

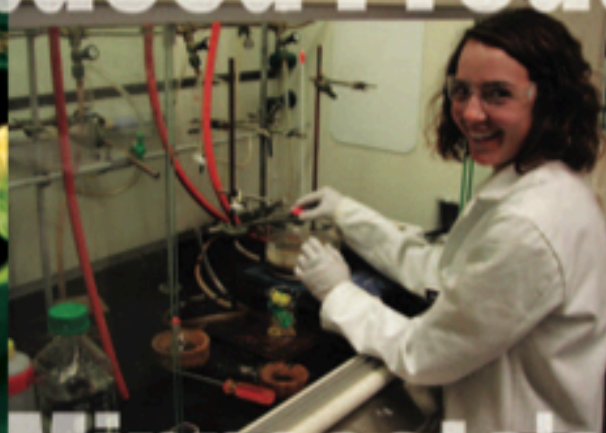


Market Research

August 2011



Biobased Products



Minnesota's Opportunity & Challenge

A Focus on BioPlastics

Agricultural Utilization Research Institute



*“If you help the farm economy in rural communities,
you help the economy of entire states.
And if you help entire states,
then that’s good for the country as a whole.”*

- Barack Obama, August 15, 2011

What Did We Want to Learn?

- How aware are Minnesota manufacturers when it comes to bioplastics?
- What are manufacturers' concerns related to using biobased material?
- Where are the obstacles in the adoption and use of such products?
- What are the most promising opportunities for Minnesota plastics manufacturers?
- How can we capitalize on these opportunities and drive economic development for the state?

Who Did We Talk To?

- Manufacturers of biobased resins and raw materials that can be substituted for petro-based plastics
- Plastics manufacturers who use biobased components in their products – or could potentially use them
- Researchers, technical experts, academia
- End users of plastic components or final plastic products – particularly those who have adopted biobased plastics in their business model

Market Interest/Demand

Sustainability

“It appears that skepticism over sustainability reigns. Problem is ... business leaders didn’t get the memo.”

– Minneapolis StarTribune, January 2011

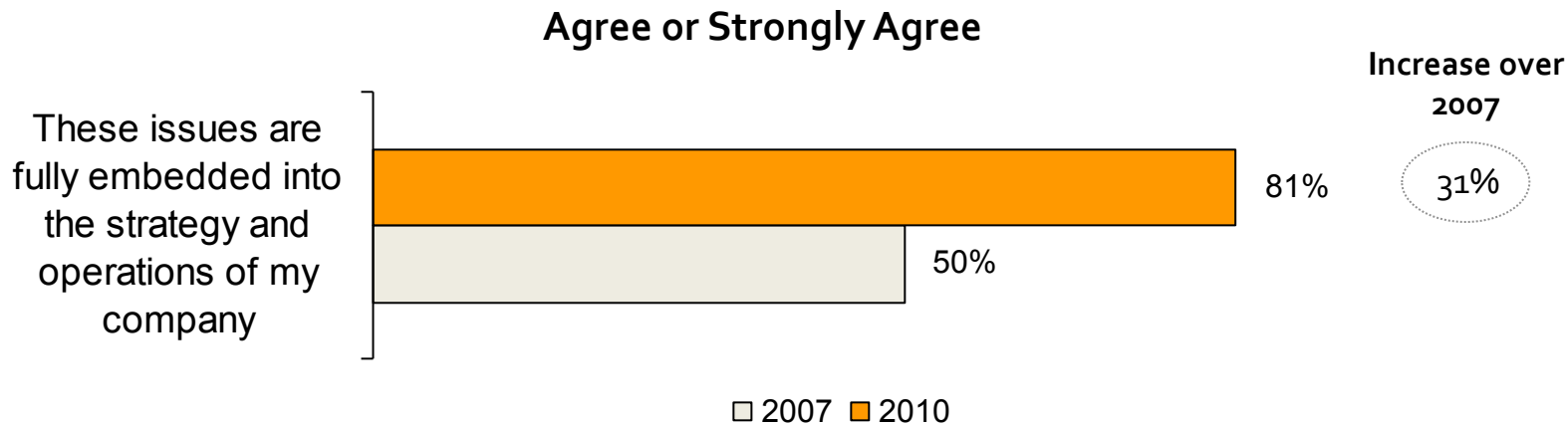


Progress toward sustainability has moved from emerging trend to mainstream commerce.

- 93% of CEOs see such initiatives as important to their company's very future
- Recession appears not to have derailed continued development of next-gen green products and the infrastructure needed to manufacture them



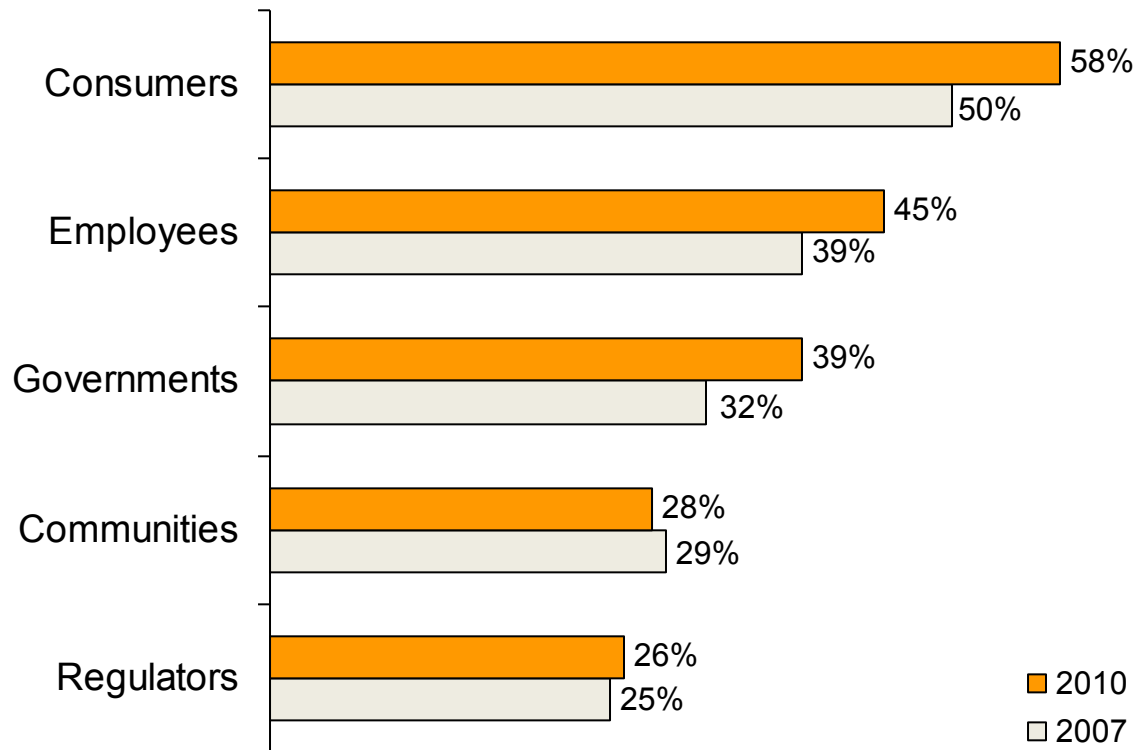
Sustainability has been fully embedded into the strategy and operations of many companies.



Source: United Nations Global Compact CEO Survey 2010 (based on 766 completed responses). 2007 data from McKinsey UN Global Compact Survey

Consumers are increasingly driving businesses' approach to sustainability.

Over the next five years, which stakeholder groups do you believe will have the greatest impact on the way you manage societal expectations?



Source: United Nations Global Compact CEO Survey 2010 (based on 766 completed responses).
2007 data from McKinsey UN Global Compact Survey.

“We will continue to evaluate and expand our eco-friendly products based on market availability and guest preference.”

–Target

Introduced six PLA packages in the bakery and deli areas in our SuperTarget stores.

Will look at expanding the use of PLA “as additional supply becomes available.”





“Sustainability is the new buzzword for everything that pertains to design for the environment, recyclability, biodegradability, energy, lifecycle analysis, energy balance. Everything comes under the umbrella now of sustainability.”

— Jay Olson, John Deere

But not all efforts are successful.

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I may completely disingrate in 14 weeks, but *crunch, crunch, crunch*.... what did you say???

Information

About:
I may completely disingrate in 14 weeks, but *crunch, crunch, crunch*.... what did you say???

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Haley

Nothing is louder than a sunchips bag.

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Discussions

Nothing is louder than a sunchips bag. + Others

Just Nothing is louder than a sunchips bag.

Just Others



Autumn Eve Peterson

This group had no significant effect on the change of the bag, the bag is very loud, this group barely exists.

October 10, 2010 at 10:11pm



Teri Ratner

Yay. A return to quiet munching.

October 6, 2010 at 11:37pm via iPhone



Omar Reyna

nice little plug for the group lol

<http://finance.yahoo.com/news/Hush-FritoLay-to-pull-most-apf-3363941657.html?x=0&.v=8>



Hush! Frito-Lay to pull most noisy SunChips bags - Yahoo! Finance

finance.yahoo.com
NEW YORK (AP) -- Frito-Lay hopes to quiet complaints about its noisy SunChips bags by switching out the biodegradable bags for the old packaging on

October 6, 2010 at 12:33pm · Share



Andrew Newell

dear people who actually complain about the loudness of a biodegradable bag: you should die. thank you.

October 6, 2010 at 12:07am



Allan Lento

here's a project for Project Noise!!

October 5, 2010 at 7:07pm

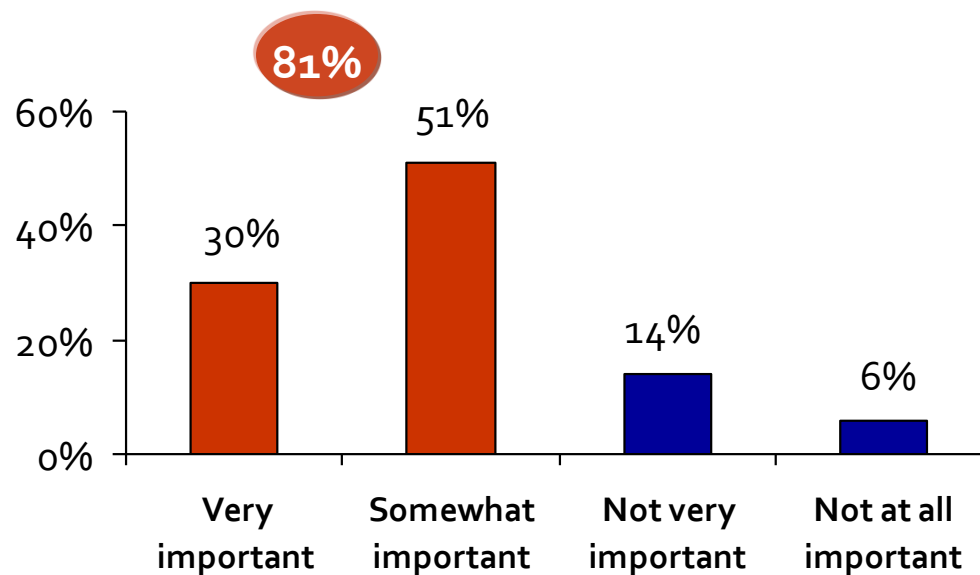


Howard Hill

<http://finance.yahoo.com/news/Hush-FritoLay-to-pull-most-apf-3363941657.html?x=0&.v=8>



Minnesota Manufacturers' Perspective: Importance of Producing Environmentally Sustainable Products



Source: Russell Herder Renewable Materials Survey, 2010

The Packaging Landscape

Worldwide market for all types of packaging is currently valued at \$429 billion, an annual growth rate exceeding the total global increase in GDP.

