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Toxicity-Resistant Crops

Continued from page 1

By Mason Inman

Thursday, October 02, 2008

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But the newly identified mutation inactivates the AtATR protein, so cells don't respond to DNA damage by shutting down cell division, thereby bypassing that checkpoint, Larsen says. "The plant is effectively blind to what's happening in the cell." So the mutant plants can maintain high levels of growth in the presence of toxic levels of aluminum, even if they sustain some DNA damage.

It is not yet clear how much DNA damage the plants sustain, Larsen says. But the strategy could work to promote short-term growth even if it would sacrifice the plants' DNA. To avoid DNA damage accumulating over generations of growing on aluminum-rich soils, farmers could obtain seeds from mutant plants grown on aluminum-free soil. This would mirror how farmers in industrialized countries use hybrid seeds from agribusinesses rather than saving their own seeds for planting further generations of crops.

"The work provides the first compelling evidence for a mechanism that explains the toxic effect of [aluminum] on root growth," says plant biologist Manny Delhaize of the Commonwealth Scientific and Industrial Research Organisation Plant Industry Center, in Canberra, Australia. "There have been numerous theories about how aluminum arrests root growth, and this work provides convincing evidence regarding the molecular process involved." Delhaize says that another method of keeping the growth rates high, while limiting any DNA damage, might be to engineer plants so that their root tips express molecules that would inactivate AtATR.

However, such a targeted approach may not be necessary, Larsen argues. Even after growing the mutant plants on aluminum-containing soils for several generations, there are "no obvious deleterious effects on growth, viability, [or] seed production," he says.

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Questions on edibility
It would seem reasonable to question the edibility of crops with high levels of aluminum. Is there an increased risk of dna damage in people or livestock. It might seem that if used with bio fuel crops, this new technology would make otherwise poor crop land productive.

Could an alternative be to change the acidity of the soils to make them more alkaline, or is this solution too costly.

Could the mutated gene "AtATR" be used to encourage other mutations in plants for scientific study with mutation rates modulated with soil acidity levels, possibly even during the plants life cycle. Each generation, select for desired characteristics.

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shomas
10/02/2008
Posts:44
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Re: Questions on edibility
I worked on this project and the possibilities are rather exciting. We hadn't considered its utility for biofuel crop production, but that's certainly an interesting application!

As to the levels of aluminum in the crops, it depends on whether

zenzicube
10/02/2008
Posts:1
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the crops themselves are bioaccumulators. Most aren't, as Al bioaccumulators are also Al-tolerant plants. Tea is one such accumulator, and people have been consuming it for thousands of years.

Aluminum-rich soils can be treated with ground limestone to raise the pH and allow for crop growth, but this is expensive, labor intensive, and short-lived as Al-rich soils are often sandy and ions tend to leach out over time (hence the acidic pH).

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soil ph conditioning crop.

Is it possible and would it be of any benefit to engineer a plant for conditioning a soils PH, making it more alkaline, and used every other year on soils other wise normally too acidic.

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shomas
10/04/2008
Posts:44
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Re: Questions on edibility

Foods genetically modified in a way that allows "more genetic damage" as stated in the article, may not be accepted by the general population as
quickly as modified plants for bio fuel might be.

I looked at http://en.wikipedia.org/wiki/Soil_pH and it says "Many nutrient cations such as zinc (Zn^{2+}), aluminum (Al^{3+}), iron (Fe^{2+}), copper (Cu^{2+}), cobalt (Co^{2+}), and manganese (Mn^{2+}) are soluble and available for uptake by plants below pH 5.0", and at http://en.wikipedia.org/wiki/Acidosis "Blood pH values compatible with life in mammals are limited to a pH range between 6.8 and 7.8. Changes in the pH of arterial blood (and therefore the extracellular fluid) outside this range result in irreversible cell damage".

From that can I assume, Because humans have a ph of 7.35 to 7.45, they wouldn't normally have to worry about aluminum ions damaging their dna?

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shomas
10/02/2008
Posts:44
Avg
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Okay, props to the editor...

...for the "aluminum foiled" caption.

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Monsterboy
10/02/2008
Posts:90
Avg
Rating:

pandoras box

For someone, who, after having done all the major work that he needed to do in philosophy and metaphysics by the age of fourteen, and quite literally played the Sorcerers Apprentice for his fifteenth year, I know firsthand just how foolhardy and dangerous that the search for real esoteric knowledge can be. Although our recent attempts at genetic manipulation would seem to be an almost biological necessity in the face of fighting pandemic diseases and promoting hybrid plants, it is also, at least to my way of thinking, just a modern form of alchemy. Ancient texts on the subject, some of which are still in existence today, reveal that inexhautible and equally foolhardy desire to quite literally turn dross into gold. If todays scientific community published a modern online compendium of each experiment which has been undertaken so far to achieve that very same effect, I'm sure that it would be an interesting study in how human nature never quite changes regardless of its present circumstances.

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phoenix
10/02/2008
Posts:172
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Any reason for concern here?

It would seem that disabling a pathway which evolved to detect genetic damage (and respond by shutting down further replication using that damaged 'blueprint') might present some risk of unleashing

flared0ne
10/02/2008
Posts:80

tumorous growth, depending on the range of possible genetic damage involved... At least we supposedly aren't talking about anything which might affect changes to germplasm, i.e. allowing the alumina-content of the substrate to somehow have an impact on the SEEDS produced later by the plant.

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Re: Any reason for concern here?

shomas
10/04/2008
Posts:44
Avg Rating:

The article proposed this "To avoid DNA damage accumulating over generations of growing on aluminum-rich soils, farmers could obtain seeds from mutant plants grown on aluminum-free soil."

On a side note, could it be possible to genetically engineer the plant to sense ph, When ph drop too low cells make an alkaline keeping the plants ph at a level to prevent dna damage?

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