



MUSHROOMS IN DEVELOPING COUNTRIES - 2008

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A year ago, I wrote about my work during 2007 in Ukraine, Tajikistan and Egypt for USAID¹. In 2008, I returned to Ukraine and to Tajikistan, but this time I went to Kenya and not to Egypt. Many of the people in Ukraine were friends from my first visit, many were also new friends and my assignment was quite different. In 2007, I worked with oyster mushroom growers, but the 2008 work was to help with *Agaricus* compost production. In western Ukraine most compost comes from Poland and is very expensive for the Ukraine growers.

UKRAINE

Compost production is just now starting in western Ukraine. Western Ukraine is the poorest part of the country, so it is difficult for them to obtain the necessary equipment. They also have to work through the learning process. With experience in grow-

ing, but none in compost production and limited resources, the quality of compost has not yet reached modern standards. However, they are learning and the lower cost will keep them going. At the operation we visited near Lviv, they were composting in the open and using only a simple fork clam on their wharf.

We went to a very interesting nearby restaurant for lunch. It was decorated with many interesting things from the local culture. The menu was also fun. Of course, Lviv is very near Transylvania and they made the most of it. I felt bound to join into the fun, so I ordered a “vampire dinner”, blood sausage. Incidentally, there never have been any vampire bats anywhere in Europe, much less in Transylvania.

Last year when I visited Tajikistan I found that they were trying to grow oyster mushrooms in a room that had windows, but even the tops of the windows were below the surrounding ground surface. There was no blower to bring in fresh air. While I

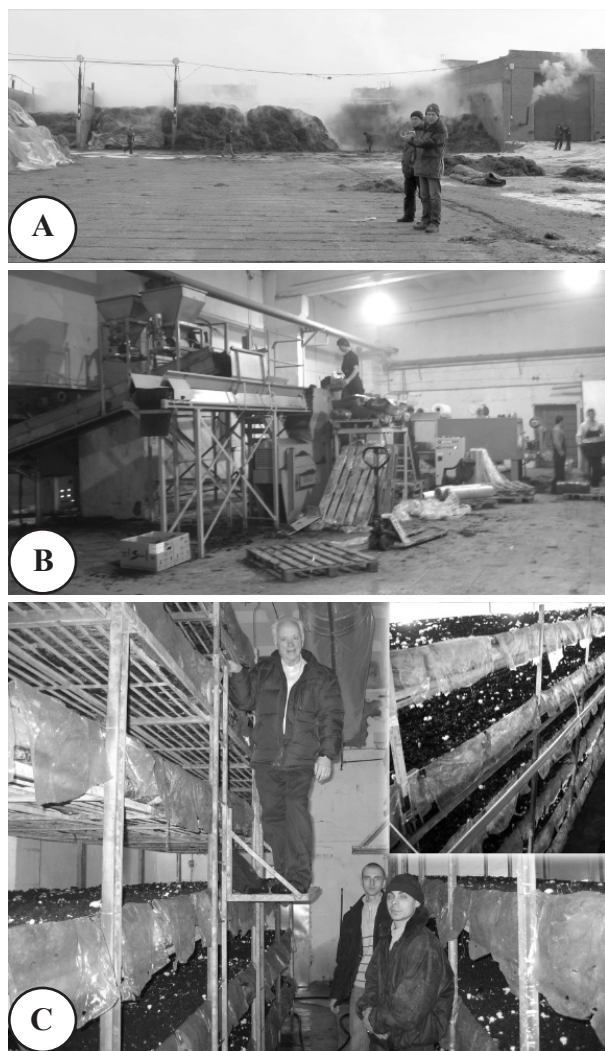


Fig. 1. *Agaricus* cultivation in Ukraine. A: Bunkers with compost, heavy tarps were used to hold some of the heat in the cold weather and slatted concrete to bring air into bunkers. B: Compost block machine, the compost enters on conveyer (foreground) and the spawn is added from bins (far left). C: Examining shelves from picking trolley, the insert shows view with more mushrooms on top tray, becoming less on lower trays.

told them that they would never do well under those conditions, I did not think much of it, because they have many limitations.