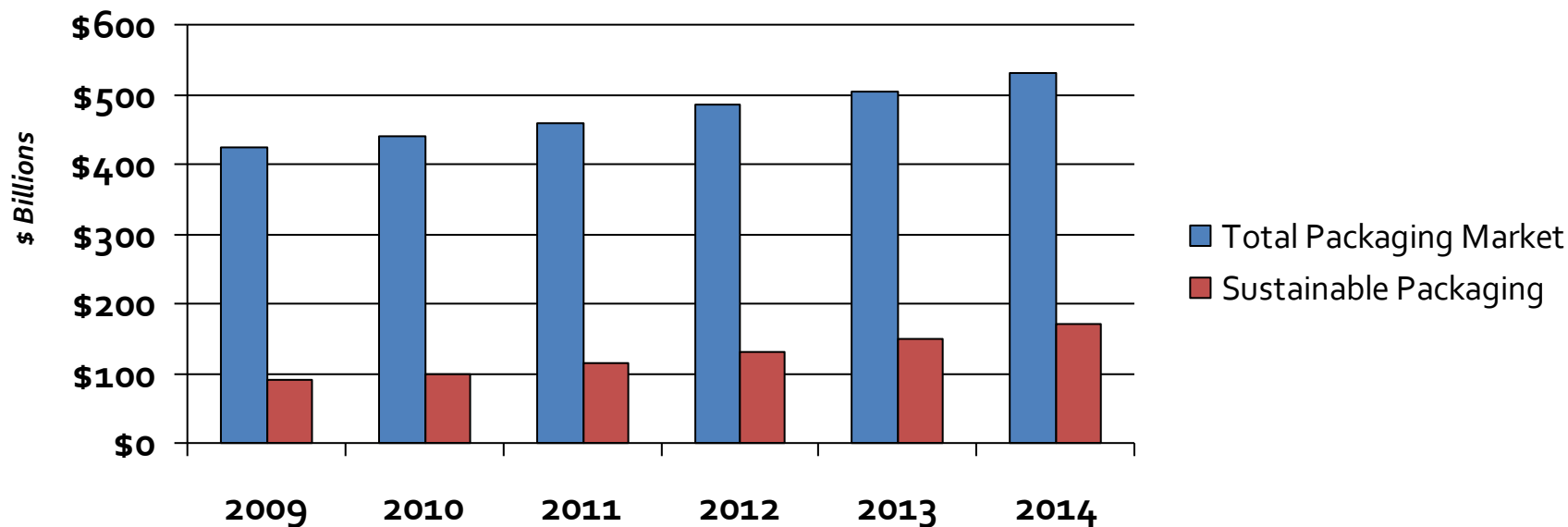


Demands have continued to increase as global population grows, challenging industry to react to packaging issues that were rarely considered in the past.



According to a recent study, sustainable packaging is projected to grow by 2014 to 32 percent of the total global packaging market, up from just 21 percent in 2009.

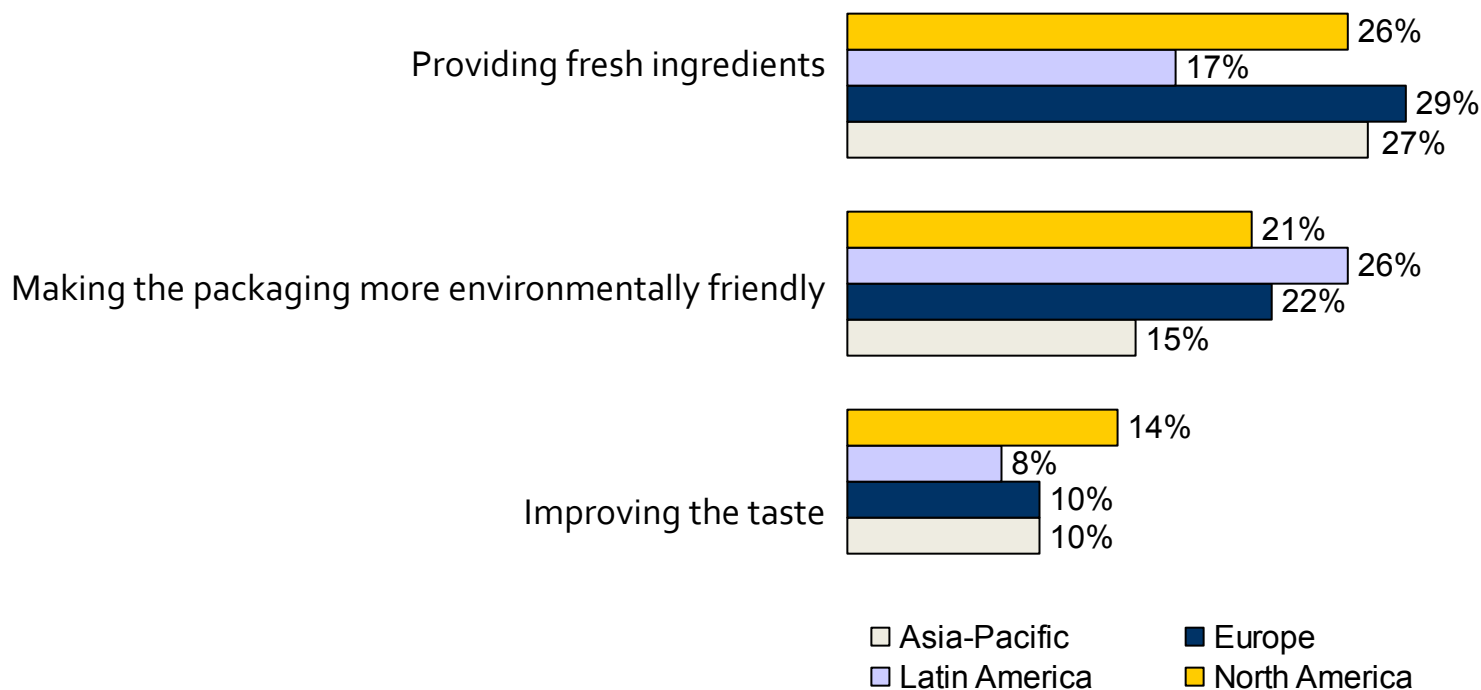
**Sustainable Packaging Forecasts,
World Markets: 2009-2014**



Source: Pike Research

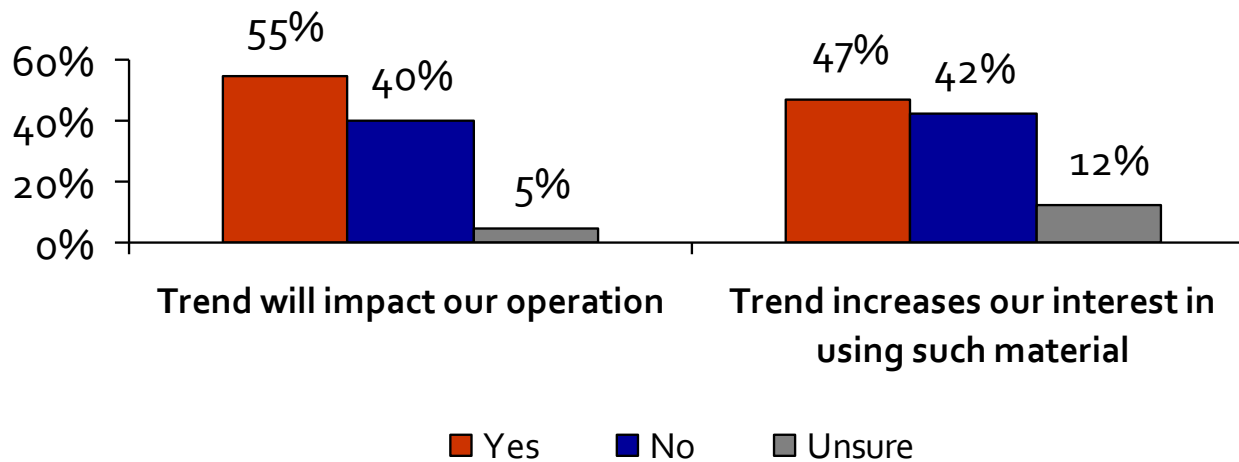
21% of North American consumers say food companies should concentrate on making packaging more environmentally friendly.

Consumers Say Food Companies Should Concentrate Most On ...



Source: Environmental Leader, "Survey: Food Cost Should Focus On Green Packaging, Not Taste," June 2009

Minnesota Manufacturers' Perspective: Consumer Interest in Environmentally Friendly Packaging and Products



Plastic-based packaging, which represents 35 percent of all materials used, will be the fastest-growing sector of the sustainable packaging market over the next five years.



Bioplastics offers the opportunity to not only help drive employment and the economy, but to positively impact Minnesota's rural communities.



Growth in bioplastics is being driven by a number of factors:

- An interest in reducing dependence on foreign oil supplies
- Environmental concerns related to pollution and landfills
- Global warming
- Human health issues related to toxic chemicals emitted by petro-based plastics

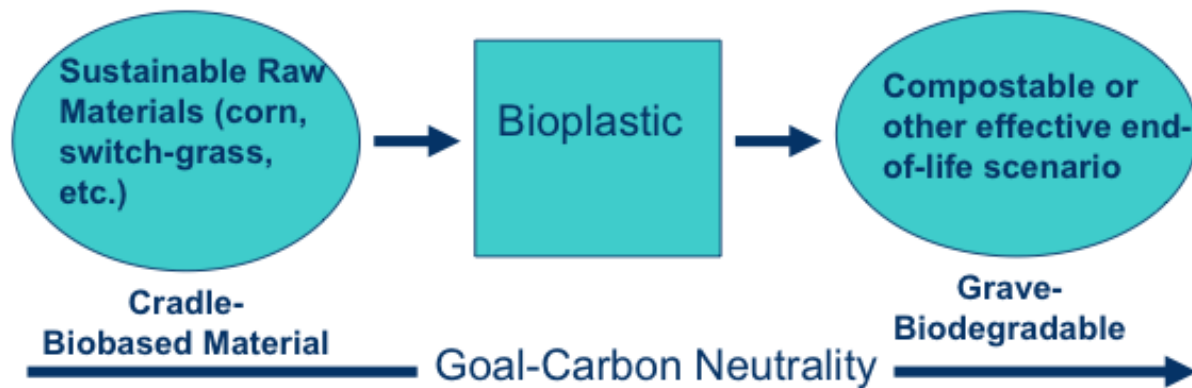


Bioplastics Defined

Technically, bioplastics are not a single class of polymers, but are a family of products that can vary considerably.

