THE IMPACT OF WHEAT VARIETIES AND FUNGICIDE APPLICATION, DURING WHEAT CULTIVATION, ON *PLEUROTUS* GROWTH ON STRAW

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ABSTRACT

Several wheat varieties are grown in Israel according to their different features. Fungicides for plant protection are applied when rust disease is expected.
Wheat straw was taken from an experiment plot that studied the impact of the fungicide Cyproconazole on the performance of 15 wheat varieties. The impact of fungicide application to the wheat, on *Pleurotus* growth on the straw was found to be variety dependent. Significant differences were found between fungal growth on straw of different varieties.
Fungal mycelium growth was harmed on straw from fungicide treated plots, of 7 wheat varieties. Mushroom yields were higher on straw from untreated plots, of the 2 tested varieties. Therefore wheat straw suitability for mushroom cultivation is not obvious. Quality control of wheat for mushroom production should include: The impact of wheat variety and fungicide treatments during wheat cultivation.

Keywords: Fungicides, Wheat varieties, Mushrooms, Straw.

INTRODUCTION

Fungicides are frequently applied during wheat cultivation mainly when rust disease is expected, to prevent damage the wheat crop.
Since wheat straw is widely used as *Pleurotus* substrate, it was important to study the impact of different varieties and fungicide application on the mushroom cultivation process It was demonstrated, that fungicides and growth regulators, application to wheat can have impact on straw structure [1,2] and retard mushroom mycelium growth [3].The production of *Pleurotus* mushrooms increased, in recent years, and it is now the third among mushroom species in the amounts of world-wide production. This fact is due to their taste, nutritional and medicinal values, and a wide variety of strains compatible for different climate (temperature, relative humidity etc.) conditions. Although, *Pleurorus* mushrooms are cultivated on wide range of lignocellulose substrates, selection of most suitable substrates is essential for good mushroom yields [4]. When wheat straw is used as substrate for *Pleurotus* cultivation, it is recommended to use straw that contains a lot of stems and less leaves (rich in lignin) [5]. Israel, although its small dimensions has a wide range of different climatic regions, with different amounts of annual precipitation. Therefore a wide range of wheat varieties are cultivated by the farmers. These varieties differ in their straw quality and in the use of fungicides during their cultivation. The purpose of the present study was to develop tools for selection of suitable straw source according to wheat variety and cultivation conditions, including the use of fungicides, during wheat cultivation.

MATERIALS AND METHODS

The study included 15 wheat varieties, some were commercial (names) and some were in trial process (numbers) grown in an experimental station in northern Israel. Two treatments were given to each one of them: The systemic fungicide Cyproconazole (Syngenta100mg/l) and untreated control. The fungicide was applied (400ml/hectare) two months after wheat germination. Wheat plots were harvested and grains and straw yields were measured. Straw samples were collected from each plot and were analyzed for pH and humidity, ash and total nitrogen content. For mushroom growth studies straw samples were chopped and their humidity was adjusted to 72% (w/w). For mushroom linear growth, glass Petri dishes were filled with 50 gr. chopped straw each, and pasteurized at 75^0C for 200 min. Plates were inoculated by commercial spawn of *Pleurotus ostreatus* (Mycellia 2140), by 4 grain spawn on the plate center. The plates were incubated at 25^0C and every 3 days colony diameter was measured. The thickness of the colony mycelium was visually observed and recorded on a scale of 1-5 (5=most thick). As a criterium for the strength of mycelium growth on the straw the colony diameter was multiplied by the thickness. The used substrate was analyzed for pH, humidity, ash and total nitrogen content. For fruit bodies production 410 gr. bags of the pasteurized chopped straw (of the wheat strains Bar-nir and Galil) was inoculated by 6% spawn (Mycellia 2140), and incubated. Mushroom yield was harvested and calculated as biological efficiency (BE = fresh mushroom yield to dry substrate).

RESULTS AND DISCUSSION

The effect of wheat varieties and fungicide treatment (during wheat growth) on *Plearotus* mycelium growth on wheat straw was found to be: Wheat variety dependent.

