CANOLA PULSE & SPECIAL CROPS GUIDE

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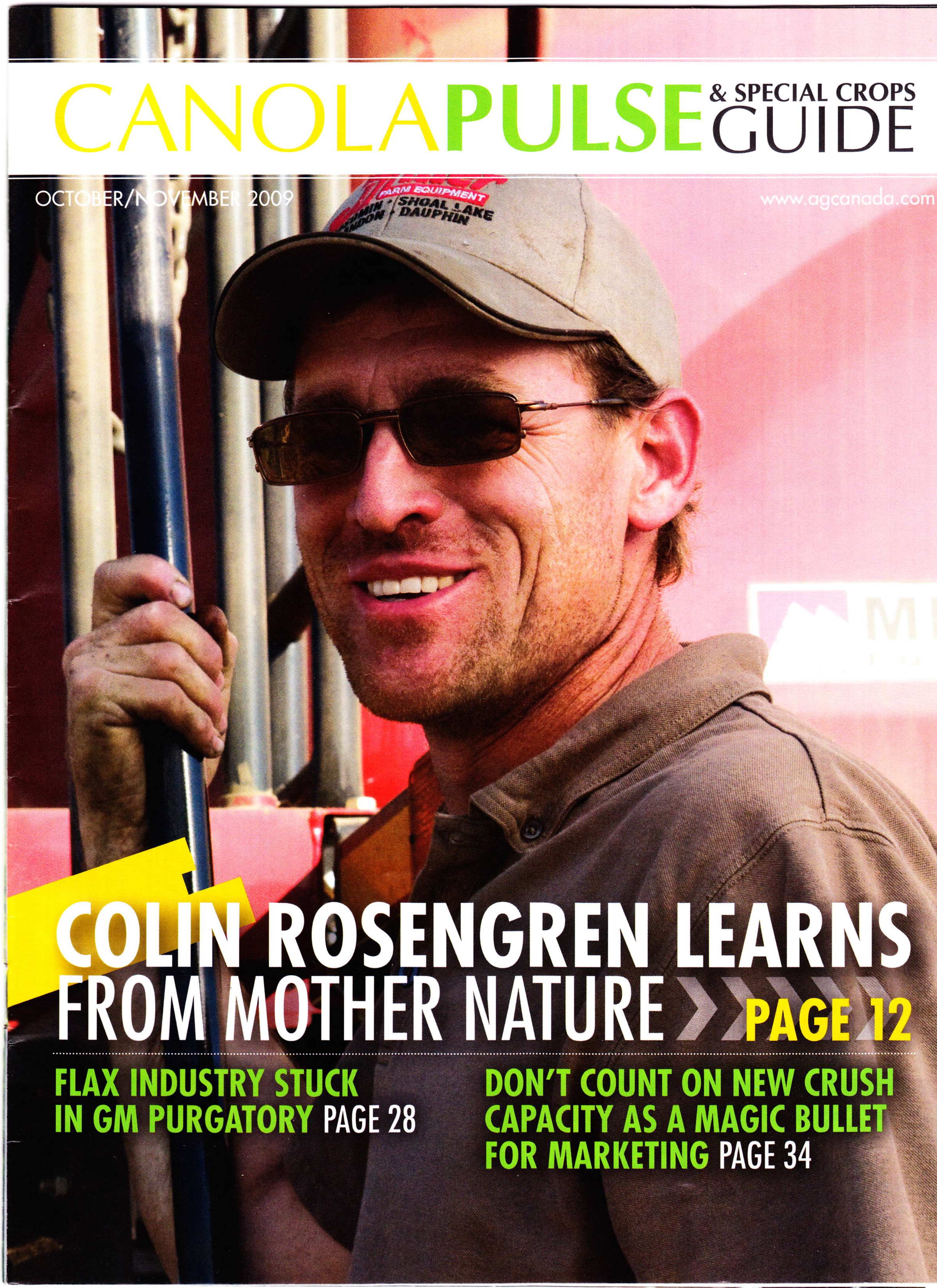

