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The effect of pre-fruiting temperatures on the yield of *Pleurotus* strains

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Summary: Authors studied the effect of different temperatures prior to fruit body appearance on the yield of 3 Pleurotus strains P70, HK35 and 357. After 17 days of incubation at 25 °C and 28 °C the substrate blocks were kept for 7 days at 13, 16, 19, 22 and 25 °C. Then temperature was reduces to 16 °C during harvest time. Tests showed difference of some degrees in the optimal prefruiting temperature requirements of the strains which could result in even in 10-15% surplus yield. It is advisable to use technologies specially adapted to strains.

Key words: *Pleurotus* strains, pre-fruiting temperature, yield

Introduction

During the cultivation of *Pleurotus* sp. different developmental phases can be distinguished: mycelium growth or incubation, pre-fruiting or mycelium maturation and harvest time. Incubation comprises the period from spawning till the full colonization of the substrate by mycelia. The substrate is completely intervowen by the Pleurotus mycelia and becomes white in colour. This process generally takes 14 days followed by the pre-fruiting or mycelium maturation phase when mycelia get strong, compact and ready to form fruit bodies. The end of the phase is indicated by the appearance of primordia. This phase takes about 1 week. In this phase air temperature is one of the most important environmental factors. The pre-fruiting phase is followed by the harvest period.

Several data concerning incubation and harvest time are found in literature but only few deal with the optimal pre-fruiting temperature requirements of the strains. *Balázs* (1982) found 20–22 °C as optimal for maturation temperature, *Kovácsné Gyenes* (2005) 18-21 °C and *Stamets* (2000) between 10–15,6 °C. The book *Anonymous* (2004) cites similar values (10–15 °C).

Yield is greatly affected by the preparedness of mycelium in the pre-fruiting phase to form fruit bodies and temperature plays an important role in this phase. Our tests aimed at collecting data about this phase.

Material and Method

The yield of 3 oyster mushroom strains frequently used in production (HK35, P70, 357) was studied in connection with incubation and pre-fruiting temperatures. In former trials 25 °C an 28 °C was found optimal for incubation and so the same temperatures were applied in our trials.

Microbiologically prefermented, heat-treated wheat straw was filled with machine into perforated plastic bags (22 kg). Parameters of the heat-treated straw were: 77% humidity, 0,76% N (in solids), 8,34 pH. Grain spawn of the tested strains was mixed mechanically into the substrate in 3 weight per cent ratio. The substrate blocks were placed into plastic tents. During incubation the substrate temperature was kept at 25 °C and 28 °C measured in the centre of the substrate. Incubation took 17 days. In the following maturation phase the blocks were kept at 5 different temperatures (13, 16, 19, 22 and 25 °C) for 1 week. After this time production continued at 16 °C. Trials included 3 replications with 1 block each (1 block = 22 kg). Data were evaluated mathematically.

Results

Strain P70 incubated at 25 °C

The highest yield (2.6 kg/block) was obtained at 19 °C. Practically it did not differ from the 22 °C treatment. No significant differences were found at 16 °C and 25 °C temperatures either. Only the treatment at 13 °C had considerably lower yield than the others (*Table 1*). Data were also subjected to regression analysis (*Figure 1*) with 2.57 kg/block maximum at 20.3 °C calculated by the curve. $Y = 0.019x^2 + 0.7725x - 5.2798$; $R^2 = 0.989$.

Strain P70 at 28 °C incubation

In this treatment the highest mean yield was at 19 °C with no significant differences at 13, 16 and 22 °C. The treatment at 25 °C however, yielded only half of the quantity (*Table 2*). To describe tendencies a quadratic polynomial was used with the formula: $y = 0.0398x^2 + 1.458x - 9.9016$; $R^2 = 0.964$. Giving maximal value at 18.3 °C with 3.45 kg/block mean yield (*Figure 2*).

Table 1 Effect of different pre-fruiting temperatures on yield of strain P70 incubated at 25 °C

Pre-fruiting temperature °C	Treatment mean kg/block
13	1.58
16	2.16
19	2.60
22	2.53
25	2.17
	$LSD_{5\%} = 0.76$

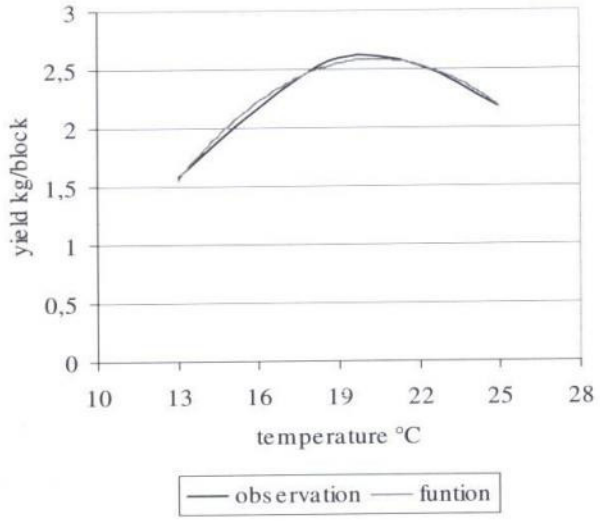

Figure 1 Strain P70 incubated at 25 °C

Table 2 Effect of different pre-fruiting temperatures on yield of strain P70 incubated at 28 °C