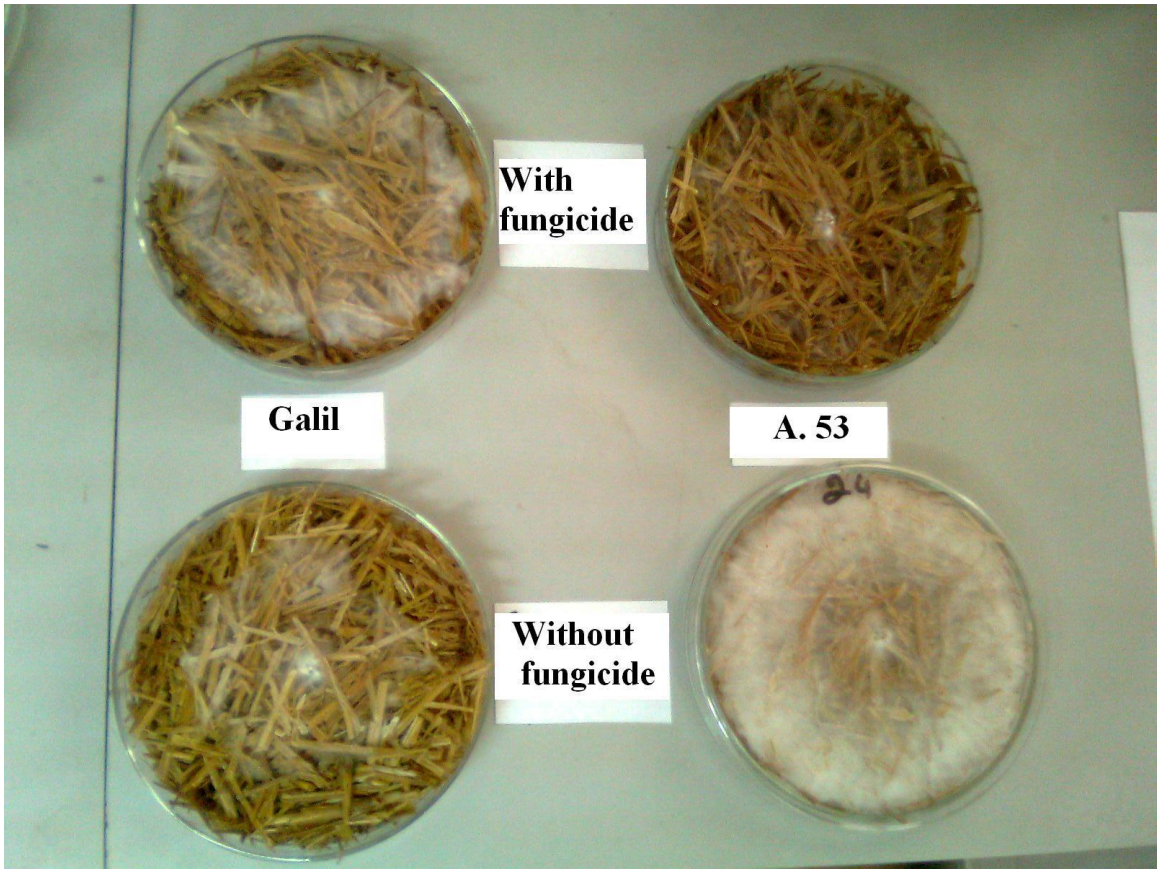

Figure 1: The impact of fungicide treatment on mycelium growth on straw of two wheat varieties

In fig.1 it is shown that fungicide application to wheat, had opposite effect on fungal mycelium growth on straw of two different wheat varieties.

