NITROGEN FERTILIZATION AND ITS INTERACTION WITH LEAF DISEASES AND FUNGICIDE USE STRATEGIES IN WHEAT

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I. INTRODUCTION

Wheat (Triticum aestivum L.) is one of the most important crops grown in SW Uruguay. Formerly focused to the domestic market, presently due to agriculture intensification wheat is been sown in around 600,000 hectares with a production over 2 million tons and exportable surplus. Thereby is an important component of crop rotations providing protection from soil erosion in winter and playing an important role in the carbon budget. Soybean-wheat have come to dominate the cultivated area over the past 10 years giving good return in normal years.

Climate frequently affects wheat yield and grain quality however, directly through effects on crop growth or indirectly through the development of fungal diseases. Wheat major foliar diseases are leaf spots (Septoria tritici or Pyrenophora tritici-repentis) and leaf rust (puccinia triticina).

Crop nutrition may affect susceptibility to pests particularly due to changes in chemical composition of plants. High N fertilization is essential to maximize cereal yield in intensive crop rotations but may increase susceptibility to some fungi attack.

OBJECTIVE

The aim of this study was to better understand the relationship between N availability and prevailing foliar fungal diseases to improve the wheat crop management, reduce grain yield variability, maintain grain quality and increase N use efficiency (NUE).

II. MATERIALS & METHODS

Data used were from experiments conducted from 2001 to 2010 at La Estanzuela Experimental Station (34° 20' 0" S, 57° 43' 0" W) to explore the interaction between Nitrogen (N) availability and chemicals applications used in the control of fungal diseases, in new and commercial wheat varieties, to asses whether or not different technological packages for individual cultivars (cvs) were justified.

Treatments consisted in a factorial combination of N levels, recommended fungicide (F) applications and wheat cvs. Diseases were measured twice after flowering. Grain yield and components were determined at harvest.

Fungicide treatments:

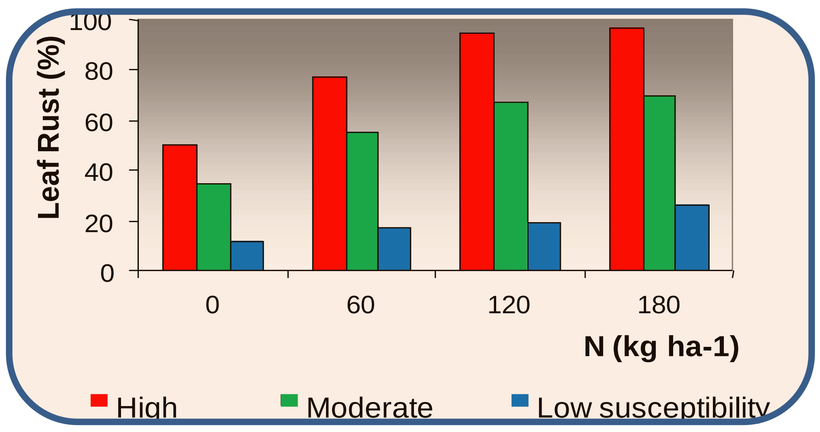
1) No fungicide protection
2) Preventive applications of fungicides through out the growing season , from Zadoks (Z) -3.2 or earlier (3 or 4)
3) Strategic fungicide application based on disease threshold, wheat cvs susceptibility and weather (0 - 2)

