

# Expository Performance Task: Sunflower Power

## Student Directions

Task:

Your class is studying about “green” energy options. You are given four articles about sunflowers and their use as biofuels or alternate fuel sources.

Read the sources carefully to **write an explanatory essay** about on sunflowers. Using more than one source, craft a thesis to explain the ways in which sunflower seeds can be used to create biofuel and the economic implications of this process.

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## Sources for Performance Task:

### Source #1

This article is from the U.S. Department of Agriculture's quarterly publication *BAR Digest* and is about studies being conducted on the use of sunflowers for biofuels.

#### **Biofuel from Sunflower: A Bright Opportunity for the Sun-loving Bloom**

by Rita T. dela Cruz

In a bid to decrease the country's overdependence on fuel, various research institutions started to focus their leads in studying and identifying some of the most cost-effective and environment-friendly energy sources to produce biofuels. Biofuels, such as bioethanol, biodiesel and biogas, are renewable fuels that are generally produced from agricultural crops or organic matter.

This effort to find an alternative bio-source is also in accordance with the recent passing into law of the Biofuel Acts or SB 2226 and the Department of Agriculture (DA)'s drive towards energy independence. The law requires that "a minimum of 1% biodiesel by volume shall be blended into all diesel engine fuels sold in the country subject to domestic supply and availability of locally sourced biodiesel component." Violators are penalized with one to five years' imprisonment and a fine.

Among the crops identified as potential sources of bioethanol are: sugarcane, sweet sorghum, coconut, corn, cassava, and jathropa. And now, sunflower is also coming into the picture as another potential bio-source for ethanol.

The potential of sunflower (along with grapeseed) is also being studied in Taipei in their effort to look for more domestic feedstocks coupled with best available and affordable technology.

Even the Brazilian agricultural experts are now optimizing the potential of sunflower by learning how to transform sunflowers into biofuel in the most cost-effective means. Other renewable energy sources that they are looking into are soybean and oilseed rape.

Meanwhile, an Italian farming association is working on biofuels produced from sunflowers and sugar beets. Its sunflower oil-powered boat premiered at the recent Kyoto Protocol conference in Montreal. It sounded a bit off-beat, but the boat ran fine.

According to experts, if this project pushes through in the market, this biofuel is going to be relatively inexpensive. It was also reported that everything smelled faintly like French fries after the demonstration.

### **Sunflowers in the Philippines**

Sunflower (*Helianthus annuus*) is an annual plant that belongs to the family of Asteraceae and is native in North and South America. Although it is not commonly grown in the Philippines, it can thrive in its soil. The giant sunflowers (grows up to 12 feet with head up to 3 inches wide) are native in the eastern United States. The common and recommended variety of sunflower in the Philippines is the hybrid type, which grows up to 105105 days after planting.

Sunflowers in the Philippines are grown for ornamental purposes and for their[their] edible oil. Specifically, at Central Luzon State University (CLSU), they have been growing sunflower since the early 70s, mainly for its edible oil. Sunflower oil, extracted from the seeds, is used for cooking. Its oil is less expensive (and healthier) than olive oil. Its fatty acid content is composed of high oleic type that contains higher level of healthy monosaturated fats.

At the moment, CLSU is reviving its sunflower production not for the edible oil but for biofuel. The sunflower seeds contain 36-42% oil and 38% protein meal.

"Biofuel from Sunflower: A Bright Opportunity for the Sun-Loving Bloom by Rita T. dela Cruz, from <http://www.bar.gov.ph/digest-home/digest-archives/64-2007-1st-quarter/1496-janmar07-sunflower-5>  
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### **Source #2**

This article from *BioFuelsChat* is about a sunflower project being carried out in a partnership between high school students and a corporation.

### **Sea of Sunflowers Becomes Biodiesel**

Thousands of sunflowers, rows and rows, dot the landscape near the heart of downtown Phoenix.

The land this garden is on, between 5th and 6<sup>th</sup> Street and Garfield and McKinley, used to be just a vacant lot. However a local community group saw it instead as an opportunity.

Years ago you'd drive through here and you'd never imagine you'd see a field of gold. The oasis is in a rather unlikely spot. The 2-acre garden is practically large enough for 5-year-old Renee Houser to get lost in.

"Oh my gosh, there's thousands of flowers out here in the middle of nowhere!" exclaims mom Nicole Houser.

It's called the Valley of the Sunflowers Project, a partnership between the Roosevelt Row Community Development Corporation and the nearby Phoenix Union Bioscience High School.

"This project is really about inspiring people, and sunflowers make people smile," says Braden Kay, Sunflowers Project Manager.

The seeds were planted back in September, and every Saturday since then volunteers have been out here tending to them, nurturing them so they can be harvested.

"What we'll do is take these seeds, press these seeds for oil, and then the bioscience class will make these seeds into biodiesel," says Kay.

They'll then use the biodiesel to power a solar powered hybrid car they're creating in class—a teaching tool for students and little Renee.

