DIFFERENCES IN THE COURSE OF AIR TEMPERATURE BETWEEN THE WHEAT CANOPY GROUND AND STANDARD CLIMATOLOGICAL STATION

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Abstract: The temperature in the ground of wheat canopy was compared with those measured on standard climatological station by regression analysis. Measurements in the wheat stand were carried out on two localities – Žabčice (site Obora and Písky) and Branišovice from year 2015. The course of temperature in the wheat stand ground differed meaningly, the length of particular winter wheat vegetation stages was different, too. The regression equations reveal the differences of standard environment and the ground of wheat canopy. These differences were dependent on the growth stage of winter wheat and experimental site. These differences can be caused by different conditions of experimental localities on results.

Key Words: temperature, wheat canopy

INTRODUCTION

Data concerning weather course are used for modelling of crop yield and prediction of pests and pathogens occurrence in many models. They are measured and collected from standard climatological station in 2 meters above grass cover in the Czech Republic, usually. Specific microclimate of field crops canopy can be different in comparison with surrounding environment. Vertical distribution of air temperature and humidity are fluctuating and there are differences in these data recorded in canopy (Krédl et al. 2012). In our previous work we focused also on differences between soil temperatures under wheat canopy and standard grass cover (Krčmářová et al. 2013a) and modelling of soil temperatures in different depth from the course of air temperature on the ground of wheat canopy (Krčmářová et al. 2013b). The comparison of the course air temperature in the wheat canopy ground with the data from standard climatological station is presented in this contribution.

MATERIAL AND METHODS

The microclimate data were obtained from two sites in Žabčice localities (GPS 49°1'18.656"N, 16°36'56.150"E) – Obora and Písky. The third site was located in Branišovice (GPS 48°96'28.106"N, 16°43'18.469"E).

Data recording for wheat was conducted by means of a mobile meteo station equipped with digital temperature sensors (Dallas semiconductor, DS18B20 type). The spring vegetation period of wheat was divided into three stages: I. BBCH 23–32 (tillering to beginning of stem elongation), II. BBCH 33–69 (stem elongation to the end of flowering) and III. BBCH 70–89 (development of fruit and ripening). The data from standard climatological station in Pohořelice were obtained from the Czech Hydrometeorological Institute. The distance between this station and Žabčice and Branišovice is 7 km, approximately. The values of air temperature were collected in 15 minute interval, for statistical processing the data were adjusted into hourly unit intervals by arithmetic average. The linear regression analysis was carried out to evaluate interrelationships between air temperatures measured in the ground of wheat canopy and climatological station in Pohořelice.

RESULTS AND DISCUSSION

As can be seen from Figures 1 and 2 the course of temperature in wheat stand ground differed meaningly, both during the light part of day (from 6 a.m. to 6 p.m.) and night (from 6 a.m. to 6 p.m.), especially between the two sites in Žabčice locality and Branišovice. In comparison of localities, the highest temperatures we usually measured in Branišovice during the light part of the day, on the other hand in the highest temperatures were determined in Žabčice and Písky. The length of particular winter wheat vegetation stages was different, too (Figure 1).

Figure 1 The course of air temperature during the light part of the day and during the vegetation periods in locality Žabčice (sites Obora a Písky) and locality Branišovice in year 2015.

