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WINTER WHEAT CROP IN THE AREA POLLUTED BY BITUMINOUS MASS FACTORIES

ZDZISŁAW PRZYBYLSKI

INSTITUTE OF PLANT PROTECTION IN POZNAŃ, FIELD EXPERIMENTAL STATION, LANGIEWICZA 28, 35-101 RZESZÓW, POLAND

Abstract. The research on the influence of pollution emitted by the WBM-30 bituminous mass factories on the winter wheat-crop was carried out in 1981. The factory was situated in the agricultural area far from the farm buildings in the village of Trzebownisko. The experimental area was divided into four zones (three zones of pollution and one control zone). The wheat ear samples were collected during full grain ripeness per 100 ears from different plantations in three repetitions in each zone.
They showed that all examined features, such as, e.g. the average ear length and 1000 grain mass were substantially different between the 1st pollution zone and control zone.

Key words: bituminous mass factories, pollution, winter wheat-crop

I. INTRODUCTION

Bituminous mass factories have been the common element of rural countryside in Poland for many years. They belong to small companies and are situated in agricultural areas far from farm buildings often by streams or forests. Their output is from 30 to 100 tons of bituminous mass per (one) hour (WMB-30, WMB-60 and WMB-100). For this reason their emissions are not noticed by villagers, the more so as they are not carried further by wind. Therefore, it is difficult to find in our publications papers on the effect of this type of pollution on agrocenosis. The main elements of emitted pollution by bituminous mass factories are sulfur oxides and dust made during technological processes which contains about 50% of SiO_2. Due to its physical property it damages the leaf surface when covering it, thus creating perfect conditions for tissue infection by pathogens. Other elements emitted by WMB are N_2O_3, SO_2, CO and polycyclic aromatic hydrocarbons (PAH). Especially the last one mentioned, covering the cultivated plants, creates danger for human and animal health when they are meant for food. The research carried out in the 1980s by the Technical Service Group of Main Technical Organization in Rzeszów on the emitted compounds by WMB proved that the highest allowed levels of SO_2 and dust emissions were exceeded many times. However, the nitrogen oxide contents were not stated as well as the emitted compounds PAH were not controlled, although it is known that they are made when burning diesel fuel and heating asphalt.

II. AREA AND METHODS

One year research on the effect of pollution emissions of bituminous mass factory on winter wheat-crop was carried out in 1981. The bituminous mass factory was situated by

the bank of the river Wisłok among the cultivated fields not far from the village of Trzebownisko near Rzeszów. It was a small factory of the output of 30 tons of bituminous mass in one hour. Winter wheat variety Grana, which was commonly cultivated in this particular village, was designated for the research purpose.

The area of research was divided into four pollution zones (4 plantations) in the south-east from the factory. The first zone was 249 meters from the factory, the second zone from 250-449 meters, the third one from 500-999 meters, and the fourth one from 1,000-2,000 meters from the factory.

During the full wheat ripeness, 100 ears were collected in three repetitions from each mentioned zone. The collected samples were transported to the Experimental Station where they were analyzed according to the following features: the average ear length, the average ear mass with grain, the average grain mass from 100 ears and the average mass of 1,000 grains.

The examination on the average mass of 1,000 grains was conducted by the Regional Seed Inspection Inspectorate in Rzeszów. The obtained results were statistically calculated using the Duncan method.

III. RESULTS

The obtained results are shown in tables 1-4. The conducted statistical calculations show that the average ear length, the average ear mass with grain and the average grain mass from 100 ears collected form the control zone and the first and third zone of pollution differed significantly from the first zone of pollution. The exception was the average mass of 1,000 wheat grains where the significant difference from the first zone was noticed only in the control zone.

The average decrease in the mass of 1,000 grains of winter wheat compared with the control zone was about 20.7%.