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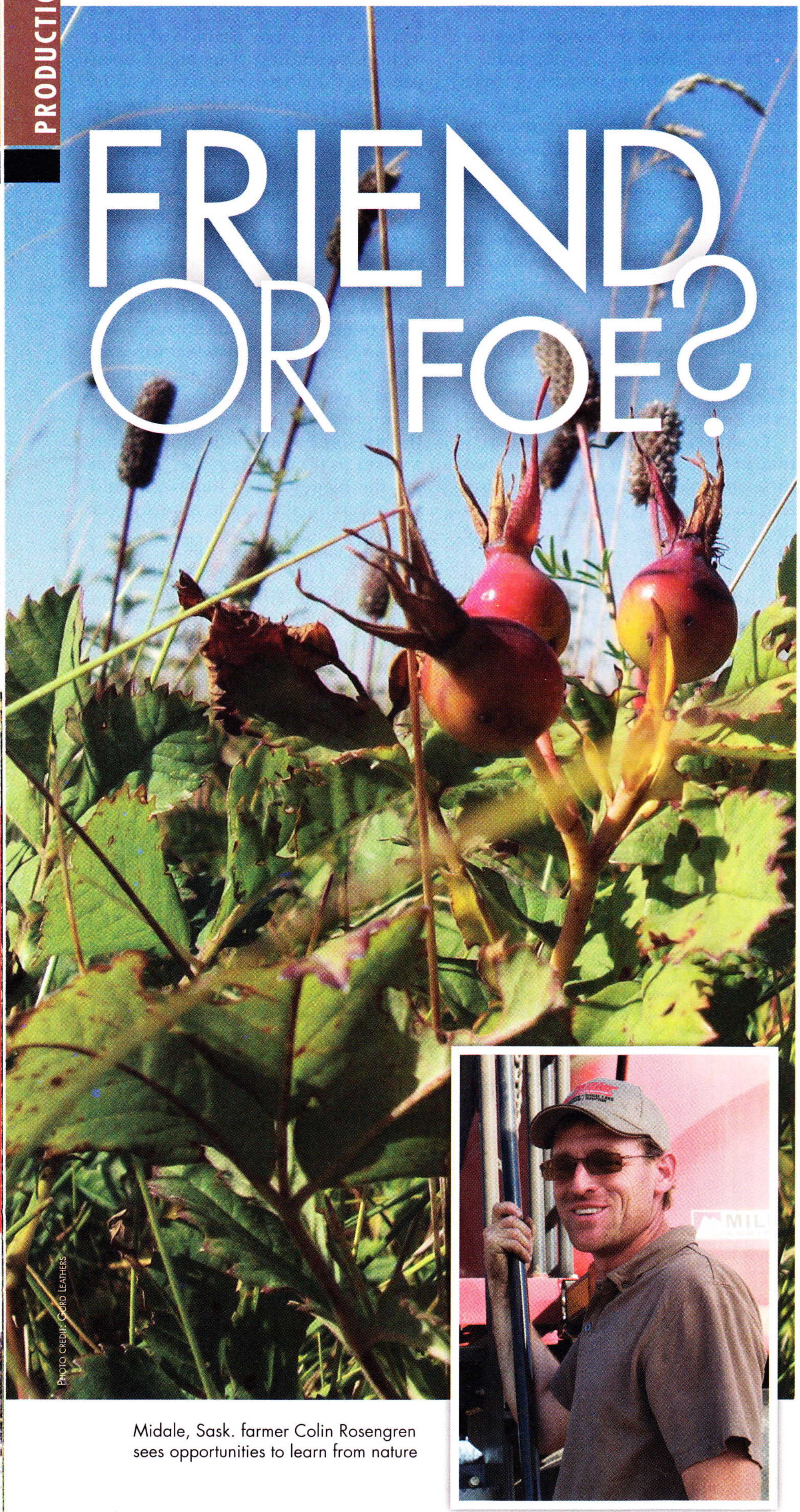

Midale, Sask. farmer Colin Rosengren sees opportunities to learn from nature

By Gord Leathers

Mother Nature can be both a farmer's best friend and worst enemy — and learning how to work with her may be the next big thing in Prairie agriculture

Just north of Winnipeg at Grosse Isle there's a patch of ground nestled between three railroad tracks. Once upon a time the trains could switch off the Gypsumville line from either direction and chug for the village of Inwood through the stony brush and cattle country of Manitoba's Interlake.

The land within the triangular wye has never been ploughed and sits as it did since the last glacier vanished some 10,000 years ago. The bluestem and cord grass dodge and weave with the wild rose and prairie clover as they applaud the gusty wind by doing the wave. This is a productive ecology shaped by four major elements: Earth, Air, Fire and Water.

