, provided through Global Affairs Canada (GAC), www.international.gc.ca.



uoguelph.ca/research
Published by the Office of Research
University Centre, University of Guelph
Guelph ON N1G 2W1
Phone: 519-824-4120, Ext. 53781

Compiled by Alaina Osborne,
Students Promoting Awareness
of Research Knowledge
Editorial Coordination:
Owen Roberts and Liz Snyder

Photos courtesy of hexanal
research project.

Design and Layout:
Gareth Lind, Lind Design

For more information, contact
jsubrama@uoguelph.ca

Electronic version with citations
available in PDF format at
uoguelph.ca/research