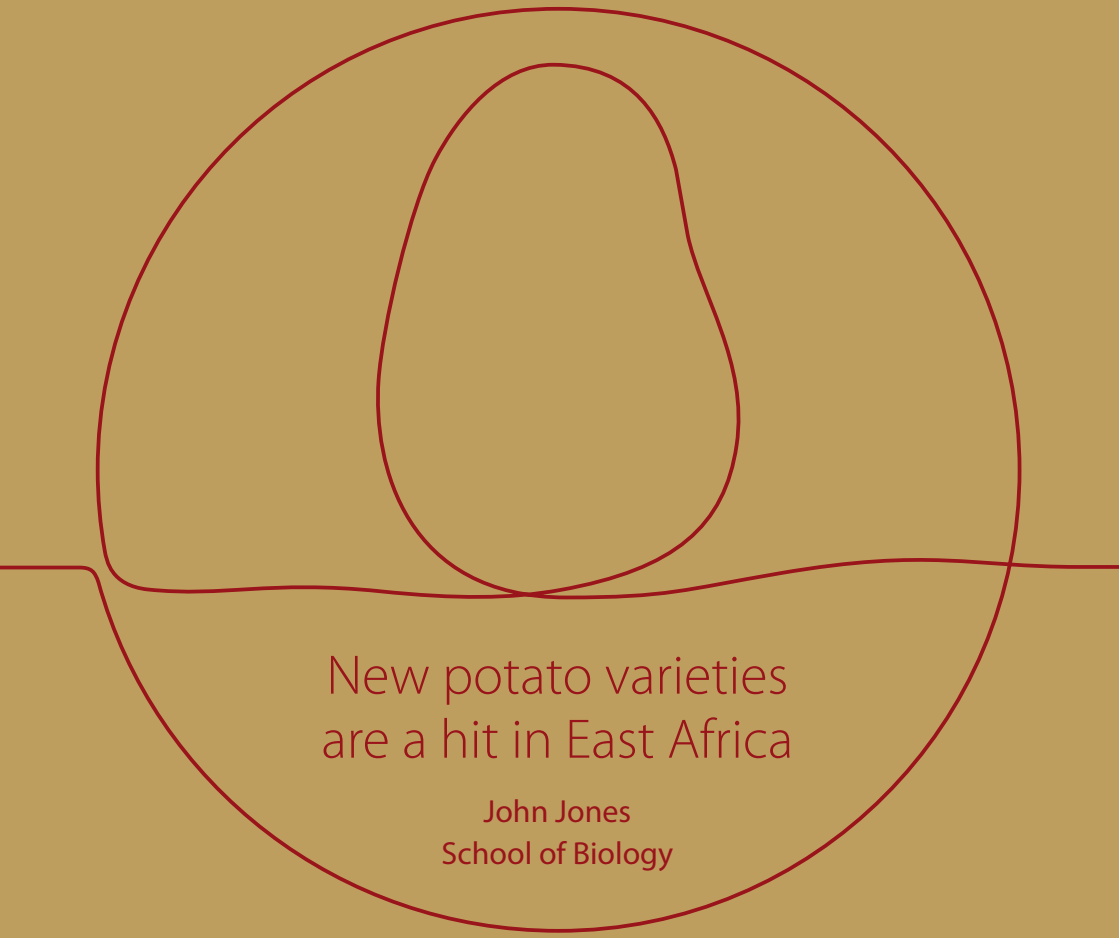
University of St Andrews

STACEES
St Andrews Network for Climate, Energy, Environment and Sustainability

The Sustainability Series



New potato varieties are a hit in East Africa

John Jones
School of Biology

September 2021

New potato varieties are a hit in East Africa

John Jones – School of Biology
(Article written by Martin Ince)

With an estimated production of 368 million tonnes in 2018, potatoes are one of the world's most important crops. If the potato harvest is lost or reduced in output, farmers and consumers alike will suffer.

The arrival of a new and damaging parasite, first detected in Kenya in 2015, means that this issue is a live one in Kenya and across East Africa. Scientists at St Andrews are a key part of the international team that is working to solve the problem by breeding a new type of potato.

John Jones is a Professor of Biology at St Andrews and Head of the Cell and Molecular Sciences Department at the James Hutton Institute, a Scottish research organisation specialising in crops, land use and natural resources. He explains that the problem is the arrival in Kenya of the potato cyst nematode (PCN) *Globodera rostochiensis,* a parasite of common potato varieties in the area. Jones says, "Most farmers are unaware of PCNs, microscopic worms which live in the soil and are invisible to the naked eye. Their presence is not obvious and there are no defined symptoms that are characteristic of this disease – the plants just appear generally unwell."

According to Jones, "These parasites co-evolved with potatoes in South America and were brought to Europe when new varieties were introduced after the Irish potato famine [in the 1840s and 1850s]. Then, the seed potato industry spread them from Europe across the world in the 20th century."

Unlike the blight that caused the Irish potato famine, Jones says, PCNs "do not destroy the entire crop in the field." Instead, the parasite reduces the yield per hectare to a damaging level. "Crisis would be too strong a term," he notes. "The picture is not black and white, but it is a big problem." The PCNs are present in Europe and found "wherever you look" in East Africa, including in Rwanda, Uganda and Kenya. Alongside the financial and nutritional consequences of reduced crop yields, this also means possible ecological damage as the lower output per hectare tempts farmers to increase capacity by cutting down virgin forest.

