Increasing photosynthetic efficiency; When it comes to retaining photosynthesis from the sun, “plants are not that efficient”

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AS A LITTLE GIRL GROWING UP at Morrisburg, Ontario, Dr Amanda Cavanaugh, now at the University of Illinois, could only dream of being involved in an agricultural scientific project with such, "potential for impact."

She spoke in Chicago at the Ag Tech Nexus Conference, put on by Global Ag Investing, on a panel with a fellow scientist from the same university, Dr Katherine Mecham- Hensold, and Illinois soybean producer Heather Hampton Knodle, about a genetic engineering research project to increase photosynthesis efficiencies in plants.

Dr KaKisha Odom from the University of Illinois moderated the panel.

With the research well-funded by the Bill and Mellissa Gates Foundation, the overall goal is determining, "how will boosting photosynthesis for plants increase crop yields?" said Cavanaugh.

When it comes to retaining photosynthesis from the sun, "plants are not that efficient -95 per cent of solar energy is lost right away," said Cavanaugh. By focusing research in areas such as leaf architecture and photo respiration, hopefully capturing a larger percentage of sunlight is, "a yield potential equation," she said.

Being in Illinois, "we're in soybean country," which is a focus of their research, said Cavanaugh. But she noted that the same research is being focused on rice and other food crops.

“Plants have one enzyme that captures CO2 and converts it to sugar," she said. By tweaking that in their initial lab experiments with tobacco, "we've had plants grow 20 to 40 per cent larger.”

While tobacco is a plant that Cavanaugh doesn't feel the world needs more of, "we're very confident it will increase yields," when the same genetic engineering manipulations are done to other food plants, she predicted.

In 20 years of field studies at the University of Illinois, "where we have increased CO2, we have increased photosynthesis and increasing yields in the ground," said Cavanaugh. There has been a "slight quality reduction, but we're not sure if it is due to CO2," she said.

The growth monitoring technology on a leaf by leaf basis out in the field is expensive and cumbersome, hence they have had to adapt by developing, "a proxy in the lab, screening devices that can look at growth rates over time," said Mecham Hensold.

The proxy process consists of taking electromagnetic radiants across the whole spectrum, with the red and blue light, "reflecting what the plant has been through, and why," said Mecham Hensold.

"Photosynthesis has never been a trait we have selected for," she said. Hence the challenge is, "how do we get what we have in the lab, in the ground?" While scientists, such as she, can prove that crops are facing, "a yield barrier," unless plants can capture more sunlight, "researchers need to listen to what farmers need," she said.

As a farmer, "the technology is Greek to me, photosynthesis has 200 steps, but if we can get a competitive edge, we're all in," said Hampton Knodle.

"Sometimes the technology has to hit the row, for those of us who are producing food," said Hampton Knodle. As far as this technology is concerned, "we're not close enough for the banker to say 'yes, there is a return on that,'" she said.

She pointed to major disruptors for farmers, like this year, that science can't solve, such as terrible weather for planting and trade disputes involving soybeans, as examples of, "we can't control weather and politics."

To bring innovative technology like this to the field, "we need a regulatory framework to allow it to happen," said Hampton Knodle. "Funding of public research is vital."

But far more important than that, for the sceptical public to embrace and understand what genetic engineering of plants like this is accomplishing for health and potentially curbing world hunger, "we need an excitement to have changes," she said. "We need to pull together to engage the public on how beneficial to society this is."

"Rice is half of the world's food staple,“ and growing ”more of that on less land," are vital messages one needs to get out to the public, said Hampton Knodle.

“It's noble, it's new, we need to do it.”