Bordering two legs of the wye are working farm fields where the rich black soil yields another year's bounty. This year it was wheat and in one field the stubble is tilled while the other waits patiently for the combine, ducking and bowing with the playful gusts. It's tall and beautifully ripened, the yellow kernels openly boasting of quality breads, pies and pastries. This is a productive ecology shaped by four major elements: Earth, Air, *Farmer* and Water.

Just by glancing back and forth between these two radically different landscapes you can get some sense of the difference that single word of difference — replacing fire with farmer — makes.

There's no arguing with results either. By converting this continent-sized natural grassland to farmers' fields and then carefully managing them, they've become some of the most productive farms on the planet. But that production system comes with an Achilles heel.

It relies on an impressive arsenal of weapons to be deployed in a never-ending battle against nature. From yield-boosting fertilizer and plants that have been bred to efficiently convert that newly found bounty to grain, to yield-protecting crop protection products that prevent the depredations of weeds, insects and disease, it's all designed to keep an emphatically unnatural — but inarguably highly productive — farm system up and running.

That's all fine and well, provided those inputs are readily available and affordable. But as a larger-and-larger human population puts more and more pressure on a finite resource base, it's entirely likely that farmers may see a situation in the future where their production costs accelerate more rapidly than their revenue, providing an opening for further refinements in the Prairie production system.

This potential next wave of the Green Revolution is known as biomimicry, and it's a system where farm fields start to behave more like that patch of wild prairie. Crops will be bred to perform under different conditions and production systems will be fine tuned to work within specific ecozones.

This takes us beyond farmer as food producer and into the realm of farmer as landscape manager. The next phase will be polycropping, planting two or more complimentary crops together, and perennial crops such as new breeds of perennial grains or traditional breeds of forages.

Ideally this means farmers can work with Nature and use some of her tricks in managing landscapes rather than engaging in a brute force contest of chemistry in order to subdue her.

This doesn't mean zero-input agriculture. It means rethinking some standard practices, asking the question "How would Nature do this?" and then using her tricks and tools to our best advantage.

It's tricky and it requires greater knowledge of crop biology but, in the long term, it just might be better for the land, better for the pocketbook, better for the farmer and better for society. Colin Rosengren, a Saskatchewan farmer who's been working on a biomimicry system on his farm says he's discerning a clear-cut trend at work — that the systems like zero till that acknowledge how nature works and try to copy it seem to be the systems that work best.

""I think as we learn more of that this will become more and more logical. Anything that's a more natural system seems to pay off. Zero tillage was more natural," Rosengren says.

APPLIED ECOLOGY

It's the height of harvest at Rosengren Farms in Midale, Saskatchewan and a dusty old truck rolls into the yard, lifts the box and tips another load into the hopper. Out pours a stream of stuff that looks like Red River Cereal, not the monochrome deluge of one crop but a marbled cascade of peas and canola. These two crops were sown, grown and harvested together because polycropping is what Colin Rosengren does.

"Peas and canola is the main combination and that's become a no-brainer for us. We don't have any acres of canola or peas on their own, they're all mixed," Rosengren says. "Pretty much everything we've tried has worked and seems to grow well together."

The idea of polycropping came to him after he graduated with an agri-

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> " ...THE MORE DIVERSE THE ECOSYSTEM, THE HIGHER THE UTILIZATION OF RESOURCES YOU SHOULD BE ABLE TO GET AND WE SEEM TO BE ABLE TO ACCOMPLISH THAT."
>
> — COLIN ROSENGREN

NO PAT ANSWERS IN BIOLOGICAL RESEARCH

Farmers are faced with more production dilemmas than almost anyone else grappling with the ins-and-outs of science.

That's because chemistry and engineering are pretty straightforward, but biology is messy. There are very few one-size-fits-all answers to any questions and this goes for fertilizer applications. To make it cost effective a farmer wants the greatest production possible with the smallest input.

Nature uses the same nutrients to get things going but they're very efficiently used and very well conserved. How does she do it and what can we steal from her bag of tricks to maximize our output while minimizing input? We're starting to understand some of those mechanisms and many of them deal with symbiotic relationships between plants and soil organisms.