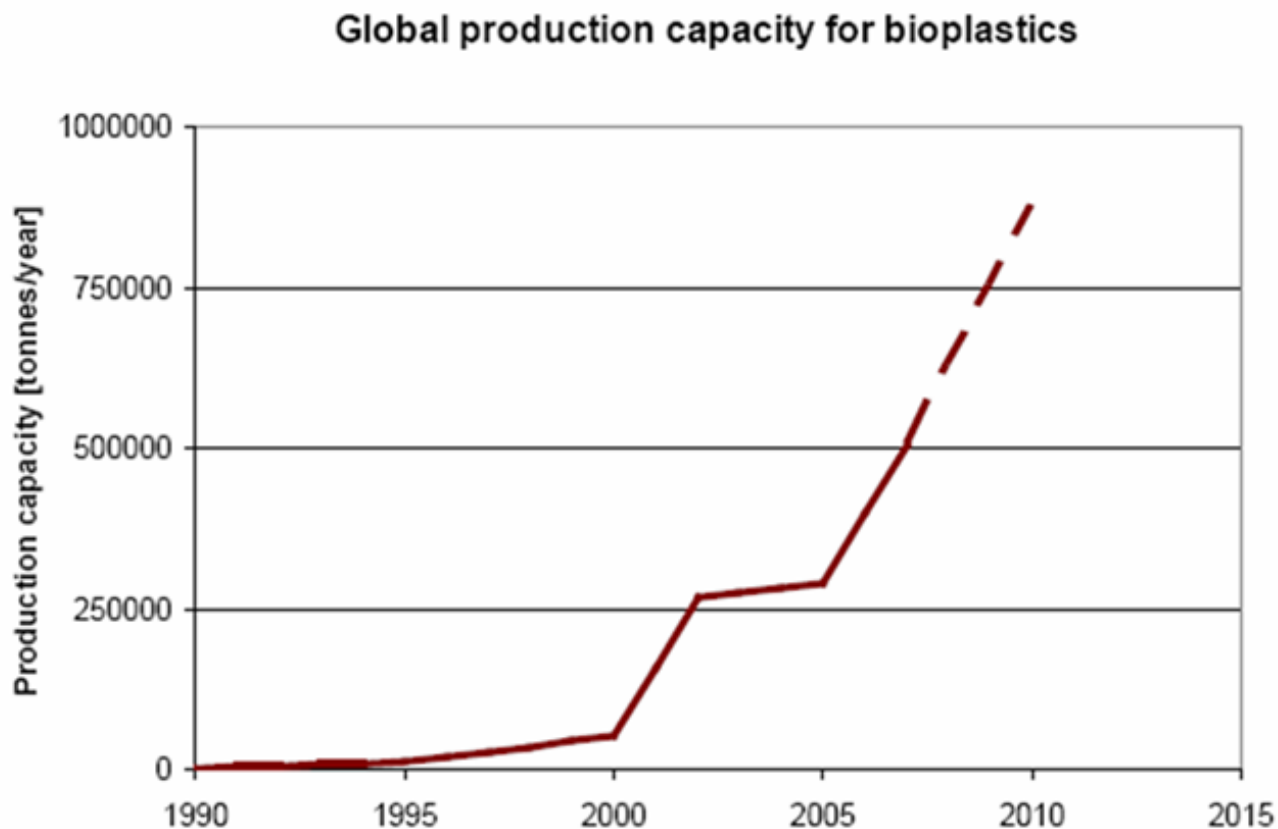
- Plastics based on renewable resources
- Biodegradable polymers that meet scientifically recognized norms for biodegradability and compostability of plastics and plastic products

Bioplastics Value Proposition



Source: Jeff Timm Consulting

Global demand for bioplastics will increase more than fourfold to 900,000 metric tons by 2013.



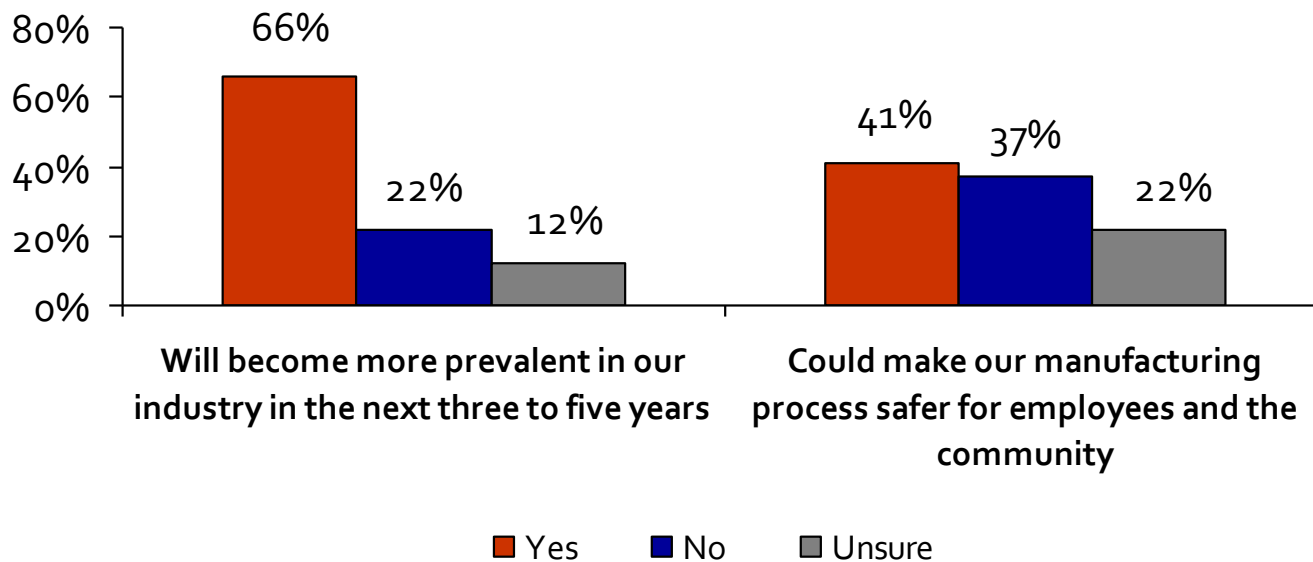
Source: BioPlastics24.com, "Bioplastic Market – An Overview"

Market Demand for Biobased Plastics

	2005	2007	2011	'07-'11 CAGR
Films/Bags	117	200	359	15.8
Ring Carriers	40	42	51	4
Loose Fill/Foam	16	17	20	4
Food Service	7	17	31	16
Molded	28	46	123	28
Fiber	5	11	50	46
Total	213	333	634	17.5

Source: United Soybean Board, "Disposable Bioplastics Consumer Disposables Agricultural Films: A Market Opportunity Study," Phil Sarnacke and Stephen Wildes, April 2008

Minnesota Manufacturers Believe the Use of Biobased Material...



Source: Russell Herder Renewable Materials Survey, 2010

Biobusiness booms in Minnesota

◀ REPORT FROM D1

around," Willoughby said.

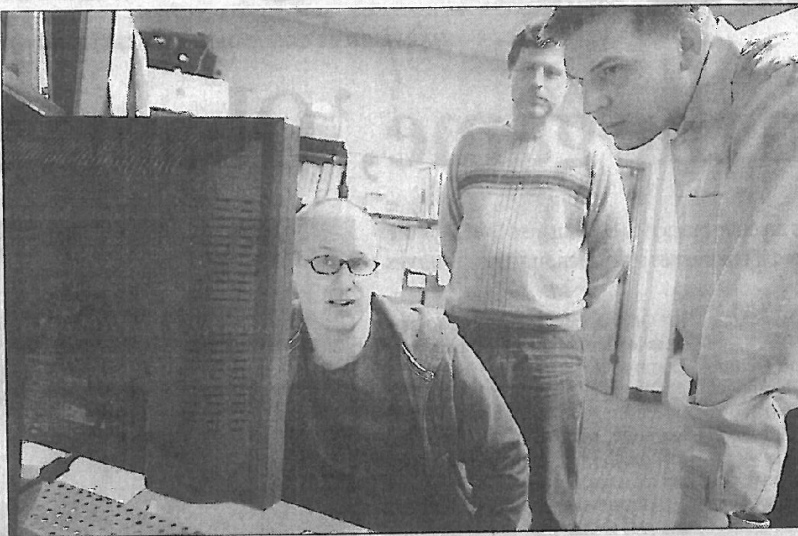
Minnesota also saw a 44 percent growth over the same five-year period in biotech jobs related to plants and agriculture and in industrial fields such as bio-energy. The growth wasn't as strong as in some of the other states, and the report points out this is an area that could be improved.

Willoughby said the overall positive trend has continued during the recession. In 2009, Minnesota saw more growth in the number of biobusiness jobs and companies compared to the rest of the nation.

For example, the number of biobusiness companies in the state grew 10.3 percent in 2009, compared with just 4 percent for the nation, Willoughby said.

Still, Willoughby classified the growth as "fragile" due to the amount of competition from other states. In the use of biotech in agriculture and industry, employment growth was modest compared to other competing states, the report said.

BioBusiness Alliance officials said how the trend pro-



GLEN STUBBE • Star Tribune file

Orasi Medical CEO Shawn Lyndon, right, stood with researchers Dan Frankowski, left, and Todd Verdoorn. Orasi, a University of Minnesota spinoff, develops software to help drug firms test treatments.

gresses will depend on policies affecting the medical devices industry and the continuation of support to grow the bioscience sector.

U.S. Sen. Al Franken said on a conference call announcing the report that the industry benefits the state because it supports large numbers of

good-paying jobs.

"Minnesota has the potential to expand its position as one of the top biobusiness states in the nation," Franken said.

Bioscience represents a bigger share of employment in Minnesota than in many other states. In fact, the state's econ-

omy is 43 percent more dependent on the sector compared to the rest of the nation, the report said.

"Minnesota can't afford to sit pretty here," Willoughby said. "It can't take for granted its success."

