INSUSFAR: Using spectrometry for the evaluation of the reaction of diverse wheat populations to spatial heterogeneity

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Climate change is expected to impact agro-ecosystems significantly with respect to changing biotic and abiotic factors affecting yield stability. In addition, future farming systems will have to compensate for lower fossil fuel, fertilizer and pesticide inputs in order to lower agriculture's contribution to climate change. This could be achieved by highly self-regulatory plant systems (Østergård et al. 2009). A key element for this high level of self-regulation is crop diversity (Howden et al. 2007). As part of the INSUSFAR project, line varieties and composite cross populations (Döring et al. 2015) of wheat (*Triticum aestivum* L.) will be tested regarding their mean yield, yield variability, static yield stability (Lin et al. 1986, Becker and Léon 1988) and their implications for yield reliability (Eskridge 1990, Evans 1993) in several environments across Germany with large inter- and intra-site heterogeneity.

On-farm experiments are being conducted on eight German farms with different input strategies and tillage systems. On each of the farms, novel composite cross populations and reference line varieties are being cultivated on plots with large spatial heterogeneity. In order to reproduce yield and variance dynamics *in situ*, non-destructive spectrometry will be used in conjunction with GPS equipment. Several measurements will be performed during each growing season. Based on these measurements, the REIP (Red Edge Inflection Point) indicator (Guyot et al. 1988) will allow an assessment of yield variability and thus, yield stability and reliability across the growing season.

At the time of writing, three preliminary experiments employing different experimental designs had been carried out on TUM experimental sites in order to judge the practicability of hand-held spectrometers for the *in situ* assessment of yield parameters. So far, results from a low-input site show a high correlation between REIP and biomass (r=0.78-0.91) and medium correlation between REIP and grain yield (r=0.51), indicating the feasibility of the method. REIP measurements reproduced yield mean and variance rankings.

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