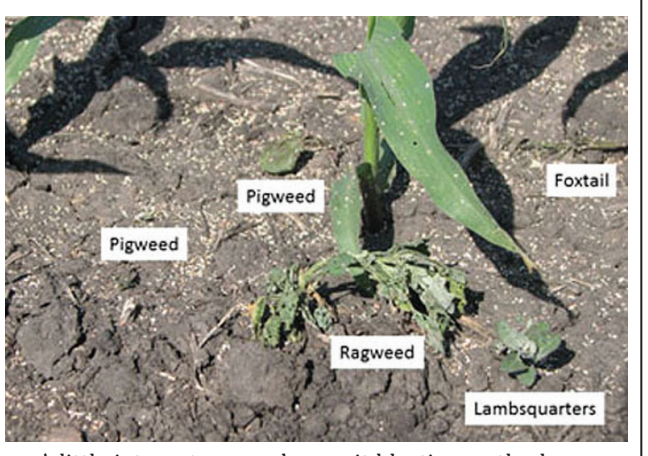
Blasting Weeds Away With Grit

Jim Eklund drives as agronomist Frank Forcella blasts small weeds away with pressurized grit from a prototype of PAGMan (Propelled Abrasive Grit Management) Jim Eklund drives as agronomist Frank Forcella blasts small weeds away with pressurized grit from a prototype of PAGMan (Propelled Abrasive Grit Management)

The timeless struggle against weeds is especially tough for organic farmers, who avoid using highly concentrated toxic herbicides in favor of chemical-free methods like hand-pulling, soil tillage, and scorching. These methods are time-consuming and expensive, and they tend to be less efficient than standard herbicides. Fortunately, the war on weeds has a new non-chemical weapon to add to its arsenal: a machine that obliterates weeds by blasting them with grit.

Propelled Abrasive Grit Management (PAGMan) is a device created by agronomist Frank Forcella and a team from South Dakota State University in Brookings and the USDA-ARS North Central Soil Conservation Research Laboratory in Morris, Minn. The system disintegrates weeds with high pressure grit particles while leaving the surrounding crops intact.



A little internet research revealed that a small sandblaster wouldnt break the budget, so they gave it a try. They bought a tiny sandblaster and, using corn cob grit, they tested it out in the greenhouse on common weeds growing alongside corn.

When the corn is about six to 12 inches tall, and the weeds are just poking up, you blast them for just a split second with the corn grit and, sure enough, the weeds disappear, said Forcella.

With this timing of the pelting process, the strong, established corn plants remain intact and can continue to grow. But the tender leaves of the emerging weeds succumb to the blasting process. Without the leafy tops on the weed plants to photosynthesize, the weeds root system withers away, and the weed dies.

PHOTO BY DEAN PETERSON

Forcella got the idea while he was daydreaming about uses for the five gallon bucket of apricot pits he had lying around the house. It just seemed wasteful to throw away all these pits, and it got me wondering what the apricot industry does with them. It turns out they sometimes grind them up and use the grit in sandblasters.

Sandblasting, or abrasive blasting, uses high pressure to propel grit in order to smooth, shape, and clean surfaces.

Out in the field one day, my colleague and I thought, What if we could adapt the sand blasters to control weeds? said Forcella. We kind of laughed it off but the idea didnt go away.

After determining which stage of plant growth is best to apply the grit, it was time to take PAGMan to the field. Forcella used a bigger unit mounted on an off-road vehicle in a corn field, and, Lo and behold it worked! said Forcella. We found that we could get 80-90% weed control, and with that kind of control you have zero crop loss.

The blasters target weeds that sprout among common row crops such as soy and corn. Two applications of the grit treatment work best and should be applied when the crop is tall and strong enough to be unharmed.

Forcella approached organic farmers with the grit-blasting method, some of whom suggested improving the idea by substituting organic fertilizer something farmers have to apply to the soil anyway for the corn cob grit. Many fertilizers, like limestone for instance, just happen to have a granular gritty texture, said Forcella. So farmers can apply the fertilizer and simultaneously blast the smithereens out of weeds.

Some weeds, like waterhemp and pigweed, have developed multiple resistance to common herbicides, and are no longer deterred by them. The PAGMan has the potential to assist in controlling these sly weeds on conventional farms as well.