Wendy Lee • 612-673-1712

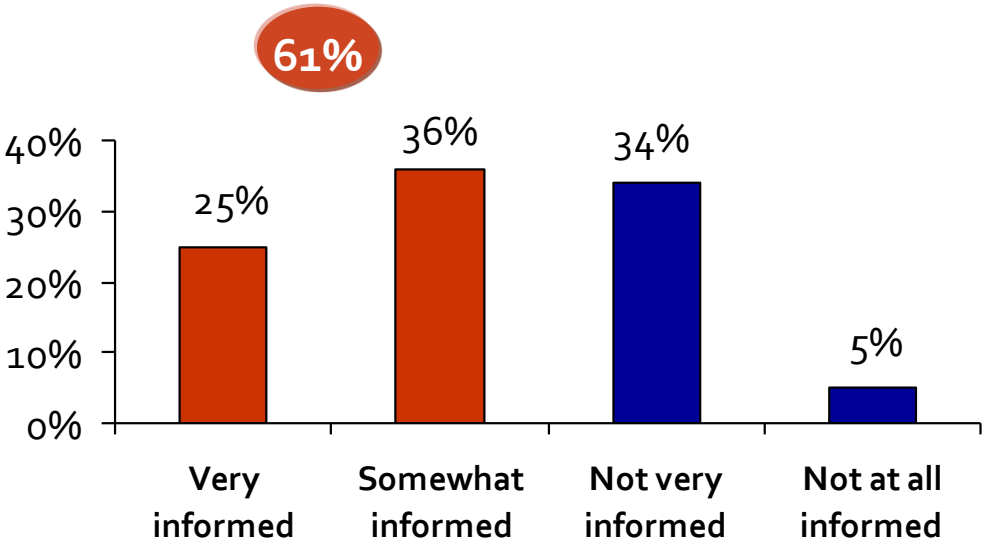
Bioplastics have the potential to reduce petroleum consumption for plastic by 15 to 20 percent by 2025.



“Improved technical properties and innovations will open new markets and applications with higher profit potentials in automotive, medicine and electronics.”

- Helmut Kaiser, “Bioplastics Market Worldwide 2007-2025”

Minnesota Manufacturers' Perspective: How Informed Are You about Biobased Material Use and Opportunities in Your Industry?



Source: Russell Herder Renewable Materials Survey, 2010

Market Drivers

While interest in biobased products – and the technology to produce them – clearly exists, industry purchasing demand has been cautious.

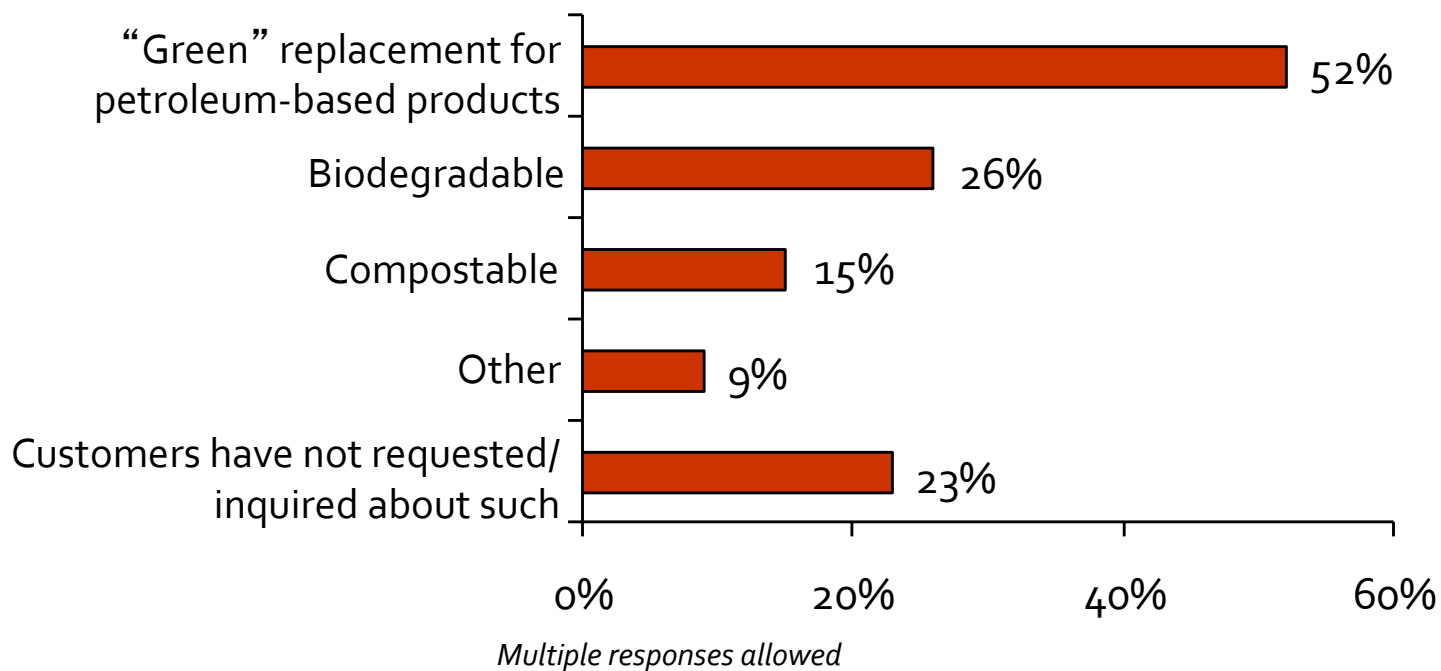
“On the material side, petroleum-based polymers are not going to be the most sustainable, but sometimes they are the more durable choices. If it has the same performance, better cost and better environmental footprint, of course we would switch right away.”

– Ben Wallace, Advanced Research Manager, Marvin Windows and Doors

The issues facing plastics manufacturers are in many ways similar to their customers; they want to be sure performance and economics are sound.



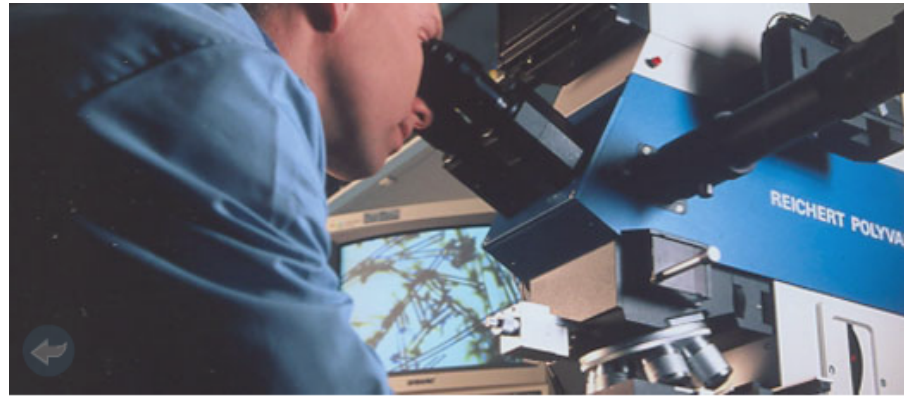
Minnesota Manufacturers' Perspective: Interest Areas of Customers Who Have Requested or Inquired about Products Made with Biobased Material



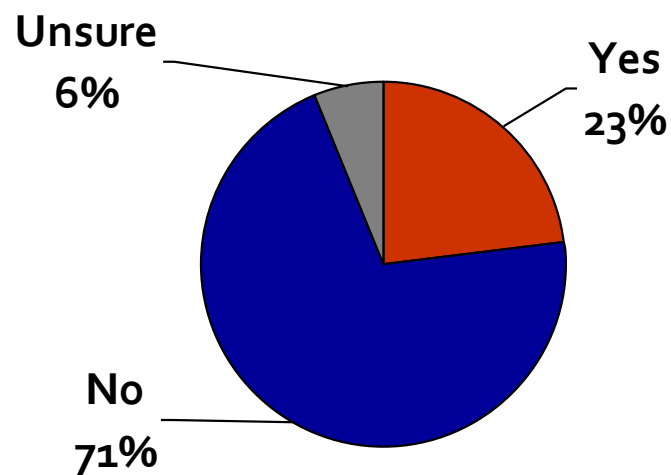
Source: Russell Herder Renewable Materials Survey, 2010

“In our business, we need to know where next-generation technologies are coming from, which includes understanding where biomaterials are at and how we can turn these things into product. It really is just starting. It’s evolutionary.”

– Jim Albrecht, ComDel Innovation

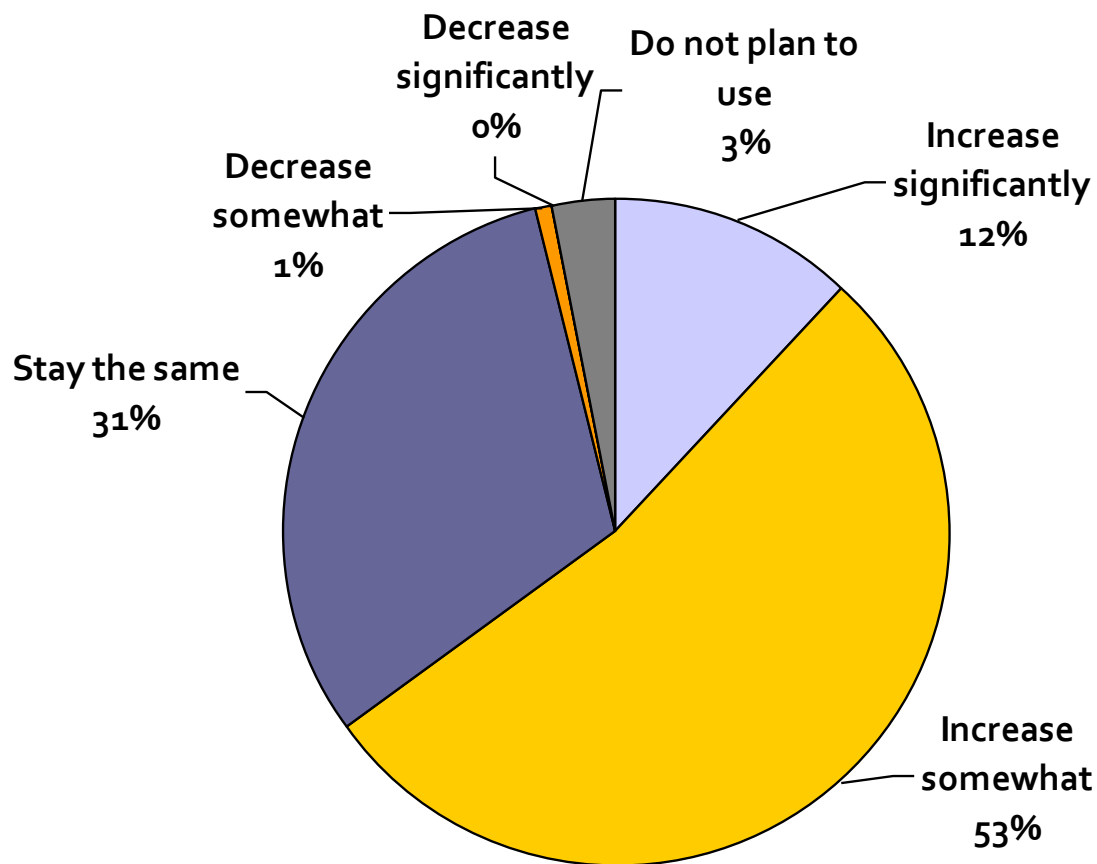


Minnesota Manufacturers' Perspective: Awareness of Other Industry Manufacturers That Have Incorporated Biobased Material to a Significant Degree