Electric power is intermittent, they are just learning and had had limited outside help.

However, this February, when I returned to Ukraine to help with *Agaricus* compost, I did look at growing rooms as well. Seeing the growing rooms tells a great amount about the compost. Most growing rooms were ordinary, and used compost blocks, but some shelves were more modern than others. Towards the end of my stay, I went to a modern bunker compost, block making plant in eastern Ukraine (**Fig. 1**). They had modern growing rooms only slightly above ground level. However, just outside the gate, there were two other growing facilities that used the same compost. Both were using the below ground rooms of Soviet era factories. All had modern Dutch equipment, with forced ventilation. I noticed that the air entered the room at the top in the ordinary manner, and the air left the room near the top. I immediately expected to see more mushrooms on the upper than lower shelves. I hate to say things with no real proof, so I crawled up on a picking trolley and looked. Just as I suspected, I saw fewer mushrooms on the lower shelves. I said that I was sure that if they kept the records by shelf, they would see that there were fewer mushrooms on the lower ones. They said they had the records and I was correct. When I told them that they must change the ventilation so that the entire room was ventilated, they were surprised and seem to doubt me. They did not say who installed the system, but I was left with the impression that they thought I must be wrong because it was done by “experts.” I am not certain what mysterious force they thought was causing them to lose yield on the lower shelves. Of course, the carbon dioxide was accumulating near the floor and the mushrooms on the lower shelves were surviving even with large amounts of carbon dioxide.

Like other eastern European people, the Ukrainians have a long history of picking and enjoying wild mushrooms. As the Ukraine becomes more industrial, fewer people will have time to hunt mushrooms and more will have money to buy them. It seems very likely that in time they will equal or even overshadow Polish mushroom production.

TAJIKISTAN

I returned to Tajikistan in April. Things are moving slowly there, but they are moving. There are several explanations to the slow movement. One is that the people that I worked with, who were most interested, were university students and the Dean of the Agrotechnology Faculty (**Fig. 2**). Of course, they have all been busy with other things, but the dean built growing rooms in the yard of his home and two students did their diploma work on growing mushrooms. The growing rooms were being finished while I was there and we initiated their first crop. The students defended their diplomas while I was there, so although only a few mushrooms were being produced, there was a great amount of activity. In addition the Dean was teaching a class and the students in the class were growing a few mushrooms. There were other problems, until the Dean's new rooms were completed, they had no good place to grow mushrooms. They have electric power, but it comes from hydroelectric plants. During the winter, the water freezes and often the plants can produce little power, worse still, 2007-8 was a very dry and cold winter. The weather resulted in many days with no power, cold buildings and a need to conserve water for irrigation. The need to conserve water results in a greater