A similar phenomenon was also observed in the case of the average ear mass with grain where the decrease was even greater (29.6%). This is evidently due to the decrease in

Table 1

The average winter wheat ear in cm in individual experimental zones (pollution zones)

Distance from WMB in m (zones)	Ear length in cm
0-249 (1st zone)	6.4
250-499 (2nd zone)	6.6*
500-999 (3rd zone)	7.0*
1,000-2,000 (control)	7.3*
LSD at P = 0.05	0.1469

*significant differences

Table 2

The average winter wheat ear mass with grain (in g) in individual experimental zones (pollution zones)

Distance from WMB in m (zones)	Ear mass in g
0-249 (1st zone)	152.0
250-499 (2nd zone)	182.0*
500-999 (3rd zone)	190.0*
1,000-2,000 (control)	205.0*
LSD at P = 0.05	2.943

*significant differences

Table 3

The average winter wheat grain mass from 100 ears (in g) in individual experimental zones (pollution zones)

Distance from WMB in m (zones)	Grain mass in g
0-249 (1st zone)	123.0
250-499 (2nd zone)	143.0*
500-999 (3rd zone)	149.0*
1,000-2,000 (control)	159.0*
LSD at P = 0.05	13.77

*significant differences

Table 4

The average mass of 1,000 winter wheat grains (in g) in individual experimental zones (pollution zones)

Distance from WMB in m (zones)	Mass of 1,000 grains in g
0-249 (1st zone)	39.6
250-499 (2nd zone)	39.3
500-999 (3rd zone)	39.4
1,000-2,000 (control)	47.8*
LSD at P=0.05	11.45

*significant differences

the average ear length in the first zone of pollution. This fact affects the wheat crop obtained near the bituminous mass factory. According to the National Agricultural Crop Inspection the average winter wheat crop in the year of the research was 27.1 q/ha.

The estimated calculations showed that the obtained crop in the first zone of pollution was lower by about 7.9 q/ha compared with the control zone. However, in comparison to the regions highly polluted by the emissions from big factories the decrease in crop was significantly lower (Przybylski 1980).

IV. CONCLUSION

1. The research conducted statistically showed a significant negative effect on winter wheat-crop caused by pollution emitted by bituminous mass factory, which is limited to a small area in the distance of 250 meters from the factory. This is due to low emission sources as well as high humidity of the emitted dust.
2. The decrease in the wheat-crop is mainly related to the great deal of dust emission, hindering plant assimilation, as well as to the enlarged contents of sulfur dioxide.
3. The effectiveness of dust collectors is very high and reaches about 99.8% (Berżowski 1979) when they are installed on the emission sources WMB. However, one should expect the contamination of natural environment by SO_2 and PAH related to the emission from hot asphalt and diesel oil burning.

V. LITERATURE

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Zdzisław Przybylski

PLONOWANIE PSZENICY OZIMEJ W STREFIE ZANIECZYSZCZONEJ PRZEZ EMISJĘ Z WYTWÓRNI MAS BITUMICZNYCH

STRESZCZENIE

Wytwórnie mas bitumicznych zlokalizowane są na obszarach rolniczych z dala od zabudowań wiejskich. Ich wydajność masy bitumicznej wynosi od 30 do 100 ton w ciągu jednej godziny. Badania nad wpływem emitowanych zanieczyszczeń na plonowanie pszenicy ozimej przeprowadzono w 1981 roku. Zakład o wydajności około 30 ton zlokalizowany był w pobliżu miejscowości Trzebownisko. Teren badań podzielono na 4 obiekty, 3 obiekty w strefie zanieczyszczonej oraz obiekt kontrolny. Próby kłosów pszenicy ozimej pobierano po 100 kłosów w trzech powtórzeniach w każdym obiekcie doświadczalnym, w czasie pełnej dojrzałości ziarna.

Otrzymane wyniki badań w zakresie plonowania tego zboża, opracowano statystycznie.

Wszystkie badane cechy różniły się istotnie pomiędzy obiektem kontrolnym a I strefą zanieczyszczeń.