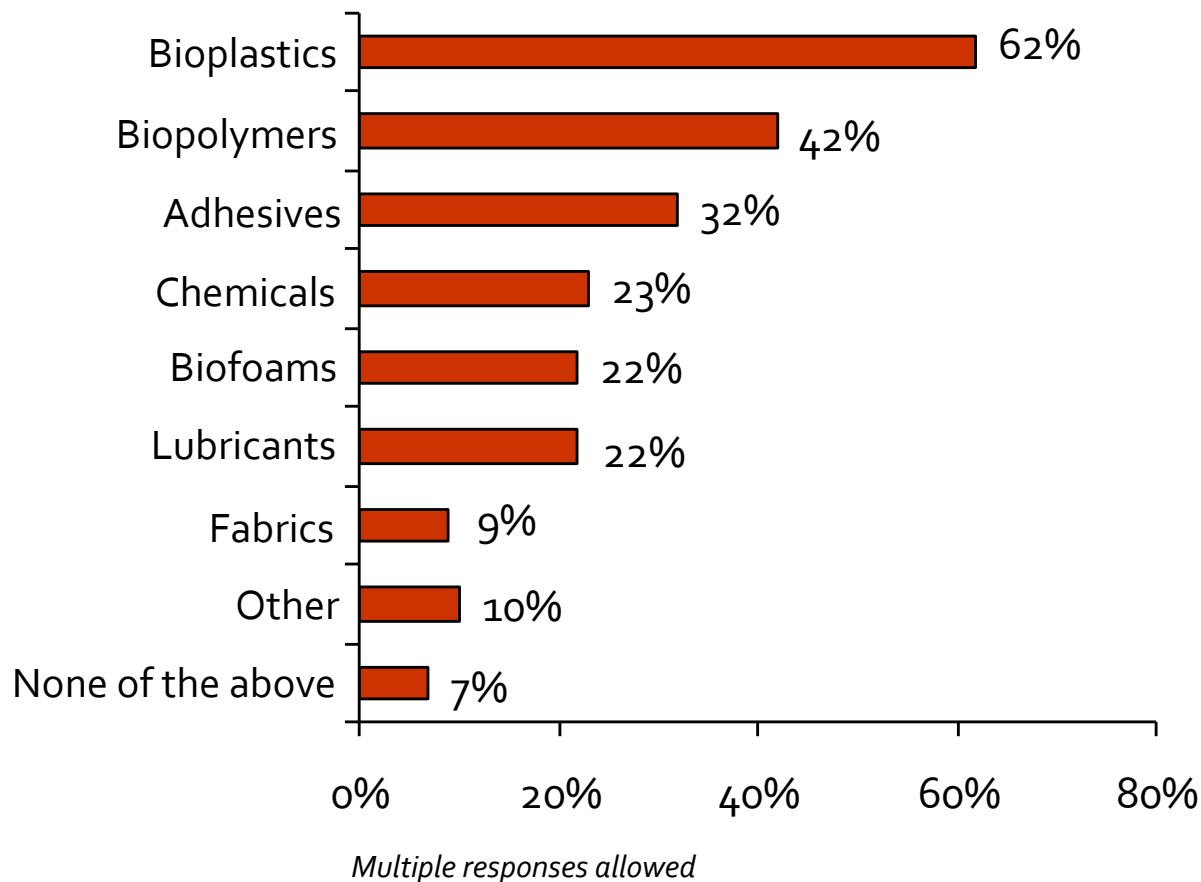
Source: Russell Herder Renewable Materials Survey, 2010

Minnesota Manufacturers' Perspective: Anticipated Use of Biobased Material



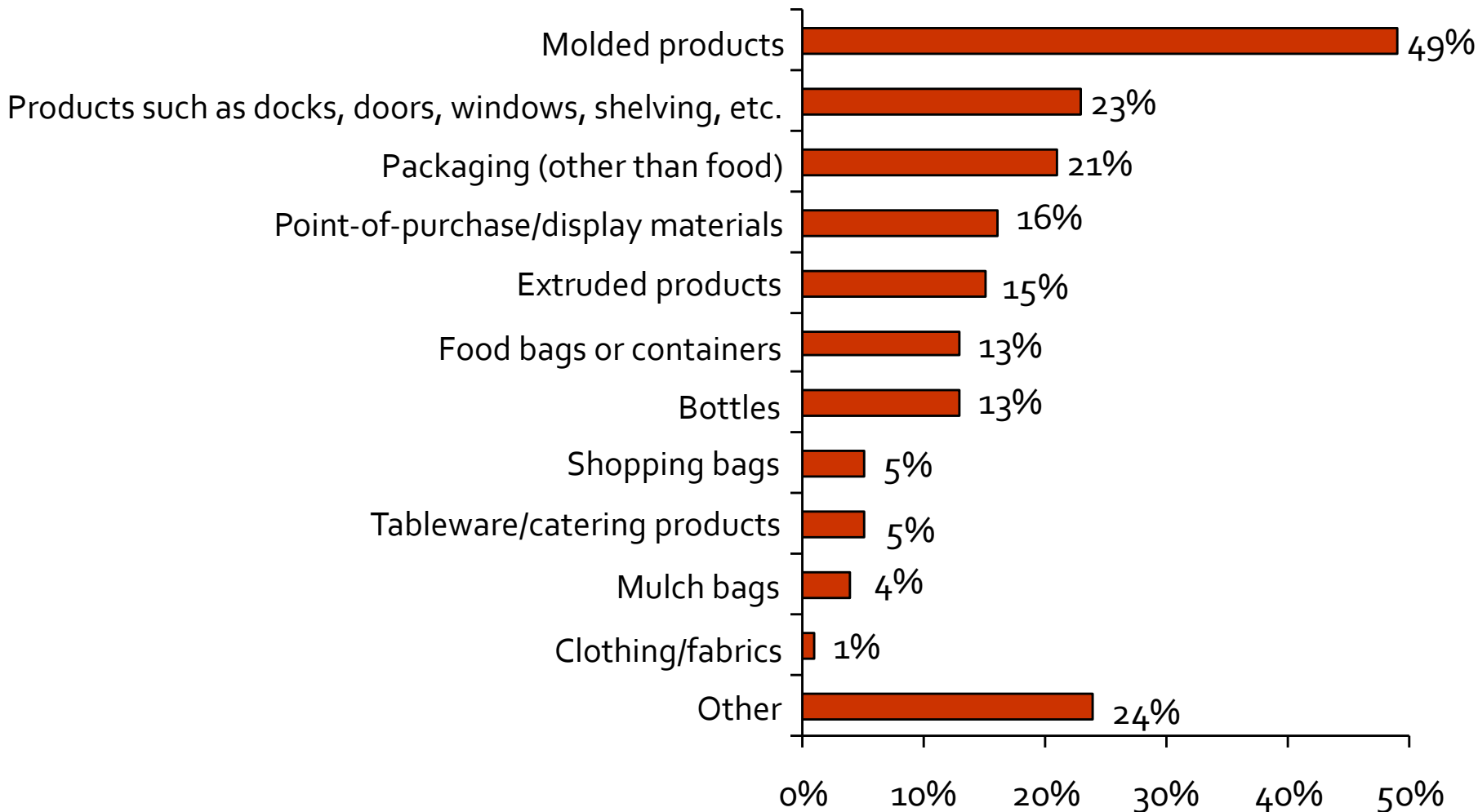
Source: Russell Herder Renewable Materials Survey, 2010

Minnesota Manufacturers' Perspective: Considerations for Uses/Applications of Biobased Materials



Source: Russell Herder Renewable Materials Survey, 2010

Minnesota Manufacturers' Perspective: Products Being Manufactured Or Considered



Multiple responses allowed

Source: Russell Herder Renewable Materials Survey, 2010

Market Challenges

Cost

The economics of the biobased equation is an area that needs further exploration.

“Despite their environmental benefits, the most significant obstacle to the proliferation of PHAs and polylactide is their cost which is approximately three to five times higher than the cost of petroleum-derived plastics.”

– John Barret and Friedrich Srienc, Department of Chemical Engineering and Material Science at the University of Minnesota

Price is the standard by which many manufacturers measure the viability of incorporating biobased plastics into their operations, especially in a difficult economy.

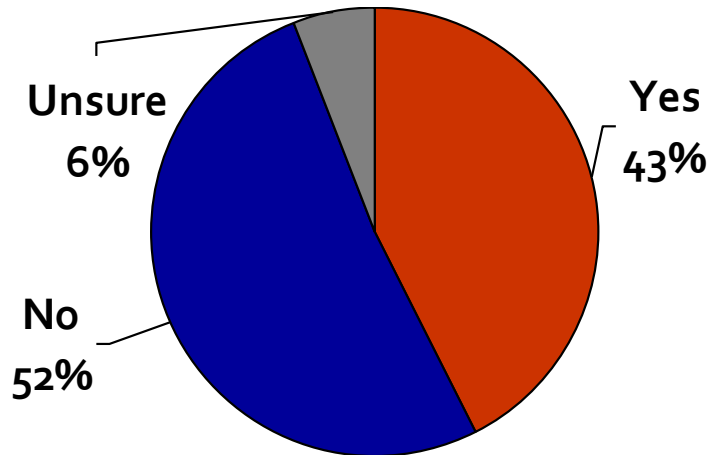
“Economic conditions in general have put companies in survival mode – and they are not particularly interested in the increased costs involved with paying for something ‘green.’ Nobody is going to pay a 20 percent premium for these products.”