Pre-fruiting temperature °C	Treatment mean kg/block
13	2.34
16	3.24
19	3.25
22	3.10
25	1.57
	$LSD_{5\%} = 0.95$

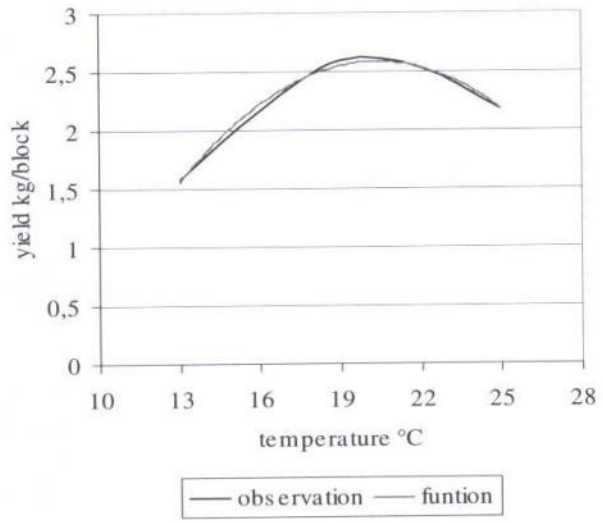

Figure 2 Strain P70 incubated at 28 °C

Table 3 Effect of different pre-fruiting temperatures on yield of strain HK35 incubated at 25 °C

Pre-fruiting temperature °C	Treatment mean kg/block
13	2.05
16	3.96
19	3.75
22	3.05
25	2.51
	$LSD_{5\%} = 0.85$

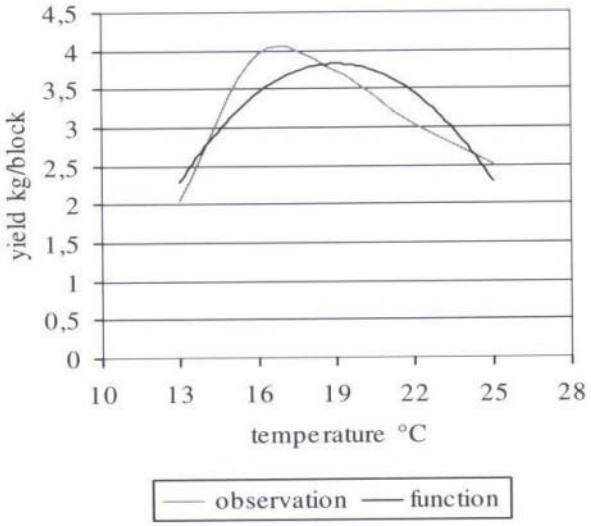

Figure 3 Strain HK35 incubated at 25 °C

Table 4 Effect of different pre-fruiting temperatures on yield of strain HK35 incubated at 28 °C

Pre-fruiting temperature °C	Treatment mean kg/block
13	2.66
16	3.05
19	2.98
22	2.63
25	2.80
	$LSD_{5\%} = 0.40$

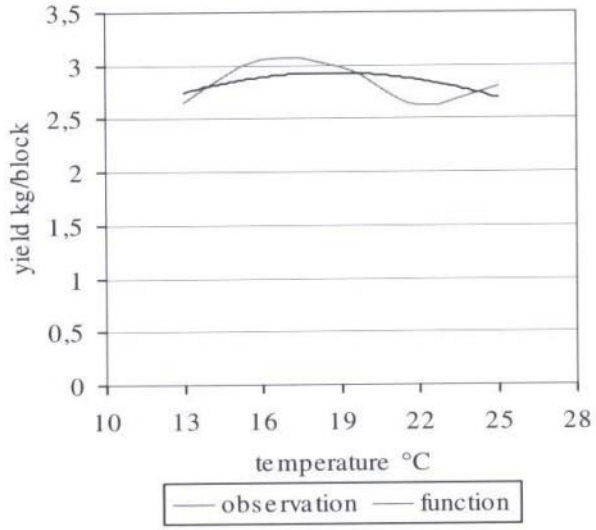

Figure 4 Strain HK35 incubated at 28 °C

Table 3 Effect of different pre-fruiting temperatures on yield of strain 357 incubated at 25 °C