Let's take a look at a single, often troublesome nutrient — phosphorus. Just because phosphorus is there doesn't mean it's in a form a plant can use.

Sometimes farmers will adjust for this through different chemistry or by overdosing a field. The result can be greater production — but unused phosphorus can move to places like water courses where it can cause trouble. Besides, it doesn't make economic sense for a farmer to lose costly fertilizer.

Nature, on the other hand, conserves nutrients by putting things into partnership. There are several varieties of soil fungi, called mycorrhizae, that can extract phosphorus but have trouble getting carbon. What they do is enter into a symbiotic partnership with plants which, by nature, put carbon compounds together through photosynthesis. The mycorrhizae grow into the plant roots and, in exchange for carbon, they'll deliver usable phosphorus compounds to the plant. It's an ancient win-win situation.

As for how much is enough, we're still not certain although we're learning more about these relationships. If the field gets too little phosphorus the plants can't get started and they'll never really get going. Too much and the plants will decide they don't need help from the fungi.

It's expensive for them to give up carbon for no beneficial return so the fungal partnership never develops. The trick is to find the "sweet spot," that magic amount that will kick start the plants but still encourage them to culture the mycorrhizae.

The future farmer will take this sort of thing into consideration and fertility regimes will be a custom combination of chemistry and biology on a field by field basis. It will require knowledge, experience and very careful record keeping for all fields.

All photos: Kari Fortune

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culture degree from the University of Saskatchewan in 1997. He heard of work done at the University of Manitoba spearheaded by Martin Entz in the Department of Agriculture, with graduate work underway by then PhD student Tony Szumigalski. Based on what he knew about farming he thought it was worth a try.

"Once you read it and see what they're doing it just makes sense," he said.

What he found was a system that allowed him to plant multiple crops together in the same field which also actually allowed him to garner higher yields on both crops, while reducing inputs, because the multiple crops seemed to complement each other, rather than compete.

It might seem like another stretch, but we can learn a bit about this phenomenon from the world of music. Those who are old enough may remember hearing *No Sugar Tonight*, an old Guess Who tune, where Burton Cummings laments the lonely feeling deep inside.

Two verses later the song changes and breaks into the slightly different *New Mother Nature*. In the last verse the two melodies are sung together, each in a very pleasing rhythmic counterpoint to the other. The result is a different song where the whole is greater than the sum of its parts.

The same kind of synergy happens within plant communities. You never see stands of only one plant, it's always a group of several different species living in some form of co-operative competition, in a larger system known as an ecosystem.

Ecology, ecosystem — they seem like foreign words that have more to do with wildlife than farming, but this is not so.

At its very core farming is a managed ecology, and farmers are shepherds moulding and shaping a plant community that simply wouldn't stand any other way. The distribution and abundance of those plants is what farmers arrange and that's what ecology is. It's all about distribution and abundance, why organisms occupy the space they do and why there are as many of them as there are.

Ecology presents two aspects that farmers have usually never heard of but still understand because it's central to their trade. The first is called succession, the way plant communities like to move toward a diverse and stable system. For instance, if you burn a spruce forest, another spruce forest grows up again, but it takes about 400 years and goes through several stages.

The first plants back in after the burn are annuals and their job is to hold down the soil so that the stable perennials can move in. Those annuals are good colonizers and they're good seed producers but they're lousy competitors so the perennials eventually push them out. If this sounds to you like any of your fields then you're right. These are the plants our ancestors cultured because of their seed production.

The second aspect deals with selection. The wild grassland is stable and diverse. This lends itself well to organisms that like stable populations that neither boom nor bust but carry on over the long term. These organisms are are said to be "k-selected." Opportunistic colonizers like your crops wait until the right conditions line up so they go through a sudden boom just like mosquitoes after a warm, wet spring. When the conditions collapse, the population crashes and waits for its next opportunity.

This huge boom followed by huge bust is called "r-selection." If this sounds to you like any of your pests then you're right. An emerging canola field is a smorgasbord for flea beetles and sclerotinia. This is why a monoculture of annual plants is so unstable and why farmers have to apply their inputs to bring their crops to a successful harvest.

Which brings us back to that tiny patch of wild prairie that sits amidst the hurly-burly of commercial agriculture. In its biological diversity lies a startling level of production and hidden in the thatched turf are the answers to some very important questions we should be asking. How can we get a farm field to behave more like that self-regulating patch of prairie? How can we manage fewer inputs to the farmer's advantage while maintaining production?