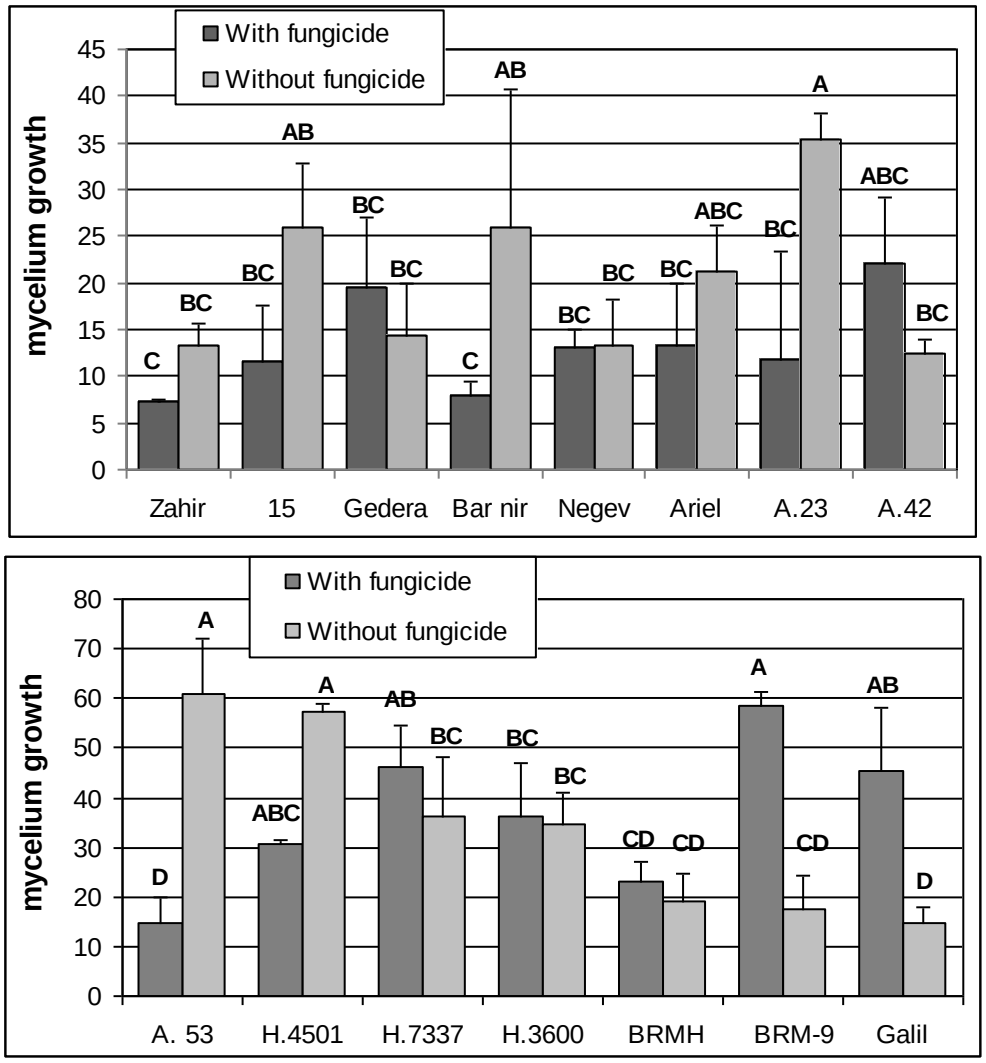

Figure 2: Growth of *Pleurotus* mycelium on straw of 15 wheat varieties

The best mycelium growth was found on straw of the varieties A53 and H4501, untreated with fungicide. For 7 wheat varieties stronger mycelium growth was found, on straw from the untreated (with fungicide) plots.

For 5 varieties stronger mycelium growth was found on wheat from fungicide treated plots. On straw of the other 3 wheat varieties no significant differences were found between the two treatments. Significant differences were found between fungal growths on straw of different varieties.

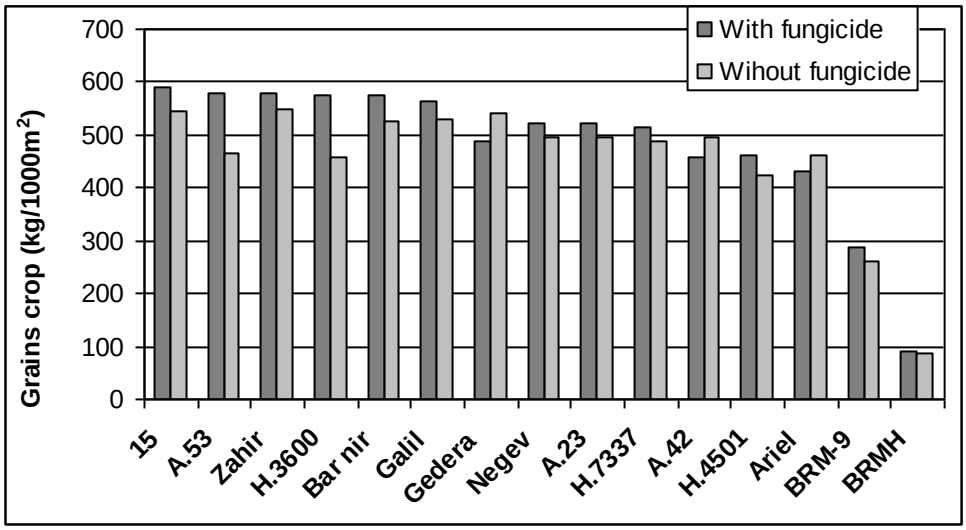

Figure 3: Grain yields of wheat varieties (2010 season)

Wheat grain yields were higher for 9 varieties with the fungicide treatment, while for 6 wheat varieties higher yields were recorded without the fungicide treatment

