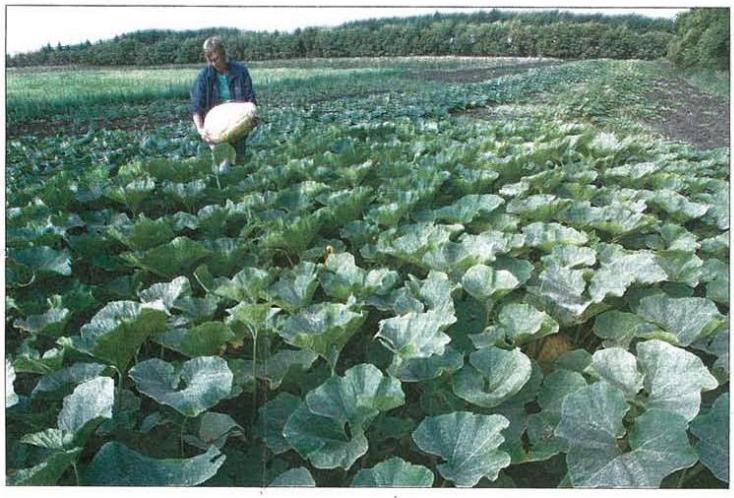
TAKING STOCK OF THE SQUASH CROP



Norah Tolmie, who runs Aagard Farms with her husband, Jes, checks the winter squash crop on their land north of Brandon. They grow vegetables for farmers' markets. | ROBERT ARNASON PHOTO

RESEARCH | FOOD PRODUCTION

Fungi could reduce need for fertilizer

Breakthrough could boost production in Third World

BY MARGARET EVANS
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LINDELL BEACH, B.C. — Fungi can greatly enhance food production without the need for copious amounts of fertilizer, says a professor with the University of Lausanne in Switzerland.

Ian Sanders studies mycorrhizal fungi, a type of fungus that lives in a symbiotic relationship with plant roots. Plants are able to thrive and grow larger because the fungi are able to extract phosphate from the soil for the plant's benefit.

"The fungus lives inside the roots but produces fine filaments called hyphae which grow out from the roots into the soil," he told the general meeting of the American Society for Microbiology in New Orleans earlier this summer.

"They act as an extension of the roots' system and are able to exploit the soil for nutrients more efficiently than the plant roots."

Plants in the tropics are especially deprived of phosphate because of the structure and chemistry of the soil.

"Most tropical soils are highly acidic and very low in phosphate," said Saunders.

"When it's added to the soil in the form of fertilizer, the phosphate binds to the soil particles and the plant cannot get it. Farmers in the tropics add enormous amounts of phosphate fertilizer, if they can afford it, but get very few benefits in growth increase. Adding mycorrhizal fungi can potentially reduce the amount of fertilizer needed as they help the plants to get the phosphate that is bound to soil particles."

Saunders said arbuscular mycorrhizal fungi are the main types of mycorrhizal fungi, forming symbioses with 80 percent of land plants. They are found in all terrestrial ecosystems from the tropics to the tundra.

This group of fungi is the only one known to provide this service to plants, exchanging the phosphate with the plant for carbohydrates. They have been doing this with almost all plants since plants began growing on land 460 million years ago.

Mycorrhizal fungi also help some plants during times of drought, can help plants obtain other important nutrients and can protect plants against pathogens.

Many commercial crops form this association with arbuscular mycorrhizal fungi, including rice, wheat, potatoes, cassava and corn, but crops that don't share this association include members of the brassicaceae family of vegetables, such as cabbage, broccoli, cauliflower and mustard.

Phosphate reserves are rapidly depleting because of increasing demand. This drives up prices, making it unaffordable for many farmers.

Phosphate production requires energy, which links the price of fertilizer to the price of oil and makes food prices unstable. Some countries are banning exports and are now stockpiling phosphate.

However, recent biotechnological breakthroughs now allow scientists to produce the fungi and suspend them in high concentrations in a gel for easy transportation. Saunders and his team are testing the effectiveness of the gel on cassava, which is one of the most important food crops in the tropics.

The gel is fully approved and licensed for safe use in the European Union, and human consumption of the crops has no known side effects.

Saunders said there is also interest in using the fungi to help plants grow on heavy-metal contaminated soils and help re-vegetation programs on waste industrial land. The fungi has been used for these kinds of purposes in North America.

The development of the gel to greatly expand food production at a far lower cost than fertilizer application has enormous implications for agricultural communities in developing countries. Two-thirds of the global population lives in these regions, where poverty and malnourishment is a constant challenge.

Aid from developed countries is a mitigating, but limited, factor. Saunders said it makes more sense to enhance food production at the source.

"The fungi, as well as many technologies that already exist in developed countries, could enhance growth of many crops in the tropics," he said.

"If done so correctly, it could lead to a large reduction in food production costs on a global scale as most of the food needed to feed the human population could be produced in the tropics. It would result in reduced poverty and economic enhancement that would affect more people than those living in Europe and North America combined. The potential is enormous (and) it could have global economic importance."

The European company Mycovitro developed the gel in collaboration with the research team.