The monocultural farm field is the norm and we find the idea of two or more crops in a field completely disjointed. In the course of his research, the University of Manitoba' s Szumigalski found that North American aboriginal tribes traditionally planted three crops together.

The "Three Sisters" community of corn, beans and squash still stands as the archetype, although in Szumigalski's trials he substituted wheat for corn, peas for beans and canola for squash. His research showed that these systems tend to overproduce by a factor of 10 per cent when compared to an equivalent monoculture. Some of Rosengren's results even surpass that.

"In general with the peas and canola I would say under any conditions that we've had in the last five years, we could always count on 20 per cent or better," Rosengren said.

Szumigalski's thesis suggests there are at least two reasons for this overproduction — complementarity and facilitation.

As farmers, as landowners and as lawn tenders we humans seem to really like an even, uniform grass cover without weeds and we labour to produce this. However, If you walk across a stretch of native turf you'll see several species occupying both the ground and canopy. The same holds under the soil and different species will have different root systems.

Complementarity refers to the ability that different plants have to use the same resources by occupying slightly different overall space. For example, the rose may sit beside the cord grass but the grass will have deeper roots and reach higher. This means that they're

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occupying the same ground but getting their resources from slightly different places. Direct competition is avoided.

"Different plants have different eco-spaces, different uses, different abilities to acquire nutrients, moisture and different timing for when they need those," Rosengren explains. "So the more diverse the ecosystem, the higher the utilization of resources you should be able to get and we seem to be able to accomplish that."

Facilitation goes one step further. This is where one species will help another. The classic example is the clover in the field which helps fix atmospheric nitrogen for the benefit of all other plants nearby. Some of these relationships are known but the overall workings of these wild systems are very complex and we're only starting to understand them. One symbiotic relationship we're becoming very aware of is the affect of vascular arbuscular mycorrhizae, the symbiotic fungi in the roots.

"It's fungi in the soil that form associations with plant roots and get into the smaller pore spaces in the soil and magnify your roots," Rosengren says. "This brings in more moisture and immobile nutrients such as phosphorus, potassium, copper and zinc and different micronutrients in a lot of cases. It's fairly critical for flax and lentils."

Other reasons for increased production can be even more unpredictable and quirky. Rosengren found that planting peas and canola together produced a mechanical synergy that came in handy at harvest.

As with the aboriginal Three Sisters system, the canola gave the peas something to climb and this kept them off the ground. Not only did the peas fix nitrogen for the canola but their vines wrapped around the stems of the canola plants and held them tightly together. This binds the canola plants together into a tight canopy.

This holds the ripening pods still in the breeze and keeps them from colliding with each other and shattering. Rosengren finds that he can straight cut the crop and has done that for about half of his harvests for the last five years.

He also finds that flax, a crop not known as a great competitor, does very well in combination with chickpeas or lentils. You want to make sure it gets a good start, if it gets shaded it might get choked out, but otherwise it holds the lentils up and they grow a little taller. He's planted combinations such as flax with durum, peas with barley and canola with lentils. Last year they even tried a triple crop.

"We did a peas with canola and barley but we need to learn a little bit more about managing our fertility on that. I think it was a little short of nitrogen in that system," he says. "We've changed some things on the drills so we could do that system better but we didn't see any additional gain over doing two to going to the three."

Planting a polycrop is easier than it sounds and can be done with off-the-shelf equipment. They set the seeder to send different seeds down alternate rows with a band of fertilizer along the flax or canola. Hoses can be blocked off using a hi-tech Red Green approach.

"We've got five tanks and three separate manifolds and air systems and two placements in the ground," he says. "If you don't want product going down it you just put duct tape over that hole and plug it. It's not too sophisticated."

You also have to make some right decisions with the crops themselves. You want varieties where both types will ripen at the same time or at least stay in the pod until the other catches up.

All in all, Rosengren sees a future for polycropping and figures the benefits will keep increasing as we learn more about soil biology and symbiosis.

"You've got a more competitive mix then you would otherwise so it's going to compete better with weeds and you've got less disease pressure," he says. "To me it's the next logical step after zero tillage and I think it will become commonplace. It magnifies all the benefits we see from zero tillage." ⊕