Making a new potato

Jones and colleagues responded to the problem by developing a new potato that has some major advantages. The new lines, which are undergoing further testing in Kenya before being designated with a formal name, are resistant to PCNs. But they must also be acceptable to farmers and to the people who do the cooking (mainly women, in this part of the world).

The aim, Jones recalls, was to produce a potato that mimics Shangi, an existing

variety that accounts for up to 75 per cent of Kenya's current potato crop grown by smallholder farmers – but with better PCN resistance. Shangi has no dormancy, which is the requirement for exposure to cold conditions that characterises many potato types. This is a welcome feature because there is no cold storage in Kenya, and farmers want to plant the next crop as soon as they can. Growers in Kenya often produce two crops each year, aligned with the rainy seasons. Those who prepare meals also want the potato to cook quickly – a further attribute of the popular Shangi that is also a feature of the new lines. "We wanted this project to have impact, so we took time to find out what the users want," Jones says.

Creating a new potato is not a simple task. Jones explains that the potato genome is large and complex, which means that a rich variety of types are available as source material. The problem is that it typically takes five to ten years to develop a new one. However, the timescale has been telescoped to one or two years for this project.

Such rapid progress was possible because the team already knew about potato lines at the Hutton Institute that combined a potato called *Solanum phujera* with conventional *Solanum tuberosum* lines containing a gene called H1. Identified in the 1950s, H1 conveys PCN resistance to potato varieties. The hope was that these new lines would have all the attributes desirable to smallholder farmers in addition to PCN resistance.

Jones emphasises that the new lines were generated by cross-breeding, an orthodox plant breeding method, rather than genetic engineering. This is because there is strong social resistance to the latter in some parts of the world.

Thus far, the new lines have passed every test for adoption in Kenya. Jones explains, "They have been planted in field trials which have been pretty good, and which have shown that they can control PCN levels. So, the farmers like it. In addition, the women's groups we have consulted say that it passes the taste test." The new potato is rich in chemicals called carotenoids that add to flavour and appearance, comparing well to the Shangi in trials. In appearance, Jones says that it looks like the Mayan Gold (a potato familiar to shoppers in European supermarkets).

The next stage of development is to get this new variety from testing to bulk use. To achieve this, the potato has to be approved as a new line by the Kenyan authorities. Then, it has to be introduced into the channels through which Kenyan farmers get seed potatoes. Jones says, "This could be done through commercial networks. They do exist, but most smallholder farmers cannot access them. It is likely that if it is a success, the lines will feed into the informal exchange markets which most farmers use."

Jones is keen to stress the multinational nature of the Kenya potato project, which has been carried out by two Scottish institutions, the University

of St Andrews and the James Hutton Institute. They have worked alongside the International Institute for Tropical Agriculture (IITA), a Kenya-based research organisation specialising in food issues. The organisation has expertise in nematode science and other aspects of African farming systems, and provides valuable expertise in working with African farmers and consumers. It is also part of CGIAR, the food-oriented research agency for the Global South. The project further included involved was icipe, the Kenya-based International Centre of Insect Physiology and Ecology. Jones notes that St Andrews is "a critical part" of the project due to its biological knowledge and that "collaboration between the three institutions is very close and we have full information sharing."

This promising project was enabled by UK development aid spending, including cash awarded to St Andrews from the Global Challenges Research Fund (part of the UK aid system). In addition, Professor Jones received £150,000 for this work from Innovate UK, part of UK Research and Innovation, via the James Hutton Institute.

Find out more
Researcher profile: www.st-andrews.ac.uk/biology/people/jj33

Publisher: St Andrews Network for Climate, Energy, Environment and Sustainability, University of St Andrews.

Editors: Sarah Bennison and Laura Pels Ferra.

Disclaimer: This article is one of a series of articles collectively entitled 'The Sustainability Series', written for STACEES, the St Andrews Network for Climate, Energy, Environment and Sustainability. STACEES is a research network at the University of St Andrews. The articles contained in the Series are based on research and may also contain opinion-based information. The opinions stated herein do not necessarily reflect the ideas, ideologies, or points of view of the Editors, the University of St Andrews or any other organisation.

Neither the University of St Andrews nor the Editors or Author(s):

- makes any warranties about the completeness, reliability and accuracy of the information contained herein and in particular takes no responsibility for the accuracy or otherwise of any part of the information contained herein (including any claims made herein) or for any errors or missing information. Any reader who relies on the information or views expressed in the article does so at their own risk. Any action taken as a result of the information or views contained in the article is at the reader's risk;
- will be liable for any losses and/or damages whether directly or indirectly from or arising in connection with the use of this article; and
- will be held responsible for any misuse, reuse, recycled and cited/uncited copies of content from by others.

University of
St Andrews

The St Andrews Network for Climate, Energy, Environment and Sustainability (STACEES) is an interdisciplinary research-focused initiative launched in April 2021 at The University of St Andrews.

The Sustainability Series comprises 15 professionally written, accessible articles commissioned by STACEES to showcase the breadth of the world-leading sustainability-focused research at the University.

Designed and produced by University of St Andrews Print & Design Unit, September 2021.
The University of St Andrews is a charity registered in Scotland. No: SC013532.