"Not only do they provide food for herself and the birds but eventually they'll provide biodiesel fuel for cars," says Houser.

She hopes this idea of transforming vacant lots into something beautiful catches on and it sounds like it already has.

We ran into another group out there partnering with the county. They plan to build a garden on a 4-acre lot near 8<sup>th</sup> Street and Jefferson.

Meanwhile that sunflower garden will be replanted in February.

"Sea of Sunflowers Becomes Biodiesel by biofuelschat, from <http://biofuelschat.com/topics/sea-sunflowers-biodiesel><http://biofuelschat.com/topics/sea-sunflowers-biodiesel> Copyright ©2013 by BioFuelsChat.com. Reprinted by permission of BioFuelsChat.com.

### **Source #3**

This article from NPR® is about farmers planting sunflowers in the hopes of earning a higher income and contributing to renewable energy sources.

### **Sunflower Power? An Entrepreneur's First Steps**

by Adam Burke

When farmers in the town of Dove Creek, Colo., started planting sunflowers a few years ago, many of them were motivated by the promise of a decent income—not energy independence. But an activist turned-

entrepreneur named Jeff Berman had floated a proposal with a green hook: He told farmers if they grew sunflowers, he'd give them a renewable fuel source.

"Well, when we first came in we were going to produce biodiesel, from local, sustainably grown oil seeds, and allow the farmers to use that fuel to grow the wheat and the beans that they also grow here," says Berman, chief executive officer of San Juan Bioenergy.

His part of the bargain was to build a facility in Dove Creek that could turn sunflower seeds into biodiesel. To do that, farmers would have to start producing sunflowers. Lots of them.

"It was very attractive to think that we could raise our tractor fuel, sure," says Dan Warren, a third-generation farmer in Dove Creek, who remembers those early meetings with Jeff Berman. "With pencil and paper you could see that there was more money involved, per acre, in the sunflowers than there was in the beans and the wheat on a normal year."

But farmers are a conservative lot. Richard Knuckles says he was skeptical.

"The way they painted the picture everything was just going to go smooth as molasses," he says. "Everybody was going to raise sunflowers and get rich."

### **A Relief from Unemployment**

It's likely that any number of development projects—green or not—would have received enthusiasm in Dove Creek. Unemployment in the surrounding county leads the state of Colorado at around 14 percent.

Grant Allen, 22, grew up here farming pinto beans and wheat with his father. Five years ago, he raised one of the first small sunflower pilot plots in the area. Now he's scaled it up.

Pointing to one of his 300-acre fields where the red earth is as fine and dry as talcum powder, he says he planted more than 2.5 million seeds there.

Still, as much he loves sunflowers, Allen says it was the processing facility that had made them a viable crop.

"We farmed sunflowers on the pure hope that they were going to get their doors open, and the [the processing facility was going to start producing," he says. "That's what kept us going, you know?"

### **Shifting from Biodiesel to Sunflower Oil**

By 2008, thousands of acres around Dove Creek were filled with sunflowers. Local grain silos filled up with the sunflower seeds that San Juan Bioenergy had purchased from farmers. Berman says he had raised \$5 million through investments and loans. And a plant was under construction that would extract oil and convert it to

biodiesel. But the biodiesel market was beginning to crash. And by the end of the year, federal subsidies for biofuels dried up.

"To survive, we had to make some changes," Berman says. "If we had insisted on building our biodiesel plant, then we would not be here.

Berman's key to survival was to focus on the part of the operation that was still viable: producing food-grade sunflower oil.

This shift in gears may not have been an easy transition for Berman, who was looking to start a green revolution with his business. But the company has managed to stay alive and hang on to its renewable vision.

### **Green Innovations**

Thus far, the facility's main green innovation is in the way that waste products—in this case sunflower hulls and pieces of plant material—are transformed into fuel. Machines grind up this biomass and press it into little fuel pellets, which look like rabbit food. The pellets are then fed into a special gasifier chamber.

Berman says 95 percent of the biomass turns into a gas, which is then routed to the company's generator. "And so you can burn natural gas, or synthetic gas in our case, in a generator to produce your own power," he says.

Berman estimates the system will eventually produce a third of the electricity and all of the heat needed to run the plant. But the workers are still fine-tuning the process. Meanwhile, Berman is continuing to dream.

"We plan, in our next phase of development, to build wind and solar," he says. That would create what might be the first "always on, hybrid renewable" plant anywhere in the United States and perhaps the world.

But that next phase is no sure thing at this point. To complete the processing plant and finish paying farmers for last year's crop, Berman has been shipping sunflower seeds to the Midwest at a loss. San Juan Bioenergy has produced just 15 tankers of oil since January. Farmers, like Allen, have begun to worry.

"Sunflowers could bring us farmers down, just as much as it could bring us up right now," Allen says.

Berman's vision has motivated a small community to step out into uncertain territory. It's a risky place to be. But in many ways, Dove Creek is no worse off than it was five years ago when Berman first came to town. And if it turns out that San Juan Bioenergy does crack the code on sunflower power, it'll be Dove Creek waiting for the world to catch up.