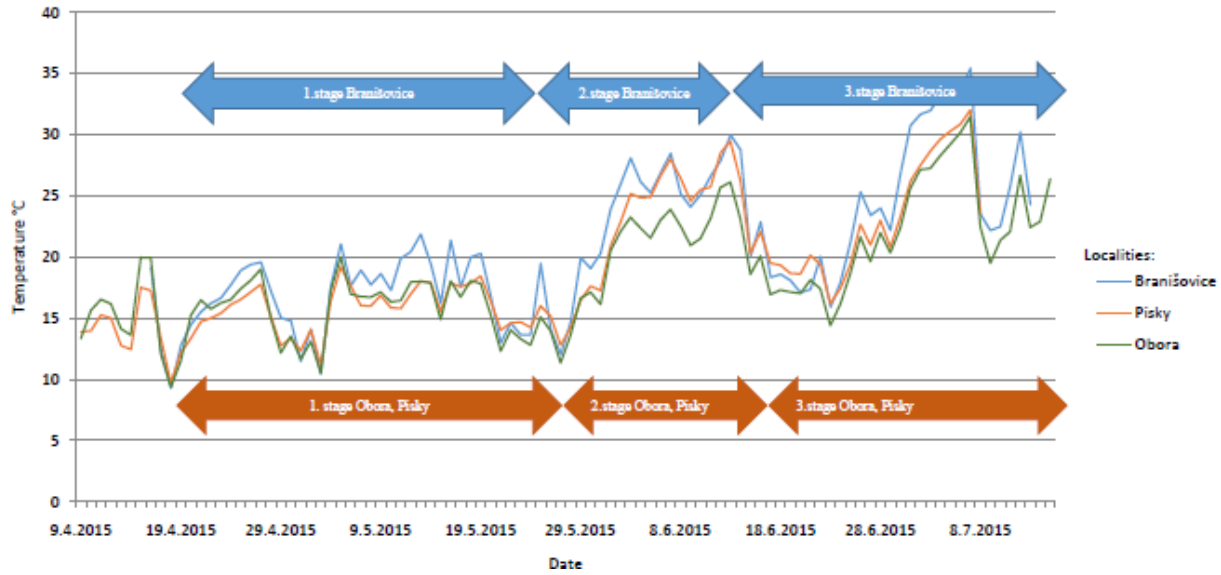
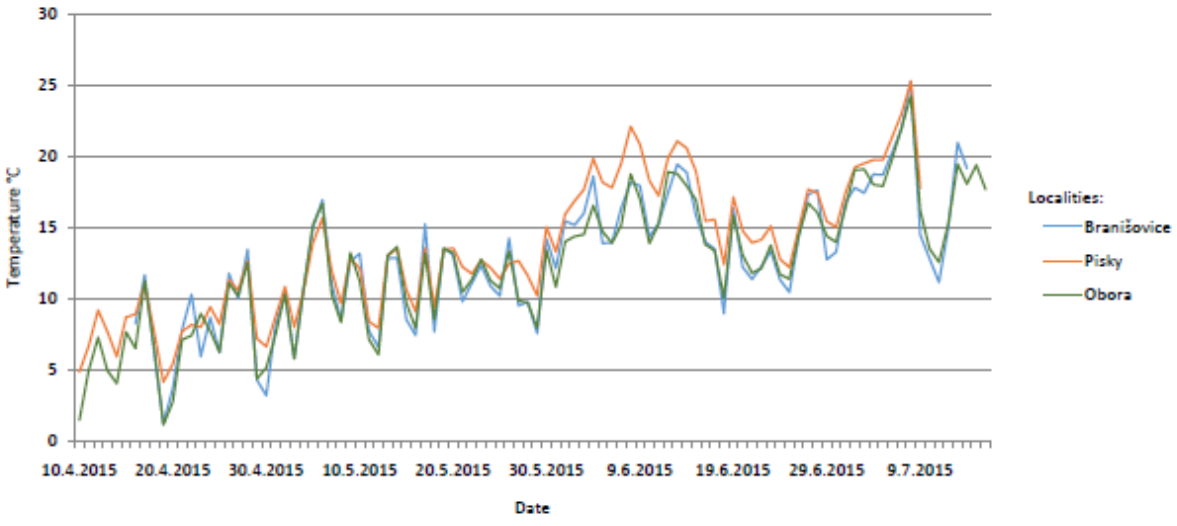


Figure 2 The course of air temperature during night in locality Žabčice (sites Obora a Písky) and locality Branišovice.



The individual regression equations between course of air temperatures in the ground of winter wheat canopy in particular experimental sites and standard climatological station in Pohořelice and coefficient of determination are given in Table 1.

The regression equations revealed the differences of standard environment and the ground of wheat canopy. These differences were dependent on the growth stage of winter wheat and experimental site. In the first stage for model temperature 20°C in Pohořelice station the computed temperatures were 18.9; 17.1 and 17.4°C for Obora and Písky (Žabčice) and Branišovice

sites, respectively. In the stage II for the same model temperature computed temperatures were 18.2; 19.3 and 19.8°C and in the stage III 19.8; 21.1 and 22.6°C.

Table 1 Regression equations between course of air temperatures in the ground of winter wheat canopy in particular experimental sites and standard climatological station in Pohořelice and coefficient of determination

Locality	Obora	Písky	Branišovice
I. stage	y = 0.9404x + 0.0609 $R^2 = 0.9292$	y = 0.6917x + 3.3078 $R^2 = 0.9089$	y = 1.0981x – 1.4021 $R^2 = 0.8973$
II.stage	y =0.8226x + 1.7177 $R^2 = 0.9285$	y = 0.8354x + 2.6141 $R^2 = 0.8491$	y = 1.1387x – 2.2357 $R^2 = 0.9048$
III.stage	y = 0.8889x + 2.0075 $R^2 = 0.9242$	y = 0.8708x + 3.6374 $R^2 = 0.9224$	y = 1.2422x – 3.503 $R^2 = 0.9031$

The microclimate of winter wheat canopy was studied by several authors. Franzaring et al. (2010) found out increasing of temperature in wheat stand in the height 0.3m above the ground by 0.7°C in average. On the other hand, in experiments carried out by Kimbal et al. (1995) the temperature in wheat canopy was by 0.3°C lower in comparison with surrounding environment. These differences can be caused by different conditions of experimental localities. Whereas former authors held their observation in humid climate of central Europe, latter experiments were situated in arid area of Arizona, USA. As can be seen from our results from warm and arid region of the Czech Republic, these differences were more pronounced in the winter wheat developmental stages from tillering to end of flowering and were by 0.2 to 2.9°C lower. In the stage of ripening the temperature was almost the same as in the surrounding environment in Žabčice and Obora, but by 1.1 or 2.9°C higher in sites Písky and Branišovice.

CONCLUSION

The course of temperatures in the crop stand can be different from the surrounding environment. In our experiments we proved the temperature in the ground of wheat canopy is different comparison with standard climatological station in dependence with winter wheat developmental stage and experimental site. This should be taken in consideration in modelling of plant pathogen infection, especially if the developed on soil surface.

ACKNOWLEDGEMENT

This article was written at Mendel University in Brno as a part of the project IGA AF MENDELU no. TP 7/2015 with the support of the Specific University Research Grant, provided by the Ministry of Education, Youth and Sports of the Czech Republic in the year of 2015.

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