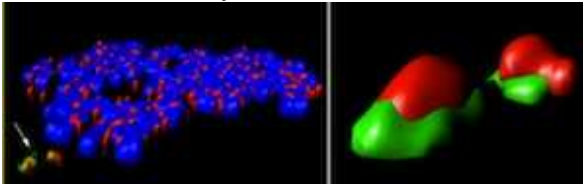


[Chromatin's Yield Machine: is instant gene-stacking a game-changer for energy crops?](#)

[Jim Lane](#) | January 19, 2011 | [0 Comments](#)



Micrograph of a sugarcane cell showing successful deployment of multiple-gene stack (arrow) with sugarcane chromosomes (blue/red). Right: Closeup of paired gene stack, showing added genes (green) and regions that mediate DNA inheritance (red)

In Illinois, Chromatin announced the successful first demonstration that genes can be assembled, stacked, and expressed in sugarcane using the company's mini-chromosome technology.

Now, what exactly is a gene stack and why should I care?

Most of what we eat or use in commodity crops – for biofuels and everything else – utilizes genetically modified organisms. According to UCSD's Steve Mayfield, up to 92% of corn, and 87 percent of soybeans, and right down along the line.

Developers, however, want to insert genes that offer improvements in multiple traits – when an organism has more than one gene inserted in this process – for example, for disease resistance, insect resistance, herbicide resistance – this is called a gene stack. In 2007, for example, Monsanto and Dow introduced an eight-gene stack (SmartStax) that contained eight herbicide tolerance and insect-protection genes, including Dow's Herculex I and Herculex RW; Monsanto's YieldGard VT Rootworm/RR2 and YieldGard VT PRO, Roundup Ready and Liberty Link tolerance genes.

Gene stacking, thereby, is foundational in the drive for higher productivity from land crops.

You can stack in one of two ways. First, the traits are inserted, one each into one varieties. Then the varieties are cross-bred in the traditional manner so that they transfer the genes, eventually, into the target. That's how Monsanto and Dow came up with SmartSTax.

The Chromatin process

The other way is to insert them all at one time into one variety, The company developed a proprietary gene stacking technology, which can be used to simultaneously, and precisely introduce multiple genes in any plant, bypassing the cross-breeding process.

How? (*Warning: some biology background is helpful, here*)

Chromatin is using a plant's own DNA to deliver several genes on an independent and heritable genetic element, without requiring insertion directly into the plant's host genome. These elements are built to deliver multiple traits and to accelerate development of new products, providing benefits to growers, industrial bioprocessors, and consumers.

Game changer or speed-changer for improving plant productivity

For all plants, aquatic or land-based, the Chromatin technology is a speed-to-market opportunity, and makes certain modifications economically feasible for the first time. But there's a catch with traditional cross-breeding. Not every plant genome is stable enough to support extensive cross-breeding in order to introduce desired genes. One of those is sugar cane.

So, let's say you wanted to introduce several genes, not just one – for example, insect resistance, herbicide resistance, disease resistance, higher sugar concentrations, and enzymes to enable better bagasse digestion. If you could do it at all in cane – and it would be a monumental, unprecedented achievement in cross-breeding, it would take, say 13 years or so to accomplish it. It has made changes at this level uneconomical.

So that's what the Chromatin breakthrough is all about. Creating a method to bring the sort of possibilities that have materially advanced yields in, say, corn and soy, to a whole new array of energy and food crops. Opening up the door for more rapid improvement of the underlying per-acre yields.

Thereby reducing the amount of acreage needed to support, say, a cellulosic ethanol or renewable diesel processing technology. Increasing thereby the radius over which biomass can be transported at economically viable rates. Making the processing plants larger, and more cost effective.

Speeding up the point at which a given technology can achieve parity with fossil oil. Pushing us faster towards the scaling of energy crops and biofuels.

Sugarcane and other feedstocks

Chromatin has wrapped itself into a worldwide exclusive with Syngenta in sugarcane – so, for improvements in the sugarcane genome, that's where they will come from in so far as this technology is concerned. Meanwhile, Chromatin is pretty well wrapped up in terms of licenses for its technology in corn, soy, canola and cotton.

And, Chromatin said last year that it would pursue opportunities in sorghum as a developer.

But there are the energy canes, and the energy grasses like switchgrass and miscanthus. Or the woods like eucalyptus or poplar. Or the aquatic species, like algae. For those platforms, this is a licensable technology.

Speaking with Chromatin CEO, Daphne Preuss

BD: Bottom line, what's the breakthrough here?

DP: Traditional methods can take decades, or not work at all. This changes that.

BD: How confident are you that this achievement in sugarcane can be duplicated with other energy crops?

DP: We're highly confident. We've already demonstrated the technology in corn and in soybeans. This is the first energy crop, and we're highly confident that the platform is extensible.

BD: Who are some of the companies you have done business with in non-energy crops?

DP: We have worldwide non-exclusive licenses with Monsanto, Syngenta, Bayer and Dow. The Syngenta license for sugarcane is worldwide, and exclusive.

BD: The protections in your IP?

DP: That's been one of our strong points. We have 14 issued patents, which include claims in algae and other energy crops as well as food crops. The IP package is very strong – its one of the reasons these companies have been willing to license.

BD: In energy crops, will these be worldwide licenses, exclusives, non exclusives – what's the outlook?

DP: We are willing to look at territories – for example, we are talking with groups in Australia, and we have a long patent trail in Brazil and Europe, for instance. We will slice and dice it in a way that creates the most value.

BD: Who are you talking to in, say, algae?

DP: Let's just say most of the usual suspects you would expect.

The Digest's Take

It will take some time for Chromatin to find and sign the right partners, and in turn for them to develop the gene stacks with the performance improvements that are desired. But let's look at the opportunities this way. Cross breeding has been the platform technique for a 500 percent improvement in corn yields, over 100 years. That's a long, long time, but it shows the kind of fundamental change possible. Without cross-breeding, the world would in all probability starved to death long ago – or rather, stalled in its industrial development as simply too many hands, and too much acreage, would have been needed on the farm.

Meanwhile, there are energy grasses, woods and aquatic species that have hardly been touched by cross-breeding or genetic improvement – and already in their wild state have had promising results in terms of productivity for biofuels. SG is just getting a leash on jatropha; companies like Sapphire Energy are just undertaking the first large-scale improvement programs for algae.

But doing so at the lowest possible cost, and the highest possible speed, is the surest road to the kinds of productivities that provide food, feed and fuel for all. This is an advance in science with game-changing characteristics across a host of energy crops.

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