With help from Dan Humberg and Cory Lanoue, field machinery engineers at SDSU, and a grant from NCSARE (North Central Sustainable Agriculture Research and Education), the team crafted a larger version of the PAGMan. This version has eight cone-shaped nozzles targeted at either side of four rows of crops. The nozzles are connected to a tank that holds the grit material.

Tests with the updated and larger PAGMan on corn plots in organically certified fields show favorable results. Forcella hopes to work in conjunction with colleagues to improve the device, possibly adding GPS in order to improve aim accuracy.

Theres a lot of expense and manpower associated with organic weed control, said Forcella. This method, if practiced at the correct growth stages, could be a win against the never-ending onslaught of noxious weeds.

■ Crop Science Society of America

Game Of Drones

Drones, or unmanned aerial vehicles (UAVs), are a hot ticket in Silicon Valley, but U.S. government dithering over regulations has given overseas companies a head-start in figuring out how best to exploit them.

Global spending on drones could add up to close to $100 billion over the next decade, with commercial uses - from farming and filming to pipelines and parcels - accounting for around an eighth of that market, according to BI Intelligence.

But for years, the Federal Aviation Administration (FAA), the authority largely responsible for regulation in the United States, has dragged its feet, only last month issuing draft rules on who can fly drones, how and where. It's likely to be a year or more before the regulations are in place - good news for companies operating outside the U.S. and looking to build a business around drones.

Sky-Futures, a British company that dominates the use of drones to collect and analyze inspection data for oil and gas companies, says its business soared 700 percent last year as the normally conservative energy industry embraced the new technology. Co-founder and operations director Chris Blackford said the company is coupling drones with software and a better understanding of what works in the field, giving Sky-Futures "a head-start over the U.S because we understand pretty intimately the problems facing the oil and gas market, and how we can solve them with technology."

Looser regulations outside the U.S. have created pockets of innovation attracting ideas, money and momentum, says Patrick Thevoz, co-founder and CEO of Swiss-based Flyability, which builds drones inside a spherical cage that allows them to bump through doors, tunnels and forests without losing balance.

Another British company, BioCarbon Engineering, hopes to speed up reforestation by using drones to plant germinated seeds, and shares in New Zealand-based Martin Aircraft <IPO-MAI.NZ> trebled in the first few days after listing in Australia last month, on investor hopes for the personalized aircraft maker which is developing a UAV that could be used by the military, oil and gas, mining and farming industries.

In Japan, the government is looking to fast track industry-friendly regulation to give its drone business an edge.

Palm Oil, Pack Dogs

But the real work, say those in the industry, is in building out the drone ecosystem: the payload, software, operator and end user, and making sense of the data. That can only come by connecting to potential customers.

"As long as you don't have the end user because they can't use it, you're basically missing a lot of the ecosystem," says Thevoz.

In Singapore, Garuda Robotics is already moving beyond just being a drone operator. "The drones are a means to get the data out of the sky," says co-founder and CEO Mark Yong, "but if you can't process it you've not created any value for the customer."

While the company has been helping map the boundaries of palm oil plantations in Malaysia, it has added the ability to calibrate the drones' cameras to measure moisture levels in individual trees. It's now working with agronomists to figure out how to make sense of that thermal data to judge the health of trees and their likely yield.

Other projects include assembling real-time 3D maps of building sites to help construction schedules, monitoring and reducing algae blooms and keeping tabs on packs of stray dogs using infrared cameras.

PHOTOS BY IOWA AG LITERACY

All of this would be hard, if not impossible, under FAA regulations that limit drones flying out of sight of the operator, or at night.

While regulation typically lags technology, no one's betting against Silicon Valley dominating the industry in the long run. Last year, more than $100 million flowed into U.S. drone start-ups, according to CB Insights, double 2013 levels.

"Let's not kid ourselves," said Philip Von Meyenburg, who runs a drone operating company out of Singapore. "They know what they're doing in the U.S."

And China, too, is in the game as hardware prices fall rapidly. China's DJI sells consumer grade drones for $500, making it hard for companies producing lower volumes to justify their higher prices.

"The challenge for all drone manufacturers now is that we're in a market that is constantly updating," said Flyability's Thevoz.

■ Jeremy Wagstaff, Reuters (AP)