RESUMÉ

The experimental material for most of this study was a long-term fertilization and irrigation experiment at the University of Pretoria. The trial provided a good opportunity for studying the performance of different wheat genotypes, over a wide range of soil fertility situations on the same sit. The main objective was to determine the potential ability of wheat genotypes to produce yield and quality under varying soil fertility situations. The interactive effects between photoperiod, temperature and vernalization on grain yield, field components and grain protein content were also quantified in growth chambers.

Deliberate selection of genotypes for nutrient use efficiency is desirable if crop yields are to be maintained. To this regard, I evaluated four South African wheat genotypes for their ability to produce higher yield and desirable grain quality with varying soil nutrient status. The most significant conclusions from this study can be summarized as follows:

1. The interactions observed with respect to grain yield, yield components and grain protein content were largely due to differences between the four wheat cultivars in the K and P limiting soil situations, indicating that wheat cultivars differ in their potential to utilize limited nutrients to produce yield and quality.

2. Grain yield is largely contributed to by main stems and first tillers, and especially the first and second kernels in the spikelet.

3. Late-maturing tillers had the same or higher protein content than the main stem, and in general increased wheat grain protein content.

4. Loaf volume quality was strongly associated with grain protein content level and was significantly reduced in less favourable soil fertility situations.

5. Increasing soil fertility largely increased ear: vegetative dry-mass ratio and hence, harvest index and grain yield potential.

6. Increasing soil fertility increased leaf area index, aboveground biomass accumulation and hence improved grain yield potential.

7. The growth and development pattern was largely influenced by photoperiod-temperatures effects compared to vernalization, indicating that breeding and selection should continue placing emphasis on wheat regional adaptability to specific growing environmental conditions and soil fertility situations.

8. The above results may have implications with regard to wheat breeding and selection objectives, in addition to crop modelling, agronomic applicability and management strategies in different production regions.