Some Principles Of Fungicide Resistance II: Increased Crop Disease Pressure Increases Risk

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This is the second in a series of articles on fungicide resistance.

The title summarizes the present article perfectly: higher disease pressure means higher risk of fungicide resistance. Figures 1-2 help in understanding why this is so. Field 1 (represented by Figure 1) has approximately twice the spore numbers as Field 2. Clearly, Field 1 has higher disease pressure.

You can also see that Field 1 has two resistant spores, rather than one.

If you count them up, you will find that the percentage of spores with resistance is slightly over 1 percent in both fields. That is to say, the mutation rate is the same in both fields, which is what we expect to find in nature. However, because of the higher disease pressure, Field 1 has approximately twice the overall spore population as Field 2. Thus, no matter what the mutation rate is, twice as many resistant spores will show up in Field 1 than in Field 2, because the overall spore population is twice as high.

So does this really matter? After all, resistant spores emerged in both fields. The answer is, "Yes, it matters", because resistance development is a matter of risk. Not all mutant spores that show up in a field will go on to cause disease. Some fall to the ground and never have a chance to infect a plant. Others may land on a plant but not be exposed to enough wetness to infect. Still others may infect but fall victim to plant defenses. So the higher number of resistant spores in Field 1 does definitely represent a higher risk for the producer, especially when one considers that billions of fungal spores can easily present in an acre of crop.

So, what does this mean for a producer? It means that, the more we depend on at-risk fungicides for disease control, the more pressure we are putting on the fungus to develop fungicide resistance. If it is possible to use others practices to reduce disease pressure, we reduce the overall risk of resistance. Anything that reduces disease pressure reduces the size of the spore population. And as Figures 1-2 show, reducing the spore population reduces the chance that a resistant mutant will occur in our fields.

This guideline applies to **all** practices that contribute to disease control: Sanitation, crop rotation, varieties with partial resistance, etc., etc. Anything we do to reduce disease pressure, reduces the risk.

Bottom line: The best way to protect the utility of fungicides is by not over-relying on them. Δ

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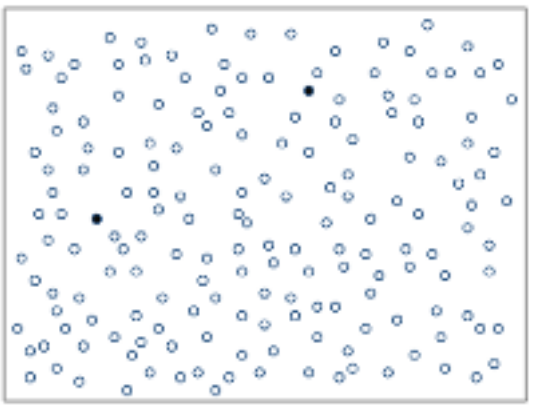

Figure 5. Initial step in fungicide resistance development: Occurrence of mutant spores with resistance to the fungicide (filled circles). Note that there are two resistant spores in this imaginary crop field.

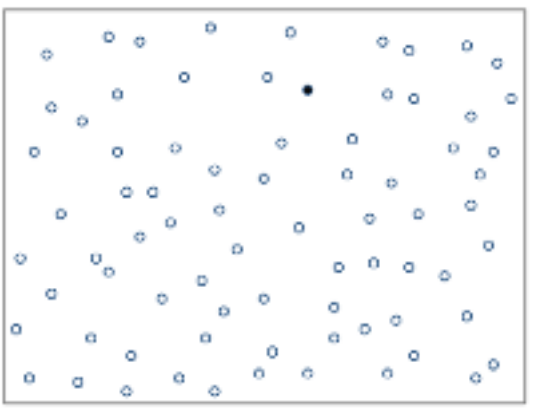

Figure 6. Imagine that this a second crop field, where the population of infectious spores is about half that of Figure 1. Only one mutant spore with resistance has occurred, instead of the two mutants that emerged in Field 1. See text for explanation.