– Mike Rone, Northern Contours



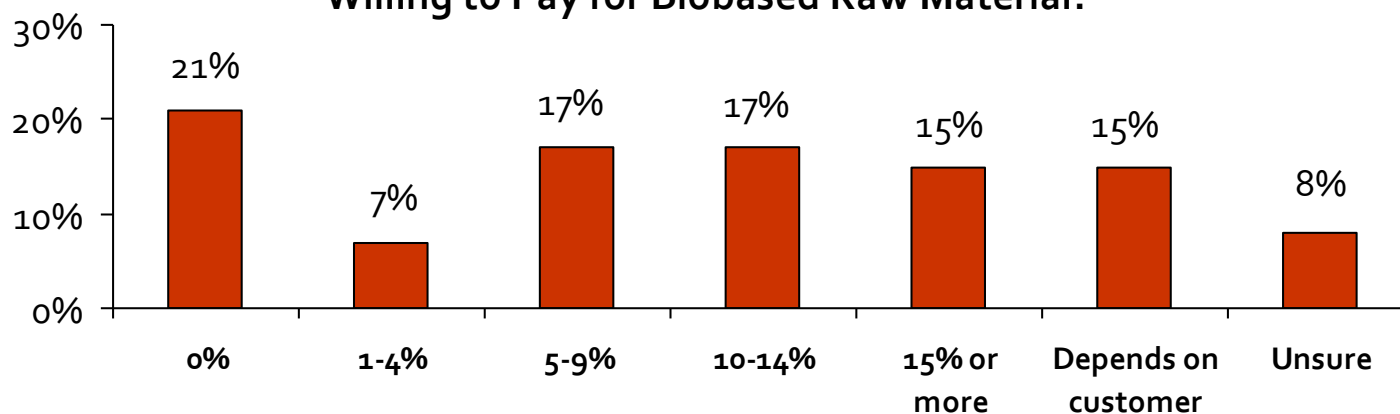
Half of recently surveyed Minnesota plastics manufacturers say that they do not expect biobased material to cost the same as their typical material source.

**Minnesota Manufacturers' Perspective:
Expect Biobased Material to Cost the Same
as Our Typical Material Source**



Source: Russell Herder Renewable Materials Survey, 2010

Minnesota Manufacturers' Perspective: What Percentage More Would You Be Willing to Pay for Biobased Raw Material?



Source: Russell Herder Renewable Materials Survey, 2010

“Economic conditions in general have put companies in survival mode – and they are not particularly interested in the increased costs involved with paying for something ‘green.’ ”

– Mike Rone, Northern Contours



Economics are also a factor within the agricultural community.



“I think there can be a high degree of skepticism [about new efforts such as bioplastics], but that does not mean that farmers are not willing to try it. If there were value-added products that could help stabilize the market for farmers, they would have interest.”

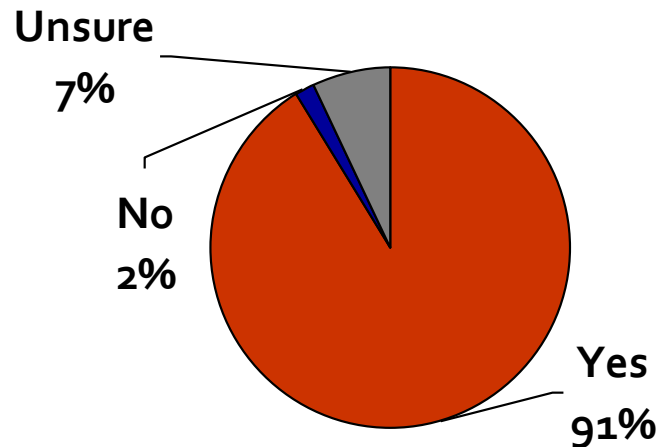
– Tim Gerlach, Minnesota Corn Growers Association



Availability and Reliable Supply

Many manufacturers – in fact nine in 10 Minnesota – express a preference to do business with local companies, but that would not be a deciding factor.

Would Prefer Local or Minnesota Supplier

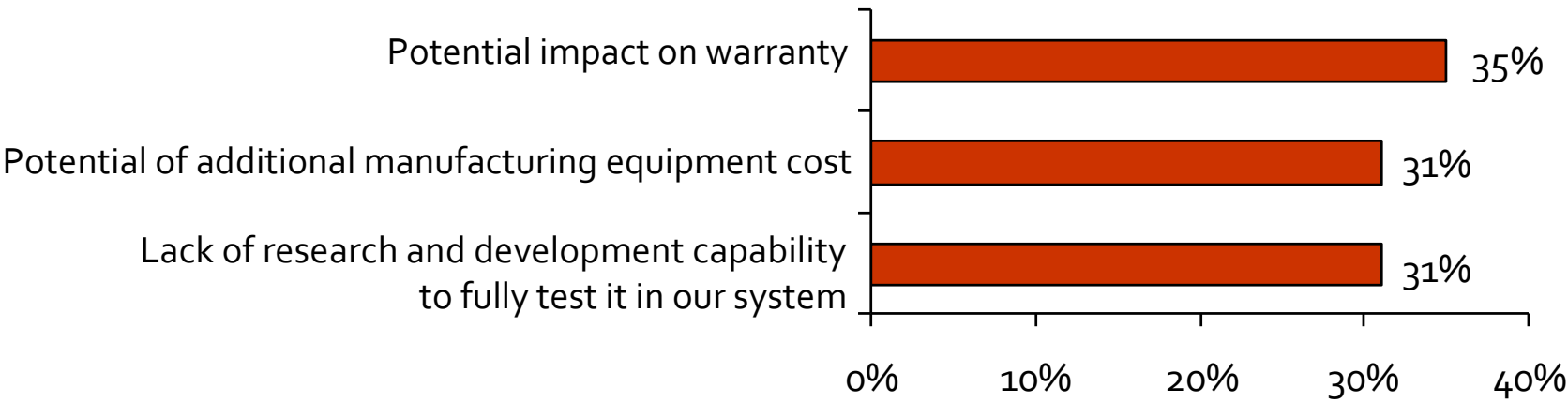


Source: Russell Herder Renewable Materials Survey, 2010

Specifications and Standards

Though they continue to have strong interest in using biomaterial, Minnesota plastics manufacturers have questions.

Concerns about Use of Biobased Material



Multiple responses allowed

Source: Russell Herder Renewable Materials Survey, 2010

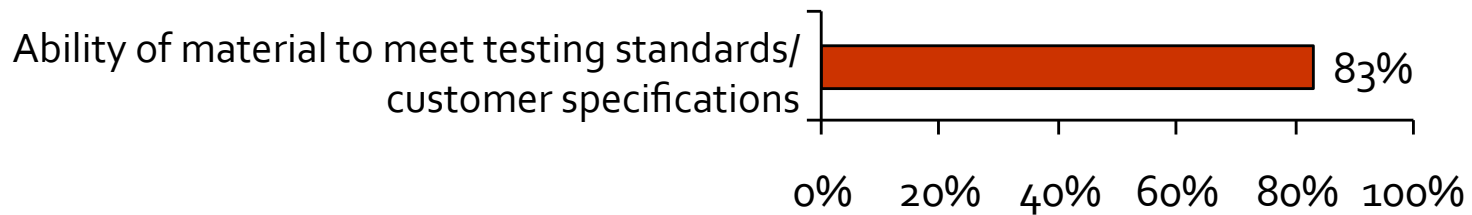
“There are a lot of warranty and personal liability issues with component changes, so to invest in that is really expensive – and the return is pretty far out because of the investment of time and money in testing under various conditions.”

– Don Hurley, ShoreMaster



Interestingly, the reverse is also true. Minnesota plastics manufacturers who could potentially supply companies such as Marvin have been getting inquiries themselves – typically from end users that are seeking a “green” replacement for petroleum-based products.

Concerns about Use of Biobased Material



Multiple responses allowed

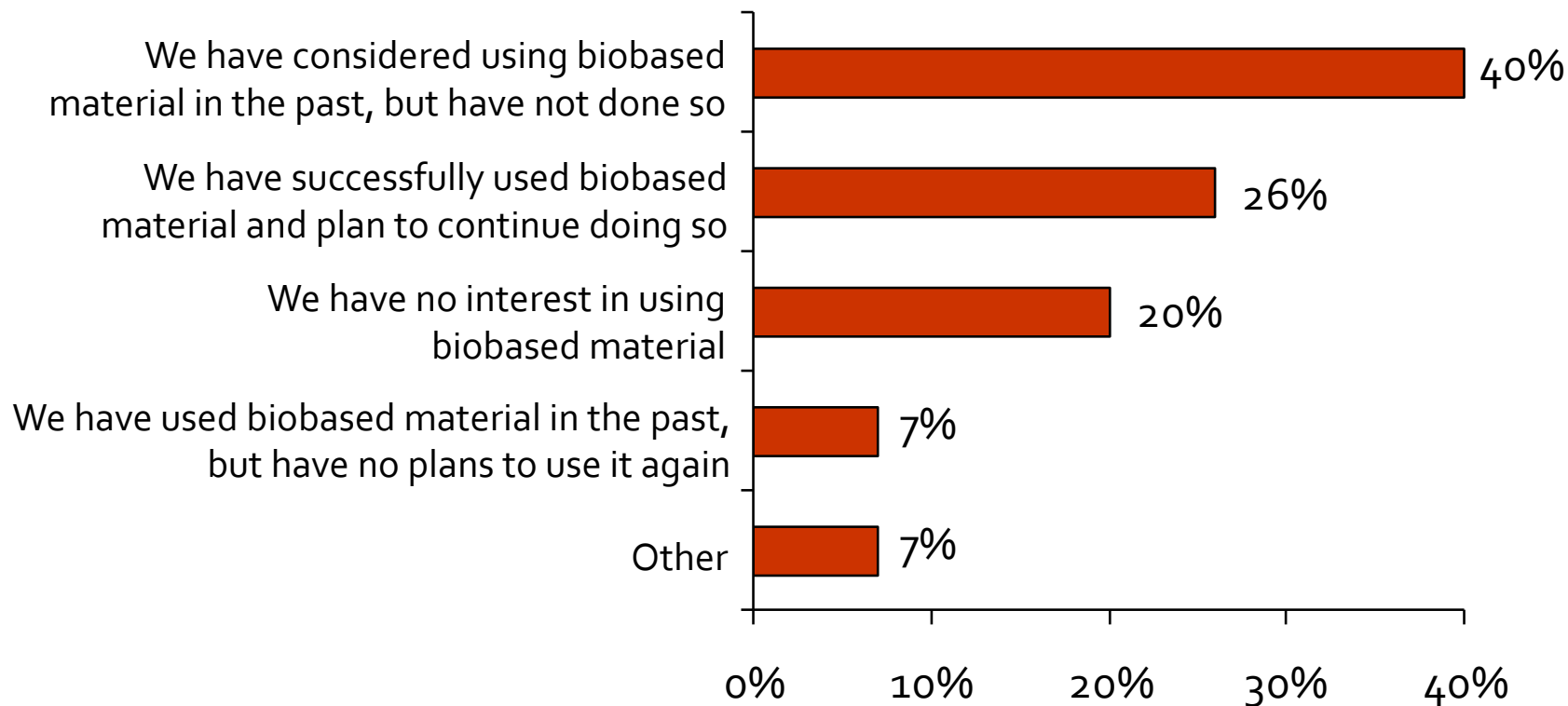
Source: Russell Herder Renewable Materials Survey, 2010

Manufacturing Challenges

A manufacturer who has made huge investments in equipment, testing, processing and research may be reluctant to risk changing to a new raw material or a component with different specifications.



