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Trichoderma: A biocontrol agent that induces resistance to both biotic and abiotic stress

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Trichoderma is a fungus acting as a biocontrol agent. Biological control, the use of specific organisms that interfere with plant pathogens, is an environmentally friendly, ecological approach to overcome the problems caused by hazardous chemical pesticides applied in plant protection. The mycoparasite *Trichoderma* is an efficient biocontrol agent excreting extracellular chitinases, ß-1-3 glucanases and proteases. Cloning these genes into plants can induce their resistance to diseases. Moreover, this biocontrol agent can induce systemic resistance (ISR) to diseases by priming the expression of several plant defense related genes which enables Trichoderma- treated plants to be more resistant to subsequent pathogen infection. Root colonization by *Trichoderma* strains results in massive changes in plant metabolism leading to accumulation of antimicrobial compounds in the whole plant. Recent studies demonstrate that *Trichoderma* can ameliorate also plant performance in the presence of various abiotic stresses such as drought, salinity and heavy metals. Understanding the molecular basis of the diverse modes of action of these versatile beneficial fungi is a central goal of our research.

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Use of functional genomics to study the response of rice to biotic and abiotic stress

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Rice *Oryza sativa* is one of the most important food crops in the world. In order to fulfill the demand for rice, production needs to be increased dramatically from its current level. Rice lines, which are more resistant to biotic and abiotic stress, play an important role in increasing the productivity of rice. This study used functional genomics to link nitrogen input to specific transcription factors (TFs) which play important roles in the induced defense response of plants. Two rice cultivars with different levels of tolerance to brown planthopper (BPH; TN1, susceptible; IR70 resistant) were grown under four different nitrogen regimes and a range of physiological parameters were measured. The most significant difference was seen in shoot height at the lowest nitrogen input, with average shoot heights of 27.9 cm and 40 cm for IR70 and TN1, respectively. Similarly, at the lowest level of nitrogen input, there were fewer leaves on the susceptible line (six and seven respectively for TN1 and IR70). As expected, plants grown on the highest nitrogen level produced the highest number of tillers (with an average of six tillers/plant) in both the rice lines. Differentially expressed genes were verified by using q-PCR. q-PCR was carried out on a selected set of TFs known to be involved in response of rice to BPH to investigate whether these same TFs are also involved in nitrogen stress. Out of the 12 TFs investigated, nine TFs were significantly up-regulated in IR70 and eight were up-regulated in TN1 in response to increased nitrogen levels. There were seven TFs which were up-regulated in both the resistant and susceptible line. Currently, the 12TFs were also investigated on the both abiotic (nitrogen) and biotic (brown planthopper) stress.

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