AGRO ENVIRON 2006

Fifth International Symposium on the Agricultural Environment

Agricultural constraints within the soil-plant-atmosphere continuum

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AGRO ENVIRON 2006

From 4 to 7 September 2006, Professor Donald Gabriels, Professor Stefaan De Neve and Dr. Joke Van De Steene of the Department of Soil Management and Soil Care organized the Fifth Symposium Agro Environ.

The Symposium was held at the Faculty of Bio-Engineering Science, Ghent University.

The Symposium entitled 'Agricultural constraints in the Soil-Plant-Atmosphere Continuum' covered a range of topics addressing key environmental agricultural and horticultural issues. The emphasis was put on applying new technologies that aim at sustaining agricultural systems, monitoring the environment and conserving natural resources.

The keynote presentation 'Environmental concerns and policies in EU agriculture: notes on expected and actual results', was given by Professor Giuseppe Zerbi from Udine University, Italy.

The sessions included in the Symposium were: (i) desertification and land degradation in agricultural ecosystems, (ii) contamination of the soil-water-atmosphere continuum in agricultural areas, (iii) waste treatment for agricultural soil amendment, (iv)role of conservation agriculture for sustainable farming and (v) biotechnology trends in agriculture and horticulture.

The Symposium Agro Environ 2006 brought together 96 scientists from 18 different countries. During the Symposium 49 oral presentations and 22 poster presentations were given.

Distribution of precipitation quality during the growing period of winter wheat

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Introduction

Pollutants in air and water are significant problems for air and water continuously move from one place to another one in the earth ecosystem. Their types and intensity can change during the short and long transportation because of the increasing fuel consumption in the world. Furthermore, water quality is affected by rainwater quality, which is important for crops as well as for the soil chemistry. Thus, the precipitation chemistry varies temporally and spatially.

Phenology for plants refers to the timing of their development stages such as sowing, emergence and flowering etc. The sensitivity of plants depending on their development stages is different even for small variations in environmental conditions. The resistance of the plants for the atmospheric conditions varies during these stages. Changes in air and precipitation quality affect on agricultural crops depending on their phenological stages. In general, most of the crops may be negatively affected during germination. Additionally, dry and wet acidic deposition on the plants can damage the leaves and make them vulnerable to diseases. Its cumulative impact can cause the plant to be very weak and unable to survive under extreme atmospheric conditions. Additionally, plant germination and reproduction are also inhibited by the effects of acid precipitation. There are number of studies on the effects of acid rain on plants that have been carried out using ecological and physiological approaches (Heck et al., 1986; Likens and Bormann 1995; Jain et al., 2000; Toros, 2000).

The aim of this study was to analyze the distribution of precipitation quality by considering the phenological stages of winter wheat during two growing seasons in 2000-2001 and 2001-2002.

Study area and measurements

Measurements on the rainwater chemistry were carried out in Tekirdağ city, which is located in the northwestern part of Turkey (Thrace). Approximately 15 % of Turkey's total wheat production comes from Thrace (Süzer, 2004).

A rainwater collector was installed to collect the samples sequentially in every 10-min. interval. Detailed information on the measurement system can be found in Şaylan et al. (2003). The rainwater samples were collected sequentially from November 2000 to December 2002 and main ions (Ca^{2+}, Na^+, Mg^{2+}, K^+, NH_4^+, SO_4^{-2}, NO_3^-, Cl^-,) were analysed together with EC and pH. A Varian Model 2010 ion chromatography, flame atomic absorption spectrometry and spectrophotometry were used to analyze those ions.

Results

In this study, the results of main ions analyses were compared with the development stages of winter wheat for two growing seasons. The average pH was 6.09 and 6.22 for the first and second growing seasons, respectively.

As seen in Figure 1, daily mean pH was generally above the threshold of the acidic rain (pH=5.6). Most of the collected rainwater samples were basic in both growing periods. In contrast, pH in the first period was lower than 5.6 throughout the tillering period. 7 samples were obtained as acidic during that development stage. The pH value was near 5.6 during 3 leaves stage in the tillering phase of the first growing season. From the 3 leaves stage until the harvest stage in that period, the precipitation was observed as being generally basic. Few numbers of acidic precipitations were appeared between the harvest and sowing of winter wheat in the second season. After the sowing and emergence in the second period, some acidic rainwater felt on the crop before the leave development. Only 3 samples were acidic along the second growing season. Generally, it can be said that the acidic precipitations occurred in January and February in the first period and in November and December in the second period. Minimum pH values appeared at Tekirdağ in the vegetative phase of the winter wheat when the crop was in the young phase.