Minnesota Manufacturers' Viewpoint on Using Biobased Material in Manufacturing Operation



Source: Russell Herder Renewable Materials Survey, 2010

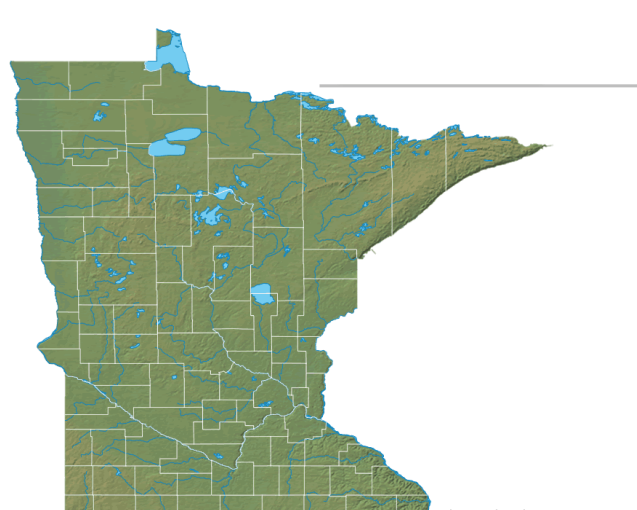
“Until someone delivers something to us that we can experiment with, there’s not much we can do. We do push back to suppliers regarding biomaterials, but until there is enough supply and demand, they will keep making what they are making until we run out of fossil fuels.”

– Scott LaRue, Excel Plastics



“Within Minnesota itself, there are very few companies who are buying bio-based, biodegradable, compostable or compounded biomaterials and converting them into finished products. But there are a lot of people buying those products who are based in Minnesota and therefore can influence the supply chain.”

— Jim Lunt, Jim Lunt & Associates, LLC



“My advice to other manufacturers is don’t be afraid of the material – try it. If you have a job that you are finishing up, run it. Learn from it. Take an hour or two, purge your machine, throw it in, get as much information from the supplier of the resin and just run it in your machine.”

– Gary Noble, Bio-Plastics Solutions

Product Misconceptions

Another factor that must be dealt with to spur biobased market growth are misperceptions on the part of both buyer and manufacturer.

“When people think biobased, they think cheap. They think, this is going to fall apart in service.”

— Chad Ulven, NDSU



“Bioplastics offer a more respectful option for our environment, and we believe that this new symbol will help provide consumers with the tools they need to make more environmentally intelligent purchasing decisions.”

- Cereplast, 2011

Funding

Securing funding for biobased material research can be challenging and time-consuming.

“This area of research really doesn’t have a home within any of the federal agencies.”

– Chad Ulven, NDSU

Regulatory

Other issues complicating the growth of biobased materials – at least for now – lie in the regulatory sector.

“When you think about 3M and the European Reach Initiative, 3M is not going to ignore a market the size of Europe.”

– Steve Kelley, Humphrey Institute



Education Need

With the projected growth in incorporating bioplastics into the production and supply chain, some believe education could be beneficial in easing the process.

“It is a new paradigm. Training – along with research and development on how to get there – is definitely a need.”

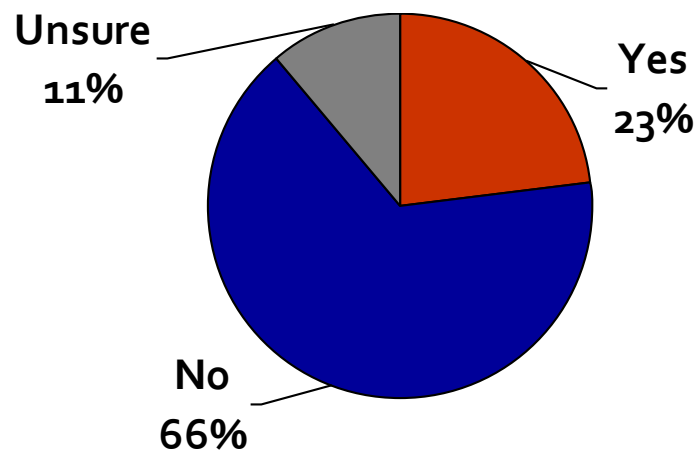
– Tim Welle, BioBusiness Alliance



“An educational component is so important with these materials. Just making sure people understand that their flow behavior is different, their melting temperatures are different and how you handle them is just a different methodology when you are working with them.”

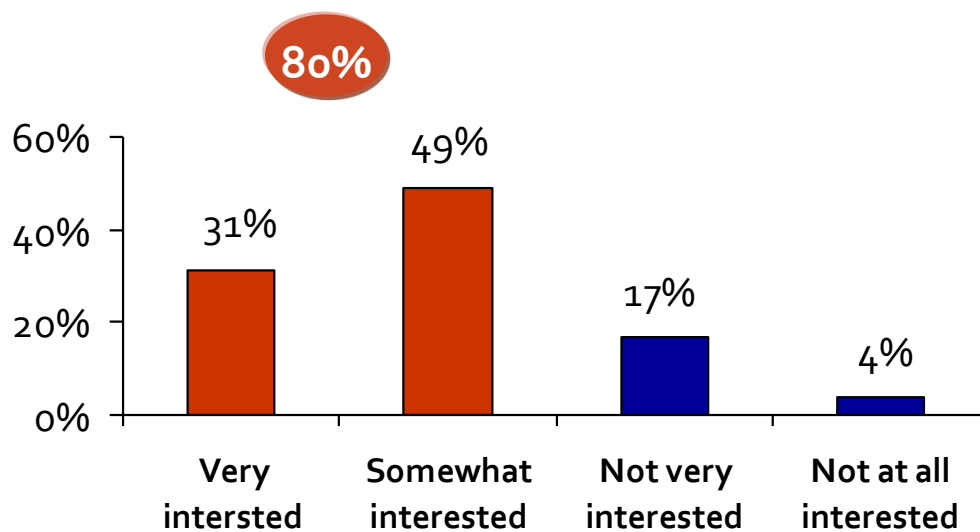
– Chad Ulven, NDSU

Staffing or Training Needs for the Use of Biobased Material Are an Obstacle



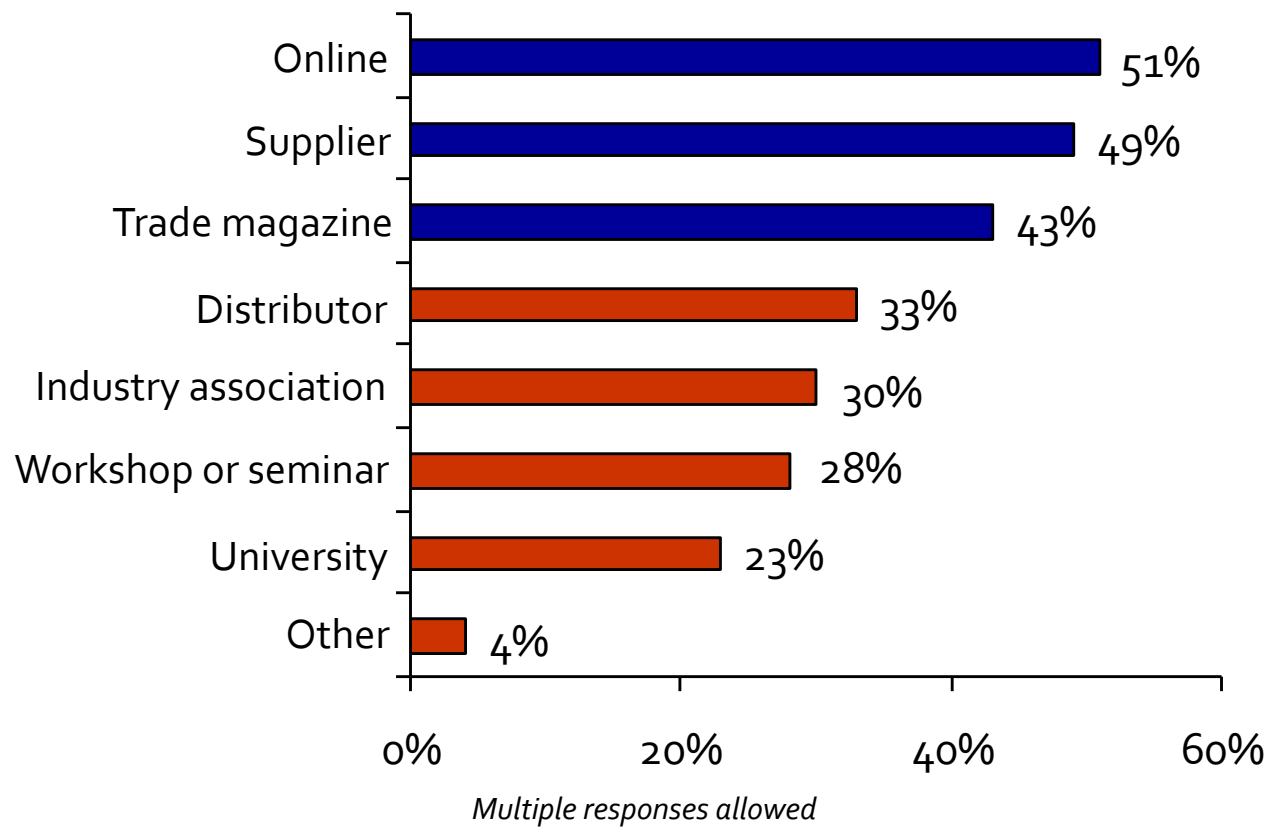
Source: Russell Herder Renewable Materials Survey, 2010

Interest in Learning More about Biobased Material



Source: Russell Herder Renewable Materials Survey, 2010

Preferences for Learning about Biobased Material



Source: Russell Herder Renewable Materials Survey, 2010

Information Sharing

To bring innovation through to commercialization requires planning, strategy development and a strong network of support. A willingness to share information is fundamental to this, but is not pervasive among retailers, OEMs and product developers.

“Why would I open my mouth? [By sharing information] you can accelerate the development cycle, but you kind of go, wait a minute. If we do, we are going to have a problem.”

– Manufacturer

*“The strongest companies rely on powerful friends.
The weakest tend to scale up alone.”*

- “The Future of Bioplastics: Making It Happen,”
2011 Bioplastek Forum, June 2011

Some believe academia should further rethink their willingness to work with the manufacturing community.

“Colleges need to recognize that they should be training students, not creating IP.”

– Manufacturer

"We need a bigger ecosystem for innovation."

– Dean Robert Elde, University of Minnesota



"I do see and understand the value of these collaborations between the University of Minnesota and industry. It is important to the University, and to society, for innovations to be moved into the marketplace in an appropriate way so that they can be further developed and used. I look forward to helping the University continue to be a place where research results can have a practical impact."

- Eric Kaler, President, University of Minnesota

Food Versus Industrial Use of Agricultural Products

Converting agricultural commodities into industrial products is a controversial issue. Uses of alternative agricultural feedstocks can address this situation to some degree.