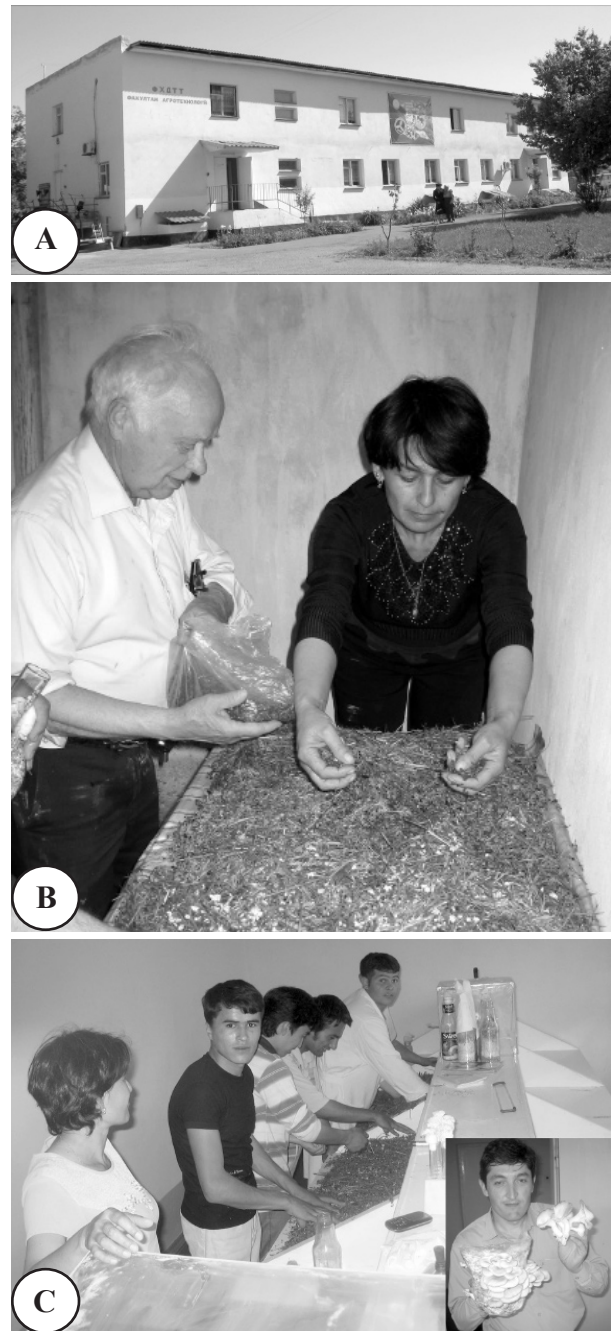


Fig. 2. The course on mushroom cultivation in Tajikistan. A: Faculty of Agro-Technology, Khujand Branch Technical University of Tajikistan. B: Spawning in the Dean's home facility. C: University class spawning, the insert shows some oyster mushrooms from previous class spawning.

problem for the hydroelectric plants. Such unreliable power means that while blowers and fluorescent lights can be used, they are not reliable. It is necessary to depend on gravity and wind for all ventilation and on windows for natural light.

The agricultural problems of Tajikistan are very complex. Unfortunately, they not only make Tajikistan the poorest country in central Asia, they contribute to the problems of their neighbors. Only 6.52% of the land is arable and 50% of the land is 3300 meters or more above sea level. Summers are dry so irrigation is required. To add to water problems, during Soviet times they were forced to grow cotton and they have not been able to break that economy. They have many other problems as well, they are land-locked, they had a terrible civil war in the 1990s, there is almost no manufacturing, and a very poor infrastructure.

For some years there has been one small *Agaricus* farm in Tajikistan. Many people pick wild mushrooms and I have seen imported pickled mushrooms for sale in an open air market. The culture of Tajikistan is closely related to the culture of Iran, Iran has been increasing their mushroom production in recent years. It seems likely that mushroom production in Tajikistan will also grow to an important crop. Since they are the poorest country in central Asia, new sources of food are of real interest. In addition to cotton, they grow rice, wheat, and other grains, so field wastes are widely available. Tree fruits and nuts are important food crops. They are on the ancient Silk Road and produce silk. The mulberry branches from silk production and the prunings from fruit and nut trees are possible substrate for *Pleurotus*, but possibly more useful as fuel for pasteurization. Another thing that makes mushroom growing of special interest is their limited water supply.

KENYA

According to statistics, Tajikistan is poorer than Kenya. Such statistics are averages and Kenya is a country of contrasts. The estates of wealthy colonials still dominate large areas of Nairobi, while in the countryside people live in mud huts and may have only an unprotected hole in the ground for a well. Kenya is on the equator so many foods grow there, however, most of the country is plateau, so temperatures can get quite low there.

