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Biotech-Can It Work In Sugarcane?

Much has been written about the potential value of biotechnology to agriculture. Many growers around the world have now seen the value of herbicide resistant corn, soybeans and cotton. Other transgenic crops currently grown include sugarbeets, canola and papaya with commercial approval in a number of other crops. While there have been many who have questioned the real economic value of this technology, according to the International Service for the Acquisition of Agri-biotech Applications (ISAAA), some 10.3 million growers around the world would testify to the value of the crop. Biotech crops are now being grown in over 22 countries around the world on more than 255 million acres. Some 90% of the growers using this technology are resource poor farmers in developing countries. Biotech crops have now been successfully grown for more than a dozen years on more than 1 billion cumulative acres demonstrating the safety and importance of this technology to more than half of the world's population who live in the countries using biotech.

These are impressive statistics considering that the technology is relatively new. However, what does it really mean to sugarcane growers around the world? Unlike all of the biotech crops that have proven to be successful, sugarcane is vegetatively propagated and its genetic make-up is much more complex. This may make it more difficult to achieve commercialization of biotech sugarcane varieties. There are already varieties of sugarcane that have been transformed with different traits and grown experimentally in several countries. Brazil, Australia, Colombia, Argentina, South Africa and the U.S. have all reported on genetic transformation with numerous other industries working toward or considering biotech. Brazil and Australia would appear to be the closest to commercialization based on news reports and discussions with researchers in all of the countries.

As most sugarcane growers have probably heard, the U.S. sugarbeet industry has successfully planted herbicide resistant sugarbeets in demonstration plots and commercially on a small portion of its acreage over the past two years. This spring, the majority of the U.S. sugarbeet acreage is expected to be planted to varieties that have the Roundup Ready gene technology from Monsanto. Sugarbeet growers around the country are eagerly awaiting their opportunity to experience this technology and have the opportunity to experience the economic savings that growers in other crops have now realized. The fact that sugarbeets market the exact same product as sugarcane and the fact that "the sugar is the same" should make the marketing of sugar from any biotech sugarcane somewhat easier than earlier thought.

But that still doesn't answer the question whether biotech sugarcane can be profitable for growers around the world. One of the real problems associated with biotech sugarcane is the complexity in getting the desired genes into the appropriate varieties that are usually industry specific. Each "event" which is the insertion of a particular gene into a sugarcane plant has to be "deregulated" before it can be grown commercially. This regulatory process is more difficult in some countries than in others. It is anticipated that the cost of this deregulation is greater than $10 million for each event although no one has yet experienced these costs. Assuming that the event is placed into an existing commercial variety or one that is expected to become commercial and after the regulatory process has been completed, then the gene's value can be realized only after sufficient testing to insure that the gene is actually being expressed and that no deleterious effects are present. The other alternative is to insert the gene into breeding material where progeny can be selected from a sexual cross that would then have gene expression. That would mean the full length of the breeding program would be expended before the trait could be utilized which in most industries is 10 years or more. And of course there is still the issue of paying the technology provider for the value of the trait.

What this means is that getting biotech in sugarcane commercialized will be difficult. However, that does not mean that the task will be impossible and the longer we wait to get started, the longer it will be before we reach commercialization. There will be more hurdles to cross in sugarcane than for some of the other crops. It may mean that more cooperation will be needed among industries to incorporate the technology. Sharing of varieties and/or breeding germplasm may become a more important issue.

What about the specific traits that are being considered and their potential importance to sugarcane growers. The trait most often discussed is herbicide tolerance. Since herbicide costs and application expenses are some of the largest items in a production budget, this trait could be considered one of the most important. Some industries use a glyphosate ripener which depending upon the herbicide resistance used might mean that a new growth regulator would be required. In a few industries, herbicides are less important and therefore the trait is not as desirable.

Insect resistant genes, primarily Bt technology, are available for other crops and have been shown to be effective against sugarcane insects. Genes that offer resistance to mosaic, yellow leaf syndrome, ratoon stunting disease, and others have been demonstrated to be of value.

Drought resistance genes are also available from several sources. It is believed that drought resistance could be part of a larger stress resistance aspect and might be associated with cold, salt or flooding resistance. Since sugarcane is a C4 plant and can accommodate unlimited quantities of sunlight, water often becomes a limiting factor in obtaining maximum yields. This trait may be as valuable as any when it comes to cost/benefit in sugarcane.

Enhanced sugar content is a trait being discussed in several

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industries and obviously would be important. Genes that can produce saleable compounds such as pharmaceuticals, proteins, or others have been tested and/or theorized. While most industries think solely about producing sugar from sugarcane, the fact is that with its high biomass potential, large quantities of other compounds, including energy, can be produced.

Can biotech in sugarcane work? Of course it will; that has already been proven experimentally. Can it provide an economic return? That answer is less certain. The cost of development is high and unlike seed planted crops, there are few seed/commercial companies willing to underwrite the cost of deregulation of biotech varieties. Much of the cost may have to be taken on by the industries themselves or technology providers.

The industries that are most advanced will likely be able to provide a clearer understanding of the true value of biotech as they move toward commercialization. Some have indicated that this could occur within the next three years. In the meantime we all remain optimistic that we can find a way to make biotech provide an economic return so that sugarcane can remain competitive in the international sweetener world. SJ

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resistencia al mosaico, el síndrome de la hoja amarilla, la enfermedad del enanismo del retoño y otras, han demostrado ser valiosos. Genes de resistencia a la sequía están también disponibles de varias fuentes. Se cree que la resistencia a la sequía pudiera ser parte de una mayor resistencia al estrés y estar asociada a la resistencia al frío, sales o inundaciones. Como la caña de azúcar es una planta C4 y puede acomodar cantidades ilimitadas de luz solar, el agua a menudo se vuelve un factor limitante en lo que se refiere a obtener máximos rendimientos. Esta característica puede ser tan valiosa como cualquiera en cuánto a costo/beneficio en caña.

Un mayor contenido de azúcar es una característica que está siendo discutida en varias industrias y obviamente sería de importancia. Los genes capaces de producir compuestos comercializables, tales como farmacéuticos, proteínas y otros, han sido evaluados y/o teorizados. Aunque la mayoría de industrias piensan solamente en producir azúcar de la caña, el hecho es que con su alto potencial de biomasa, pudieran obtenerse grandes cantidades de otros compuestos, incluyendo energía.

¿Puede la biotecnología resultar en caña de azúcar? Por supuesto que sí; eso ya se ha comprobado experimentalmente. ¿Puede proveer retornos económicos? Esa respuesta es menos cierta. El costo de desarrollo es alto y a diferencia de los cultivos propagados por semilla verdadera, son pocas las empresas comerciales de semilla que deseen garantizar el costo de desregular variedades transgénicas. La mayor parte de los costos pudiera ser absorbido ya sea por las industrias en si o por los proveedores de la técnica.

Las industrias más avanzadas probablemente puedan proveer un conocimiento más claro del valor real de la biotecnología a medida avanzan hacia la comercialización. Algunos han indicado que esto pudiera ocurrir en el transcurso de los próximos tres años. Mientras tanto, todos seguiremos optimistas de que vamos a encontrar una forma de hacer que la biotecnología provea retornos económicos para que la caña de azúcar pueda permanecer competitiva en el escenario internacional de los endulzantes.

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