

CHASING THE RED QUEEN

In “Chasing the Red Queen: the Evolutionary Race Between Agricultural Pests and Poisons” (2014), Andy Dyer quotes Lewis Carroll’s “Through the Looking Glass.” In my country, Alice tells the Red Queen, if you “ran very fast for a long time, as we’ve been doing,” you’d surely get somewhere. But in Wonderland, the Red Queen replies, “it takes all of the running you can do to keep in the same place.”

Biologists have borrowed the “Red Queen Hypothesis,” Dyer says, to explain how agricultural pests adapt to environmental stresses like pesticides, in a never-ending “evolutionary arms race” without winners or a finish line.

Once begun, we must use pesticides more, and more frequently, at increasing cost. The agrochemical companies are as trapped in the race as the farmers. And the more effective a pesticide, the more likely it is to promote resistance.

How did we land ourselves on such a treadmill?

Just 2 per cent of all U.S. farms account for almost half of total production. They’re huge, farmed with massive machines which compact the soil and cultivate every inch of it, to eliminate habitat for weeds.

Ideally no life remains in these fields during the dormant season. The only biomass returned to them is, occasionally,

manure. The soil becomes an inert medium for holding crops while they're watered and chemically fed.

Fields are planted with one or two crops, bred for uniformity and hence lacking genetic diversity. Chemical fertilizers and pesticides make all this possible.

How well is this working out? Traditional farms lost 32% of their harvest to pests; huge high tech contemporary farms also lose 32% to pests, with much more environmental damage. The list of arthropods targeting corn is now so long that many are categorized by genus, not species.

And such agricultural systems are unsustainable, because they don't play by the Red Queen's rules – the inviolable rules of evolutionary biology.

We simply can't eradicate large populations of small, genetically diverse organisms. We spray, kill them off massively, and the genetically immune survivors' population explodes to fill the void. The more intense the selective force – poison sprays –and the greater the population reduction, the faster organisms adapt and survive.

This adaptive response is quite independent of the environmental stress – sprays, GMO's, predators, etc.

As Dyer says, “Every toxin selects the replacement for the pest being controlled.” “No organism in existence today has ever failed to adapt to the challenge of the environment.”

Currently 434 biotypes of 237 weed species are reported resistant to 155 herbicides. There are about 700 species of insects and mites resistant to about 350 insecticides worldwide. Since it takes only 5 years for a poison to begin becoming ineffective, the industry has turned to GM spray-resistant and insecticidal plants. But resistance to biotech crops begins as fast as to sprays – 5 to 6 years – so their ineffectiveness increases, as does a list of resistant species.

We’ve improved our crops’ sweetness, juiciness, starches, protein, fats and overall yield, deprived them of their inborn resistance and of their predators’ attackers. No wonder the Red Queen foils our best efforts!

Perhaps knowing corporations won’t make drastic changes quickly, Dyer suggests compromises to slow genetic adaptation – by adopting a slower, multi-pronged attack. Two stressors might double resistance time, so use a range of chemicals, not just one, like glyphosate. Encourage natural predators, along with chemical spot treatments. Create crop mosaics, so no single pest mutation can dominate. Plant polycultures, use no-till and cover crops, and go organic. Let stock onto fields again; create fish farm/farm complexes, as in Asia.

We must turn, Dyer says, from “how to maximize production” to “how do we protect the source of high productivity?”

We must, that is, end the dream of eradicating enemies and play by the Red Queen’s rules.