

NEW TWIST ON TOBACCO

BIOENGINEERED TOBACCO MAY SAVE LIVES INSTEAD OF ENDANGERING THEM

BY ROBIN ROENKER

Kentucky's tobacco production has fallen dramatically in recent decades, with increased public awareness about the health risks of smoking.

But thanks to cutting-edge research happening right now in Owensboro, the story of tobacco in Kentucky may have a new, brighter chapter—a story of saving lives.

Owensboro's Kentucky BioProcessing (KBP) made

international headlines in October 2014 when ZMapp, a drug candidate to treat Ebola produced in its facility, successfully treated two American aid workers who had contracted the disease in West Africa.

What many people outside of Kentucky may not have heard is that ZMapp was created by using tobacco—but not the tobacco we've all seen growing on farms.

At KBP, a special bioengineered strain of tobacco (*Nicotiana benthamiana*) is used to replicate and produce proteins that form the basis of potential life-saving novel drug



Top, *Nicotiana benthamiana*, a variety of tobacco plant, is used as a biopharmaceutical host for research at Kentucky BioProcessing in Owensboro. Photos: Reynolds American Services Company

candidates. The desired protein is injected into the plant almost like a “blueprint,” explains Hugh Haydon, KBP's president.

“If you think of the plant as a factory, and inside is all the equipment, all the machinery, all the energy, all the manpower that is necessary to make the product. But the factory is idle because it doesn't know what to make,” Haydon says. “Then along we come, and through

our transformation process, we stick a blueprint in (the plant), and now it knows what to make, so it turns on all that machinery and it manufactures our product for us.”

What’s so appealing about KBP’s manufacturing process is that the tobacco plants are able to produce mass quantities of the desired protein, and do it quickly and cost-effectively.

From start to finish, the entire process, from seeding the plant to having the protein in hand, takes just under 40 days, Haydon says.

Kentucky BioProcessing is still actively producing ZMapp—now undergoing clinical trial in West Africa—for its developer, Mapp Biopharmaceutical. But that’s not the only potential new drug being grown in its innovative, climate-controlled indoor facility, which features multiple, tiered growing platforms with roughly 1.4 acres of cultivation space for the tobacco plants.

UofL collaboration

The University of Louisville’s Owensboro Cancer Research Program, based in Owensboro specifically to collaborate closely with Kentucky BioProcessing on new drug development, has three new drug candidates being manufactured at KPBP, all of them potentially lifesaving.

The first, which could go to clinical trial as early as 2017, is a gel-based microbicide aimed at preventing the sexual transmission of HIV. The protein at the heart of the proposed new drug is naturally derived from red marine algae, making it an ideal candidate for reproduction using KPBP’s tobacco system, says Dr. Kenneth Palmer, director of UofL’s Owensboro Cancer Research Program.

UofL’s Owensboro research team is also collaborating with KBP to produce an immunotherapeutic to treat inflammatory conditions in the colon, which could help prevent colon cancer



Dr. Kenneth Palmer, specialist in plant-based pharmaceutical research at UofL, works in his research lab in Owensboro, utilizing tobacco plants to develop a gel with a specific protein that will prevent the transmission of HIV in humans. Photo: University of Louisville

in patients predisposed to it. A third new drug among a pipeline of others in development is what Palmer calls a “next-generation” human papilloma virus vaccine—so-called because it’s able to address more strains of HPV than vaccines currently on the market.

The effectiveness of KBP’s tobacco-based system has led to a productive collaboration and close partnership between the two teams, Palmer says.

“We develop the initial process in our UofL laboratories, and then Kentucky BioProcessing scales our process up, optimizes it, and does the manufacturing in a regulatory-compliant fashion, so that we have a product that is suitable” for required preclinical and clinical testing, he says.

“I come from a biased perspective, because I’m a friend of Kentucky

BioProcessing, but I think it’s fair to say they are the worldwide leader in their field,” says Palmer. “They have the (drug) product that’s closest to market, and they have the most experience using this process.” **KL**

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