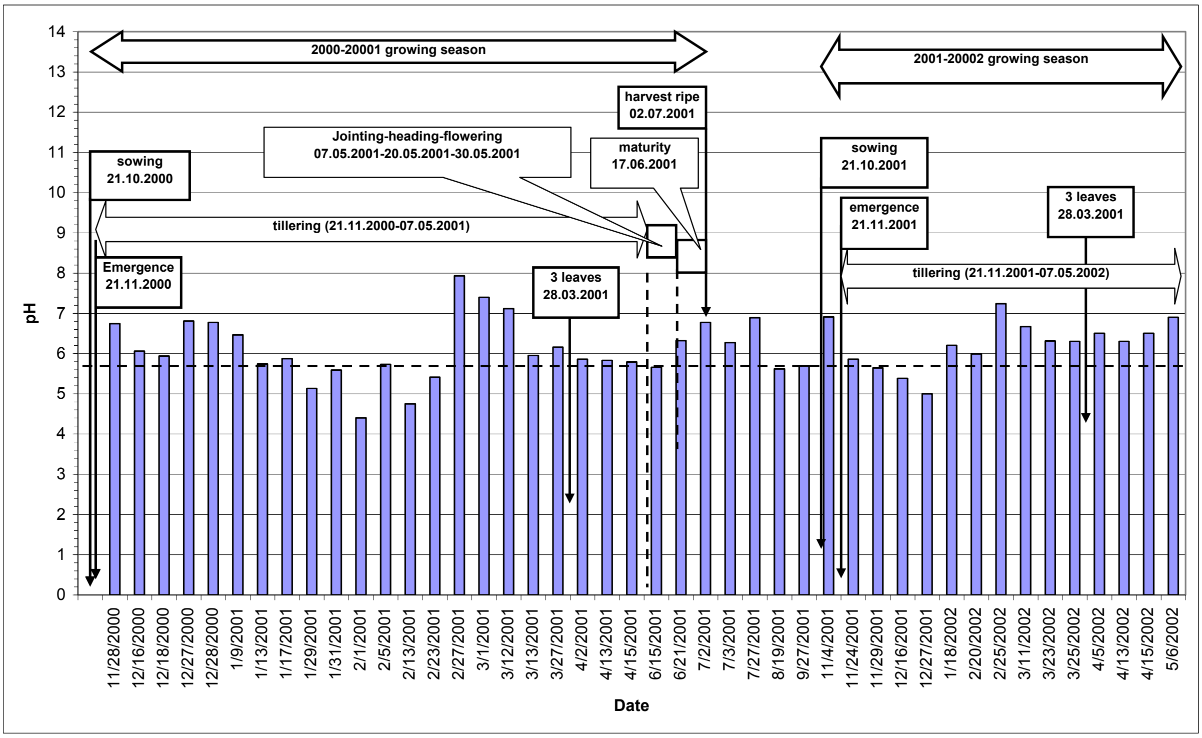

Fig. 1. Variation of mean pH concentration for rainwater samples during the two growth seasons of winter wheat.