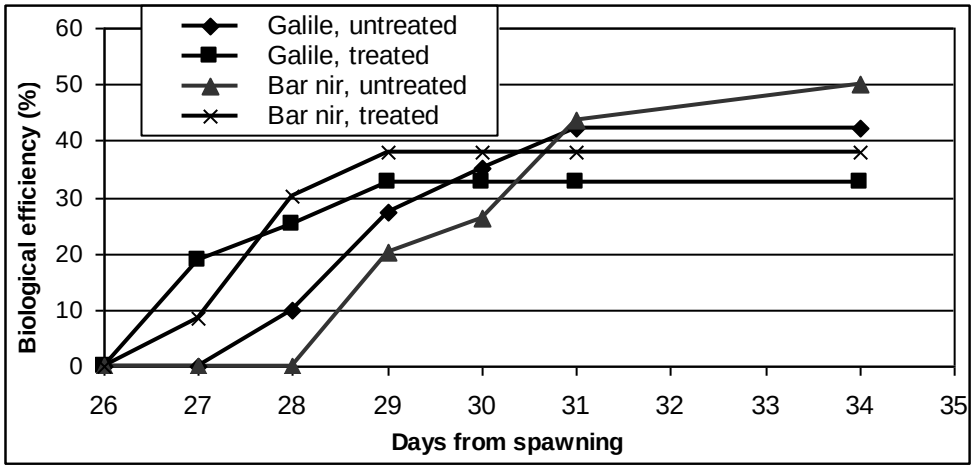

Figure 4: Mushroom yield calculated as Biological Efficiency (BE), on straw of two wheat varieties (Galile and Bar-Nir, treated and untreated with fungicide.

With these two varieties (Galile and Bar Nir), mushroom yield BE, was higher on non sprayed (with fungicide) straw, although the differences were not significant.

Table 1: The effect of *Pleurotus* growth on the composition of wheat straw of Galile and Bar Nir varieties treated and untreated with fungicide.

Treatment	Beginning of experiment			End of experiment		
	pH	Total N (%)	Ash (%)	pH	Total N (%)	Ash (%)
Galile, untreated	5.8	0.81	11.68	4.69±0.05	0.95±0.06	18.80±0.99
Galile, treated	5.66	0.93	15.93	4.97±0.35	0.90±0.03	17.40±0.54
Bar nir, untreated	5.9	1.04	19.61	4.82±0.37	1.15±0.06	21.25±1.34
Bar nir, treated	6.04	0.94	13.64	4.69±0.01	1.01±0.05	24.46±0.75

The differences in chemical composition of the straws, before and after fungal growth, between the fungicide treated and untreated straw of two wheat varieties are presented in table 1. Ash content in the straws increased during fungal growth. The effect of fungicide treatment on ash content was different between the two wheat varieties. Galile straw ash content increased more in the untreated straw. Bar Nir straw ash content increased more in the fungicide treated straw. These results showed that the effect of fungicide treatment on straw quality for mushroom cultivation was variety dependent.

CONCLUSIONS

The interactions between wheat variety and fungicide treatment, during wheat growth can impact straw suitability for mushroom cultivation. Mushroom growth on straw varies according to straw quality. The wheat variety and cultivation conditions are important factors in straw quality. For some wheat varieties, straw suitably as a source for *Pleurotus* substrate could be harmed by fungicide treatments, during wheat growth.

REFERENCES

[1] Savoie J.M., Chalaux N. and Olivier J.M. (1992) Variability in straw quality and mushroom production: Importance of fungicide schedules on chemical composition and potential degradability of wheat straw . Bioresource Technology. 41: 161-166

[2] Savoie J.M., Minvielle N. and Chalaux N. (1994) Estimation of wheat straw quality for edible mushroom production and effects of a growth regulator. Bioresource Technology. 48.:149-153.

[3] Grogan H.M. and Jukes A.A. (2003) Persistence of the fungicides thiabendazole, carbendazim and prochloraz-Mn in mushroom casing soil. Pest Management Science 59: 1225-1231.

[4] Levanon, D. and Danai, O. (2002). Environmental aspects of growing mushrooms.In: Manual for Growing *Pleurotus* . D.J. Royse and J.E.Sanchez, eds. pp259-268 ECOSUR-UTEHA,Mexico.

[5] Levanon, D. and Danai O.(2004) Mushroom Production In: Encyclopeadia for Bioresource technology. Pandey A.(ed.) pp 265-276. Haworth Press USA.