

Contribution of Plant Responses to Efficacy of Fungicides – a Perspective

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ABSTRACT

It is a frequent field observation that fungicides exert beneficial effects in crop plants beyond their direct fungicidal action. Such crop strengthening effects, described e.g. as greening or as stress tolerance, apparently can increase yield. Although in the past years advanced phenotyping methods have been developed, molecular explanations are only fragmentary. Focusing on azoles and strobilurins some biochemical, molecular biological and physiological mechanisms are outlined. A comparison with host plant defense inducers sheds a light on plant-driven mechanisms, which might be activated by successful fungicides.

INTRODUCTION

Since long time, field observations by agronomic development scientists in industrial companies have led to speculations, that fungicides may increase crop yield by mechanisms beyond their direct antifungal action. Figure 1 shows the yields observed in 21 different unintentionally low-disease Bayer field trials with an azole (tebuconazole) and a strobilurin fungicide (trifloxystrobin) in winter wheat. The trials reveal a high biological variability, nevertheless with a median yield of treated plots significantly above untreated controls.

Clear proof for such yield effects is very difficult to obtain, since crop yield in the field is subject to many diverse non-controlled factors and it cannot always be excluded, that an observed yield effect of a fungicide has been due to control of an undetected infection. Thus there are only few reports in the scientific literature, which either support (Mahoney *et al.* 2015; Ajigboye *et al.* 2014; Smith *et al.* 2013; Henry *et al.* 2011; Beck *et al.* 2002; Jabs *et al.* 2002; Brueck *et al.* 1984) or reject (Swoboda & Pedersen 2009; Bertelsen *et al.* 2001) an intrinsic positive yield effect of fungicides on field crops. Yield effects are easier to determine under controllable disease-free glass house conditions. Glass house trials confirm the field observation of intrinsic yield increases by use of fungicides (Berdugo *et al.* 2012).