“Wheat straw, corn stover, corn cellulose and wood pulp – these can all be the source of natural fibers that can be used to reinforce plastics.”

– Jim Lunt, Jim Lunt & Associates

Waste Stream Management

While the initial push in bioplastics was toward compostability, the infrastructure needed to ensure biodegradable performance under optimum conditions simply does not exist.

“We have to start figuring out the infrastructure for end of life more quickly for these [biobased] materials. That is where we will see the advantage of the materials over the petroleum-based ones. We have to open up our composting, our digesting and all of the kinds of appropriate end of life strategies.”

— Jim Kleinschmit, IATP

Shifting from degradable to durable plastics from renewable resources helps reduce the need to build a composting collection and processing infrastructure.

“Because people want durable, they are not as concerned about compostability.”

– Jim Lunt

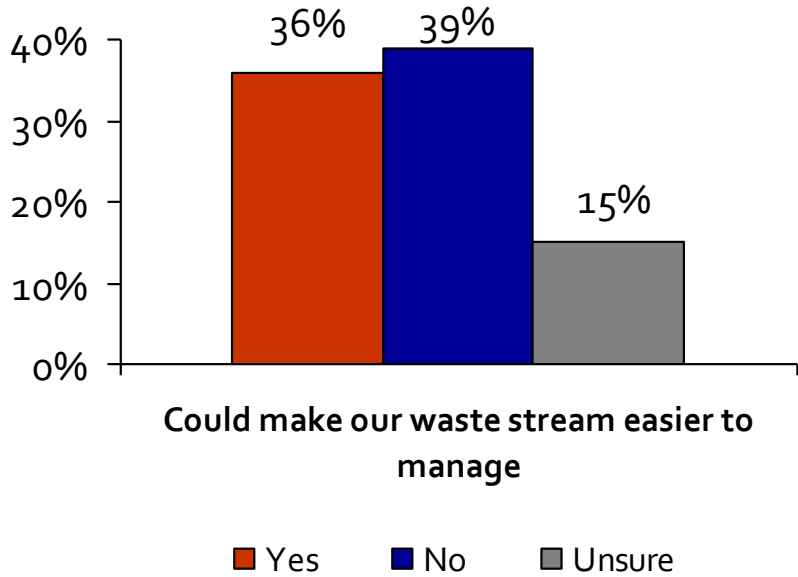
"I think a big hurdle for all of us to overcome is aligning the value chain and helping build out the infrastructure for disposal options – enabling consumers to have access to industrial composting and other new technologies like anaerobic digestion."

– Debra Darby of Telles



When a manufacturer changes the specifications or characteristics of the raw materials or components they use, that can also have an effect on the waste stream from that facility

**Believe the Use of Biobased Material
Could Make Our Waste Stream Easier to Manage**



Source: Russell Herder Renewable Materials Survey, 2010

The Promise and Potential of Bioplastics

“Where is the greatest potential? There is no single answer. It is about how we can apply the knowledge that we have acquired from petroleum chemistry and the industry it created. We must look at the renewable world with new eyes and say, ‘Can we try to create non-toxic substitutes and make them with renewable feedstocks?’ It is not easy, but it’s possible.”

— Olga Selifonova, Reluceo

“As the new biobased economy emerges, the North Central region is proving to be the home of intensive innovation, an early adopter of new technologies, and the ‘go-to’ location for economic activity.”

- Battelle Report, 2011



FINAL REPORT

POWER & PROMISE:

Agbioscience in the North Central United States

*The Importance of North Central Experiment Stations,
Extension Services and their Land-grant Universities
in the Global Bioscience Economy*

Performed For:
*North Central Regional
Association of State Agricultural
Experiment Station Directors
and the North Central Cooperative
Extension Association*

With Sponsorship By:
*Iowa State University • Kansas
State University • Michigan
State University • North Dakota
State University • The Ohio State
University • Purdue University •
South Dakota State University •
University of Illinois • University
of Minnesota • University of
Missouri • University of Nebraska
• University of Wisconsin*

- North Central region well-positioned to fulfill the promise of agbioscience product development and job growth
- Land-grant university system should be a priority for leveraging investment
- Agbioscience represents opportunity for U.S. to expand its leadership in a biobased, sustainable, resource-driven economy

The Minnesota Advantage

- Intellectual capital
- Innovative spirit
- Environmental mindset
- Rich agricultural resources
- Receptive manufacturing community
- Proven track record in fostering biocatalysis

The BioCentury

“... agriculture has emerged once again as a robust platform for economic growth and solutions to broad-ranging human needs.”

- Battelle Institute, 2011

“... we have the soybeans and the crushing facilities. To complete the circle, we need the companies and the technology to be able to utilize and build the biobased products here.”

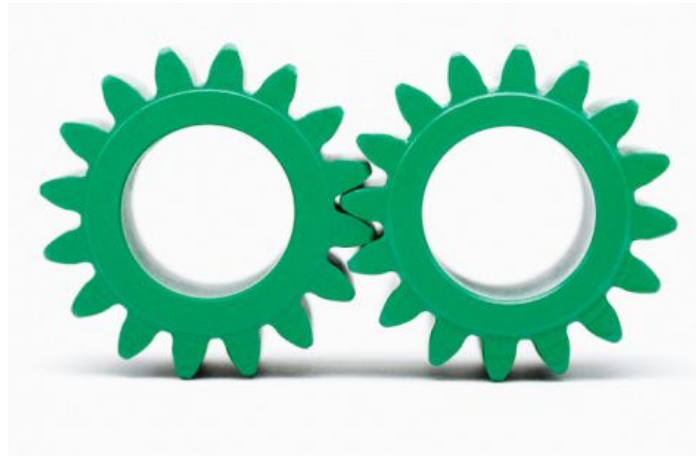
— Jim Palmer, Minnesota Soybean Board

Nearest-Term Opportunities?

- Pressure-sensitive adhesives
- Foam
- Hardened plastics
- Packaging
- Certain types of non-load-bearing or non-critical-performance molded products
- Vertical integration: owning several stages of the value stream – from manufacturing to distribution – either directly or through partnerships and agreements

“There is some connecting of the dots. It will take a little bit of capital and a little bit of risk tolerance before that kind of thing can come together. But it will never happen if people don't start talking about it.”

— Doug Cameron, Alberti Advisors



Leveraging Minnesota's Strength in Biofuels

Opportunity may exist to leverage Minnesota's biofuels industry into the green chemicals category, which operates at the molecular level in discovering ways to replace petroleum based products such as resins with biobased sources.



Public-Private Partnerships

Addressing costs is a real issue – but one that can sometimes be best addressed through close working relationships.

“We believe that building on the foundation of polymer science excellence at the University of Minnesota, we're going to be one of the nation's – if not the world's – leading centers in this area.”

– Marc Hillmyer, Center for Sustainable Polyols at the University of Minnesota



"There needs to be a very robust transfer of technology from academia to industry because, without that transfer ... we won't be able to make money; we will end up having a lot of technology sitting on the shelf in investments that didn't help society at all."

– Paul Rothweiler, Aspen Research

Process to Adoption

Manufacturers need to figure out how to use biobased materials in their processes without comprising efficiency, equipment and profitability – while assuring their customers of consistent performance, reliability and competitive cost.

“The industry is certainly not going away; it is well down the path of being economically sustainable. It is just a matter of what the specific markets are that it would work within. And, who knows? Maybe it is creating a market.”

– Tim Welle, BioBusiness Alliance



“There are a lot of machines for sale in today’s economy, which might offer an opportunity for an aggressive, visionary manufacturer to pick up the equipment needed for a dedicated bioline.”

– Harold Stanislawski, Fergus Falls Economic Improvement Commission

Recommendations

Educate ...

- **Proactively shape awareness, attitudes and understanding** of the economic, health and environmental benefits of biobased products among consumers, retailers, manufacturers, and the financial and agricultural communities
- **Support Minnesota educational institutions** in shaping the skills and mindsets necessary for sustainable development
- **Provide education to manufacturers** to help ease transition of using biobased material in their operation
- **Conduct a “connect the dots” conference** which brings resin/polyol providers together with university researchers, start-ups, manufacturers and venture capital to discuss what is happening, who is doing what and to begin networking Minnesota ideas, research and businesses that can help each other succeed
- **Evolve group into a community of innovation** to help nurture potential of biobased manufacturing in Minnesota
- **Aggressively raise the media profile**, through the efforts of AURI, industry partners and leaders of the agricultural community, about what is happening in Minnesota related to biobased plastics, green chemicals and bioproducts

Collaborate and Support ...

- **Nurture an investment environment** more favorable to stimulating innovation and market development
- **More robust technology transfer** – a guide or website that incorporates services available to increase biobased opportunities
- **Create an innovation ecosystem** involving academic institutions, nonprofits and the private sector that encourages knowledge sharing and joint ventures
- **Encourage a strategic approach toward developing and manufacturing** biobased products, supported by comprehensive and coordinated legislative actions in such areas as agricultural, environmental and industrial policy
- **Find ways to leverage Minnesota's strong biofuels foundation** in the next-generation green chemicals marketplace
- **Support financing of demonstration projects and onsite assistance** to manufacturers to further encourage adoption and up-scaling of biobased production and innovations

- **Investigate the possibility of using ethanol and biodiesel plants as the centerpiece for a biorefinery “campus,”** including incubators for start-up green chemical companies, biomaterials research and development, and manufacturing using biobased materials including the use of distillers grains as plastics strengtheners and the emerging research on using waste glycerol from biodiesel production to produce bioplastics
- **Consider a biobased plastics manufacturing pilot plant facility** in which manufacturers, bioplastics resin/polyols suppliers and product developers could test processes and products before scaling up to full production

Remove Barriers ...

- **Create a clearer and more positive regulatory environment for sustainability**
- **Support the development of closed system collection, recycling and composting** of biobased plastics in large companies, athletic facilities, etc. (e.g., University of Minnesota, Cargill, Target Field)
- **Conduct a pilot educational study of a community-based composting infrastructure** whereby residents could bring compostable materials – including bioplastics – to a single neighborhood composting location

Thought Leader Forum: Top Identified Priorities

1. **Nurture an investment environment** including the provision of an infrastructure/clearing- house mechanism.
2. **Encourage a strategic approach.**
3. **Leverage Minnesota's strong biofuels foundation** and investigate ethanol plants as potential centerpieces for a biorefinery campus, potentially structured as co-ops.
4. **Proactively shape awareness, attitudes and understanding** of the biobased materials industry, including what it is today, addressing the food versus biobased industry, and sustainability issues.
5. **Create an innovation ecosystem** that includes the entire biobased materials system, from production to consumers, and focuses on sustainability.

6. **Educate manufacturers** about biobased materials and their appropriate use.
7. **Hold a “connect the dots” conference.**
8. **Evolve this group** and others into an innovation community.
9. **Take a more regional approach.**
10. **Support Minnesota educational institutions.**