Kenya is still a country of tribes. A year ago the inter-tribal problems erupted as "election riots" in several cities. However, the more important tribal effect, for me, is that members of some tribes consider all mushrooms to be poison and other tribes have a history of collecting mushrooms for food. While it encourages groups to ask for help, unlike some international development programs, the USAID Farmer to Farmer program helps only groups that ask for help, so the people I worked with were from tribes that did eat mushrooms. The result was many people who had begun to grow mushrooms and were enthusiastic to learn more and better methods.

Fuel is a major problem. Almost the only fuel used for heating is wood and with the growing population, more trees are cut down. Fewer trees mean less fuel, more carbon dioxide and eventually desertification. That problem led Wangari Maathai, of Kenya, to establish the Green Belt Movement in 1977 and to receive the Nobel Peace Prize in 2004. For all of her effort, and accomplishments, the population continues to grow and the need for fuel grows with it. My students had been boiling straw, they were thrilled when I told them that 60 C was the temperature for pasteurization and that only 30 to 60

minutes are required. Higher temperature and longer times are not only unnecessary, but are a source of trouble. Of course, the lower temperature and shorter time saves large amounts of fuel.

Another problem in Kenya is that there is almost no electricity in the countryside. Even many of the most modern farms have no electricity. With no electricity there is no possibility of forced ventilation or electric lights. I had been preaching for years that because the sun heats and windows allow heat loss at night and when it is cloudy, that natural light required more heating or cooling, so that fluorescent lights saved money and were easier to use. Suddenly I found myself in a place where my suggestion made no sense. It was necessary to help them provide natural light with a minimum of diurnal heating and cooling.

Mud-wattle buildings with thatched roofs are a tradition. Mud, like other masonry holds heat by thermal inertia and thatch is a good insulator. So they are good for inexpensive buildings. Mud and particularly thatch are not clean, but when the inside is lined with polyethylene film, they become excellent buildings (Fig. 3). One grower ended the mud about 30 cm below the eaves and covered that area with woven polypropylene bags, so that her building let sunlight enter with almost no heat, but in the evening it cooled rapidly. Most had an opening for fresh air to enter, but few had an opening near the floor for the carbon dioxide to leave.

During my final week in Kenya, we had a three-day meeting of growers in Nakuru. I lectured and gave participant-demonstrations those days with breaks for tea and lunch. The enthusiasm was overwhelming and each day lasted about 11 hours. On the third day, my Kenyan colleagues lectured on and reviewed the entire meeting. It was



Fig. 3. Mushrooms in Kenya. A: Mud wattle mushroom house with woven polypropylene bags for light and ventilation, the insert shows inside rear left corner. B: Balm Mushroom Place Café, the insert shows Café sign in hallway. C: Students and leaders at the end of the training conference.

planned to end with lunch, but it continued until about 15:00.

Kenya began growing *Agaricus* mushrooms in the 1970s. The first farm no longer produces mushroom, however, there are several small farms near Nairobi. I visited one of those farms. They were successful, but like many farms throughout the world there was great room for improvement. Like most capital cities, Nairobi has a sizable international community, so mushrooms will sell well there. Because of tribal traditions and relatively few foreign people in other communities, we must expect large differences in the local market from place to place in Kenya.

The Kenya Ministry of Agriculture, USAID, many other organization: foreign, international and Kenyan, both non-profit and commercial, have worked together to support and promote increased maize production in Kenya. It is hoped that large

amounts of maize wastes will be used to grow mushrooms.

The people who asked the USAID to have me come to Kenya have established "The Balm Mushroom Place" a "hole-in-the-wall" cafe in Nakuru, that serves mushroom dishes. It is operated by Eunice, who is an excellent cook and seems to do a good business considering the size of her tiny shop.

When I left, I promised to write a book on growing oyster mushrooms under the conditions in Kenya. That book is in progress, and almost written.

LITERATURE CITED

1. Kurtzman, R. H. 2007. Mushrooms in developing countries. *Micologia Aplicada International* 19: 57-61.