

Influence of Moisture and Temperature on Yam Decay Organisms

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ABSTRACT

Yam decay by three storage fungi was greatest at 25-30 C. There was negligible decay by all fungi at 15 C. *Penicillium oxalicum* was less severe at temperatures above 25 C, whereas *Aspergillus niger* was progressively more severe above this temperature up to 35 C. *Botryodiplodia theobromae* did not cause decay at 35 C. Moisture availability did not significantly influence the amount of decay, although optimum moisture level for decay was 90% relative humidity. *Phytopathology* 60:1698-1699.

In a previous paper (1) on fungi associated with storage decay of yam in Nigeria, *Penicillium oxalicum* Currie & Thom, *Aspergillus niger* van Tiegh, and *Botryodiplodia theobromae* Pat. were found to be the major organisms of decay in stored yam. The markedly higher incidence of decay in the yams stackpiled in heaps on the floor of the hut over that of yams tied up on stakes in a barn was attributed partly to the humid conditions resulting from stackpiling.

Coursey (2) observed that cold storage was not suitable for yams, and suggested investigating cool (as distinct from cold) storage at temp of ca. 15 C. He added that it should be possible to discover a temp at which no chilling damage occurred, but at which respiration rate and fungal attack, and hence storage losses, would be very substantially reduced.

Young (6) indicated that freezing temp must be avoided in storage of yams, and suggested 12 to 16 C as the opt range of storage temp. Irreversible damage to the respiratory metabolism of tuber tissue of *Dioscorea rotundata* caused by holding the tissue at 5 C but not at 10 C was reported by Coursey et al. (3). *Dioscorea rotundata* was found to be susceptible to low temp injury, and temp higher than 12.5 C were necessary for its safe storage and transport.

Hardly any information is available on the effect of temp and moisture on storage decay organisms of yam. The following investigation provides some information on this point.

Dioscorea rotundata Poir. (the white yam), a popular variety of yam cultivated in Nigeria, was used. Tubers were harvested 3 weeks prior to inoculation. Cultures of *Penicillium oxalicum*, *Aspergillus niger*, and *Botryodiplodia theobromae* were originally isolated from decayed tissue of yam in Ibadan, Nigeria. Inoculum of each fungus was prepared on potato-dextrose agar (PDA) incubated in petri plates for 7 days at 25 C. Inoculation of tubers was carried out at the head, middle, and tail regions as described by Okafor (4).

Effects of temp on yam decay by each fungus were studied by placing inoculated tubers in incubators main-

TABLE 1. Effect of incubation temp on yam (*Dioscorea rotundata*) decay caused by *Penicillium oxalicum*, *Aspergillus niger*, and *Botryodiplodia theobromae*

Incubation temp, C	<i>Penicillium oxalicum</i>	<i>Aspergillus niger</i>	<i>Botryodiplodia theobromae</i>
15	0.3 ^a	0.1	0.2
20	2.2	0.5	3.2
25	3.6	3.2	3.4
30	1.1	4.3	3.5
35	0.7	5.1	0

^a Average extent of decay in cm from site of inoculation in head, middle, and tail regions of six tubers.

tained at the required temp of 15, 20, 25, 30, and 35 C. For each fungus, six inoculated yam tubers were placed at each temp for 4 weeks, after which the inoculated tubers were sliced through the site of inoculation. Decay was measured in the head, middle, and tail regions.

Effects of moisture on decay were studied at five moisture levels, 60, 70, 80, 90, and 100% relative humidity (RH). Only two fungi, *Penicillium oxalicum* and *Aspergillus niger*, were tested because of the limited space afforded by the 8-inch desiccators. Humidity was determined and maintained using potassium hydroxide solution and cobalt thiocyanate test papers according to the method described by Solomon (5). Five tubers inoculated with each fungus were placed in desiccators at each moisture level at room temp of 24-27 C for 4 weeks, after which measurements of decay were taken.

The direct effect of temp on the cultural growth of each of the three decay fungi was also assessed. Four petri plates containing sterile PDA were each inoculated centrally with a 2-mm block of inoculum taken from the margins of actively growing colonies of each fungus and placed in incubators maintained at 15, 20, 25, 30, 35, and 40 C. The average daily growth of each fungus at each temp was measured and recorded.

Yam decay was greatest at 25-30 C with the three fungi (Table 1). Decay was negligible at 15 C. *Penicillium oxalicum* caused progressive increase in decay with rising temp up to 25 C, but above this temp decay progressively decreased. With *Aspergillus niger*, decay progressively increased with increasing temp up to 35 C, but with *Botryodiplodia theobromae* decay was rapid from 20 to 30 C. There was no decay at 35 C.

In temp studies of cultural growth of these fungi, *Penicillium* and *Botryodiplodia* achieved max growth at 20 C and 25 C, respectively, but did not grow at

TABLE 2. Effect of temp on growth of the yam decay fungi on potato-dextrose agar

Incubation temp, C	<i>Penicillium oxalicum</i>	<i>Aspergillus niger</i>	<i>Botryodiplodia theobromae</i>
15	4.2 ^a	1.5	5.5
20	7.0	7.0	31.0
25	4.3	8.1	33.0
30	4.2	7.0	31.0
35	0	16.0	0
40	0	3	0

^a Average daily growth of fungus colony in mm.

TABLE 3. Effect of moisture on yam (*Dioscorea rotundata*) decay caused by *Penicillium oxalicum* and *Aspergillus niger* at 24-27 C

Relative humidity	<i>Penicillium oxalicum</i>	<i>Aspergillus niger</i>
60	2.6 ^a	2.0
70	2.7	2.1
80	3.0	1.6
90	3.5	2.2
100	2.0	1.4

^a Average extent of decay in cm from site of inoculation in head, middle, and tail regions of five tubers.

35 C, whereas *Aspergillus niger* grew best at 35 C (Table 2).

The moisture studies (Table 3) showed that decay by *Penicillium* gradually increased with increasing RH up to 90% and decreased at 100% RH. A similar trend occurred with *Aspergillus*, although the figures did not appear stable at 80% RH. Moisture availability did not greatly influence the amount of decay, but the least amount of decay was found at 100% RH.

Results of this investigation indicate that yam decay caused by storage fungi operates over a rather wide range of temp. It is likely that temp has a direct effect on tissue penetration and decay by the fungus, as indicated by the similar trend observed in the effect of temp on cultural growth of the fungi. The effect of moisture in this investigation was minimal.

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