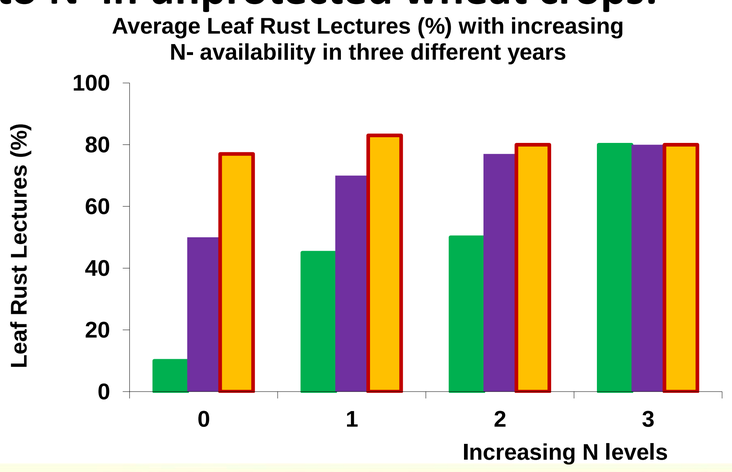
Nitrogen levels: 0-60-120-180 kg ha^{-1} (as urea) ½ at Z-2.2 and ½ at Z-3.0

III: RESULTS & DISCUSSION

Fungicide and N treatments always affected wheat grain yield being significant the interaction of those variables. Diseases decreased grain yield and thus NUE. The negative effect varied depending on the pathogen, growth stage at onset of the infection and severity. Although leaf spots and rust were present in almost all years their prevalence varied between experimental sites and cultivars . Foliar diseases caused by biotrophic fungi increased with increasing N availability while those caused by necrotrophic pathogen (leaf spots) were unaffected by N.

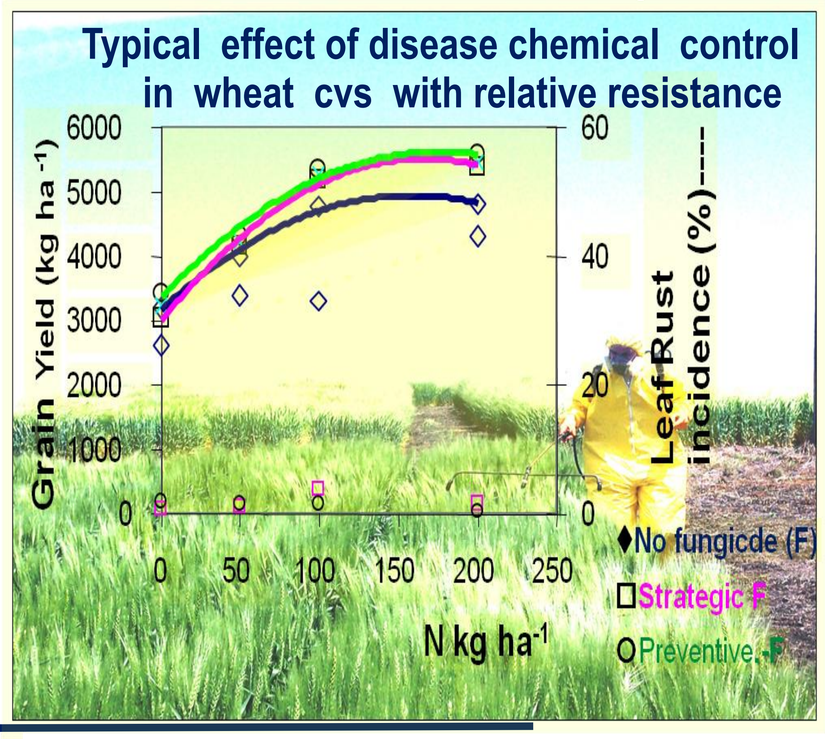
Typical leaf rust responses (% of infection) to N in unprotected wheat crops:





Preventive fungicide applications were justified with high susceptible wheat cultivars and high N levels. Strategic fungicide use was as effective as the former control treatment when leaf rust prevailed over other diseases, less susceptible wheat and/or lower N rates, reducing production and environmental costs.

Higher grain yield with crop protection was related to higher grains/head (particularly with leaf spots) or heavier grains (particularly with rust infection) .



VI. CONCLUSIONS

Wheat N-fertilization and fungicide use should be managed as a whole due to their significant interaction. Cultivars-specific management may improve input efficiency , reduce production risk and strengthen the sustainability of cropping systems.