"Sunflower Power? An Entrepreneur's First Steps by Adam Burke, from <http://www.npr.org/templates/story/story.php?storyId=113222071>. Copyright ©2013 by NPR. Reprinted by permission of NPR.

## Source #4

This article from the *New York Times*<sup>®</sup> is about community gardening with sunflowers.

### **Shrinking Violets They Aren't**

by Michael Tortorella

The difference between a vacant lot and a community garden comes down to a single thing: a sunflower.

*Helianthus annuus* is not just a plant but a kind of logo, said Deborah Greig, 30, an urban agriculture coordinator at East New York Farms in Brooklyn. She seems to have a knack for brand management.

"They're a really iconic way to make people notice that you're trying to make a change in the community," Ms. Greig said. "There's not a lot of green space in East New York."

The half-acre plot she helps manage, the United Community Centers Youth Farm, lies almost in the shadow of the second-to-last-stop on the No. 3 train. The main mission here is to help the neighborhood grow its own nourishing food. But a perimeter of brilliant sunflowers, towering over the cyclone fence, seems to function like commercial signage, she said.

The sturdy sunflower does not shrink from a little "hard labor, too," Ms. Greig added. "I think they do some catching of the trash that blows in."

At the South Bronx community garden La Finca del Sur, she said, growers are experimenting with sunflowers in a soil-treatment practice called phytoremediation. In field tests last summer, the plant's deep taproots seemed to pull heavy metal contaminants like mercury and lead from the garden's polluted soil.

When the sunflower isn't doing dirty work, it dresses up nicely. This year, Ms. Greig and her friend Molly Culver, 31, will include sunflowers in designs for a half-dozen weddings as part of a side business called Molly Oliver Flowers. Many of these blooms will come from the Youth Farm at the High School for Public Service in Crown Heights, Brooklyn, where Ms. Culver is a manager.

"We're planting around 150,150, or more, every other week through the end of June," Ms. Culver said. (The farm supplies an on-site market and a cut-flower Community Supported Agriculture operation.) All told, Ms. Culver will be raising more than 1,000,1,000 sunflowers in the concrete heart of Brooklyn.

As it turns out, this is a perfectly natural place for a sunflower to be. When Ms. Greig and Ms. Culver—and I stocked up on sunflower seeds this winter, we were joining a gardening tradition that goes back some 5,000 years. *Helianthus annuus* is the quintessential American flower. And its path to the garden each year is a kind of tall, shaggy tale, rather like the sunflower stalk itself.

Sunflowers are likely the second-oldest domesticated seed crop in eastern North America. (Squash came first.) Archaeological digs in the river valleys of Appalachia (sites with names like Cloudsplitter and Napoleon Hollow) have identified the burned hulls of cultivated sunflower seeds from 4860 B.P. (or before present). Other sites in Mexico may be older still.

New York's pre-colonial dwellers, the Lenape, likely planted sunflowers at the edges of the maize fields alongside their camps. In Brooklyn, the Lenape might have sowed sunflowers near Gravesend and the Gowanus Creek. Other fields lay in Harlem, north of a settlement called Konaande Kongh. In the Bronx, the Lenape planted near Hunts Point and Clason Point.

From the accounts and detailed drawings of European explorers along the Eastern Seaboard, these sunflowers were of the common cultivated variety, macrocarpus. The plants reached seven or eight feet tall and formed a single large head. (Wild sunflowers grow with a branched habit and form numerous smaller heads.)

Writing in 1951, the eminent American sunflower taxonomist Charles B. Heiser Jr. concluded that oil from the crushed seeds "was used chiefly to anoint the hair." This practice could still be observed in the Iroquoian tribes of Ontario in the 1940s.

On other occasions, the seeds "were roasted over a fire, then pounded and cooked with roasted white corn, sweetened with maple sugar and used in somewhat the same way we use lard."

The sunflower packets in the seed rack at the hardware store did not come directly from America's pre-colonial stock. In the 16<sup>th</sup> century, the plant began a grand tour of Europe: the Flemish botanist Rembert Dodoens recorded an accurate drawing as early as 1568. In the centuries of European breeding that followed, the sunflower probably learned how to curtsy before royalty and wear a powdered wig and dance a gavotte.

It is mostly the repatriated<sup>1</sup> sunflower that we grow today. (Dr. Heiser reports that the plant made its homecoming debut in C. W. Dorr's seed catalog in 1880.) The search for the modern sunflower might lead you to Tom Heaton's breeding nursery in Woodland, Calif., on the outskirts of Sacramento. Some of the most popular ornamental cultivars came into existence here, and in 100 acres of seed-production fields spread across the valley.

The sunflowers go by names like the Joker (which has a motley ruffle like a fool's collar), Moulin Rouge (burgundy), Moonshadow (pale) and Kong (which Dr. Heaton has grown to 19 feet). And there's the ProCut line, which might be the hardest working sunflower in the floral trade.

<sup>1</sup>repatriate: to return to one's own country

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