Pre-fruiting temperature °C	Treatment mean kg/block
13	1.32
16	2.96
19	4.32
22	3.68
25	3.17
	$LSD_{5\%} = 0.83$

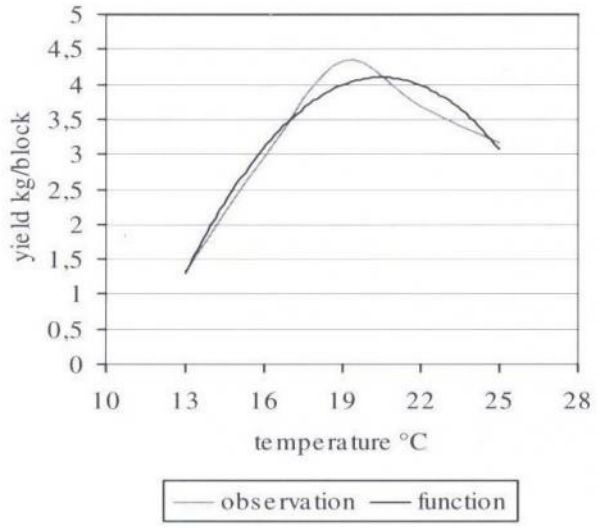

Figure 5 Strain 357 incubated at 25 °C

Table 6 Effect of different pre-fruiting temperatures on yield of strain 357 incubated at 28 °C

Pre-fruiting temperature °C	Treatment mean kg/block
13	2.33
16	2.21
19	3.50
22	2.95
25	1.41
	$LSD_{5\%} = 1.19$

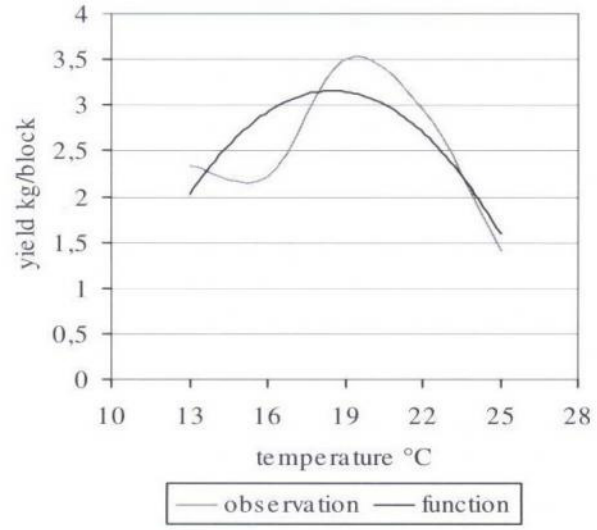

Figure 6 Strain 357 incubated at 28 °C

Strain HK35 at 25 °C incubation

The highest yield was obtained in the treatment at 16 °C, hardly higher than that in treatment at 19 °C. Yields were significantly lower at 13, 22 and 25 (*Table 3*). Formula of the quadratic polynomial: $y = -0.0425x^2 + 1.6138x - 11.51$; $R^2 = 0.792$. Calculated maximal yield at 19 °C 3.81 kg/block (*Figure 3*).

Strain HK35 at 28 °C incubation

The best result was obtained at 16 °C but it did not differ significantly from the other treatments (*Table 4*). The poorest yield was given by treatment at 22 °C with 2.63 kg/block mean yield. The formula of the quadratic polinomial (*Figure 4*): $y = 0.0057x^2 + 0.2125x + 0.9527$; $R^2 = 0.272$.

Strain 357 at 25 °C incubation

The highest yield was reached at 19 °C. Treatments at 13, 16 and 25 °C were significantly different (*Table 5*). The highest mean yield modelled by quandratic polynomial was 4.07 kg/block at 20.9 °C (*Figure 5*). $y = -0.05x^2 + 2.047x - 16.859$; $R^2 = 0.9544$.

Strain 357 at 28 °C incubation

The best result was given by the treatment at 19 °C with 3.5 kg/block followed by the treatment at 22 °C which was, however, not significant (*Table 6*). The other treatments (13, 16, 25 °C) were significantly lower in yield. The lowest yield was found in treatment at 25 °C with 1.41 kg/block. The formula of the quadratic polynomial: $y = 0.0371x^2 + 1.3748x - 9.563$; $R^2 = 0.674$. Maximal yield calculated by the formula at 18.5 °C 3.17 kg/block (*Figure 6*).

Conclusion

Pre-fruting temperatures affect Pleurotus yield differently. The highest yield was obtained in strain P70 at 19 °C pre-fruting temperature, in strain HK35 at 16 °C and in strain 357 at 19 °C at both incubation temperatures (25 and 28 °C). Tests indicate that strains differ in some degree in their optimal pre-fruiting temperature requirement which could be utilized to get even 10–15% surplus yield. It is recommended to use special technologies adapted to different strains.

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