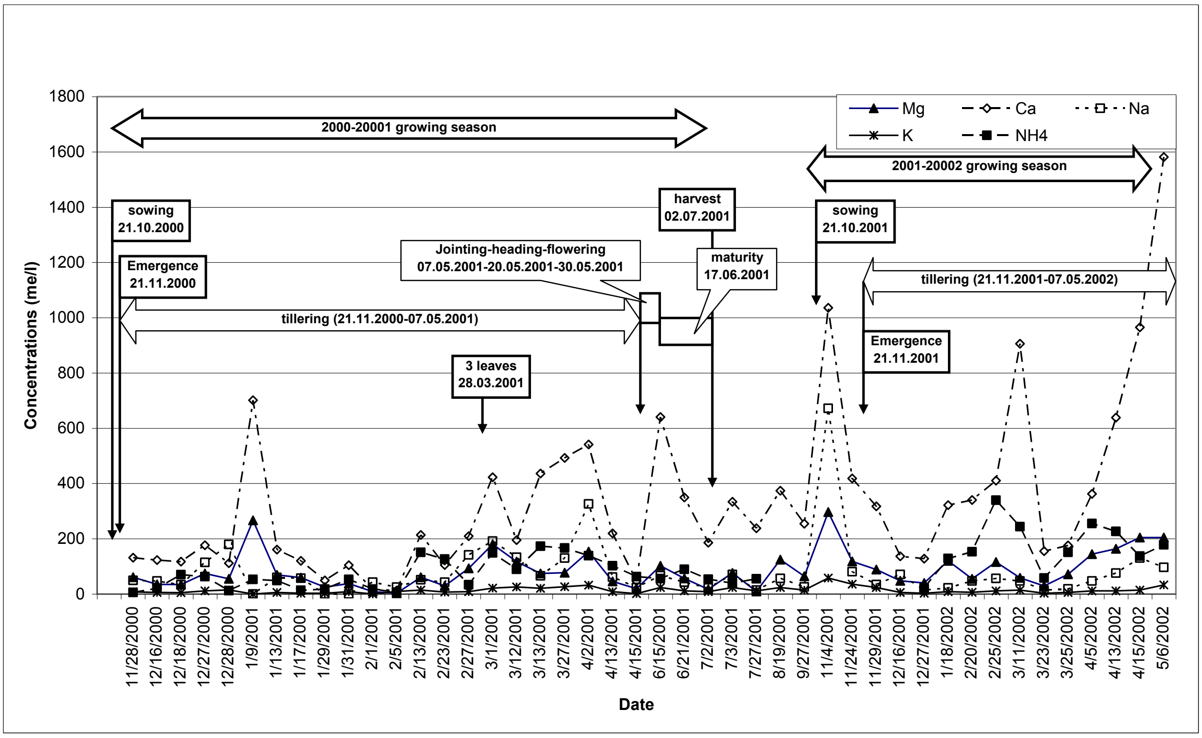

Fig. 2. Variation of mean cation concentrations for rainwater samples during the two growth seasons of winter wheat.

As seen in Figure 2, all cation concentrations are under 200 μel/l between sowing and 3 leaves stages (except Ca concentration). Ca amounts increased just before the beginning of the 3 leaves stage and it was usually above 200 μel/l from 3 leaves until harvest. Average concentration was 235.4 μel/l in the first season. After the harvest of the first growing season, Ca concentration did not decrease until the second period sowing. Just after sowing in the second period, Ca concentration exceeded 1000 μel/l. After the emergence stage, Ca concentration showed once again low values for a few days. Then it has shown increment again until the harvest of second period. In the second season, the average Ca concentration was 2 times higher than that of the first season. For the cations during the first season, an increasing trend can be seen in Figure 2, which occurred in the 3 leaves stage (February, March and April). During the second part of April the cation concentrations decreased under 100 μel/l except Ca. In addition to these, NH_4 concentration was high in February, March and April for the second season. All cation concentrations increased sharply in the last phenological stages (March, April and May) during the second growing period of winter wheat. Especially during the late growing stages, few samples could be collected because of insufficient precipitation amounts for the analyses.

Consequently, it can be said that high ion concentrations in rainwater samples decreased after the washout of the atmosphere (Şaylan et al., 2003). The pH values varied around 6, while the concentrations of major ions were also very high. Although high ion concentrations were observed, high pH may be resulted from the neutralization due to the soil type, which is enriched by $CaCO_3$. These results are consistent with the results of Toros (2000).

Conclusion

In this study, the distribution of precipitation chemistry throughout the development stages of winter wheat has been investigated during two growing seasons. After the analysis, it has been estimated that SO_4^{2-} and Ca^{2+} ions were dominant in Tekirdağ. According to the results, acidic precipitation appeared for a few days and high ion concentration occurred between the tillering and harvest stages of winter wheat. These high values and their variations could cause direct and indirect impacts on winter wheat. One possible direct influence of the acidic precipitation on winter wheat can be changes in the mineral uptake and damages in the tissues. Its indirect impact could result in changes of the mineral nutrient availability in the soil. Generally, crops can be negatively affected by acidic deposition especially in the germination process. For future studies, it can be recommended that analyzes on wheat quality and soil chemistry together with the precipitation chemistry have to be investigated in the field and laboratory.

Acknowledgements

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