In previous years cases tended to be located in southern Missouri, the problem is more widespread during 1993. Cases have thus far been reported from 21 counties.

It is generally stated that cattle do not prefer oak as a feed source, but eat acorns under conditions where poor pasture or harsh weather conditions restrict access to other forage. This year, we have received several reports of cattle becoming intoxicated while on relatively good pasture, without feed restriction. Acorn intoxication is more likely to occur when there is a heavy crop. In addition, immature acorns contain higher concentrations of toxin than mature ones. Wet weather, such as occurred in Missouri throughout much of the summer, delays ripening and means that green acorns may be available for a longer period of time. Environmental factors, such as heavy mid-September rains may have dislodged green acorns from the trees, making them available to cattle. Studies have shown that red oak acorns have a higher concentration of tannins and are more likely to be toxic than those from white oaks. Red oaks appear to be producing more acorns this year and this may further explain the toxicity observed.

After renal damage occurs, the effects of oak intoxication are likely to be permanent, and usually result in death. Although mildly affected animals will make growth recoveries after the acute illness is over, calves with extensive renal damage will remain small and stunted. Thus, prevention is the most efficient means of limiting losses. Cattle appear to acquire a taste for the acorns and may continue to ingest them. When access cannot be controlled, animals can be supplemented ration containing 10-15% calcium hydroxide (hydrated lime). It is recommended that mature cattle be given 4 pounds of this supplement daily and calves be fed 2 pounds. The lime effectively binds tannins and prevents their absorption. When signs of intoxication do occur, supportive treatment and laxatives usually have little effect.

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A POTENTIAL NEW PROFIT FROM OAK WOODLANDS
by Dr. Mo-Mei Chen

In California, a variety of mushrooms have become increasingly popular. Because mushrooms grow well in oak woodland habitat, commercial mushroom production offers a profit potential for oak woodland owners. Woodland owners can also sell oak sawdust to mushroom producers.

During the last 30 years, mushroom production has increased twenty-fold. According to Dr. Phillip Miles, professor of biology at the State University of New York in Buffalo, worldwide production of phoenix tall oyster mushrooms (Pleurotus sajor-
caju) has exploded. The most recent statistics show 909,000 metric tons of production, mostly in mainland China. In the United States, shiitake, oyster and all other species increased 2 percent to annual sales in 1991-92 of $16.4 million.

Shiitake (black oak mushroom) production has become worldwide, multi-billion dollar industry. During the 1980s, shiitake mushrooms were Japan's number one agricultural crop export. In Asia, it is common for an ordinary meal to contain 30 percent mushrooms. The consumer demand for exotic mushrooms in the United States also promises a diverse and growing mushroom market in the future.

Many mushroom species are sold in specialty shops, supermarkets, and restaurants. For example, the Monterey Market in Berkeley carries over 10 different types of fresh edible fungi produced by local growers. Recent retail prices of mushrooms at Monterey Market were as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Price per pound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shiitake</td>
<td>$5.89 to 11.50</td>
</tr>
<tr>
<td>Oyster</td>
<td>3.98</td>
</tr>
<tr>
<td>Morel</td>
<td>13.00 to 15.00</td>
</tr>
<tr>
<td>Matsutake</td>
<td>19.00</td>
</tr>
<tr>
<td>Chantrelle</td>
<td>13.00 to 15.00</td>
</tr>
<tr>
<td>Boleus</td>
<td>15.00</td>
</tr>
<tr>
<td>Black truffles</td>
<td>135.00</td>
</tr>
</tbody>
</table>

Of these seven species, only shiitake and oyster mushrooms are commercially grown. The other five species are wild, and have variable annual yields. These mushrooms are an important food source for wildlife, too.

Many Levels of Production Possible

Mushrooms can be grown by anyone, from backyard gardeners to large-scale corporations. They do not require arable land, special or large amounts of water. Most edible mushrooms prefer hardwood lands. Oaks are preferred over alder and maple for high yield commercial mushroom species.

Mushrooms can be cultivated in hardened sawdust, logs and stumps, and even in the lawn. They can be grown outdoors or indoors. "Just add water" kits or spawn raised under laboratory conditions are available.

California Produces Diversity of Mushrooms Year Round

A variety of mushrooms can be grown from California's coastal range to the Sierra Nevada. With the cool moist winters in Central and Northern California, mushrooms can be grown outside yearlong. They can also be grown indoors in incubation and growing houses. California oak is excellent for growing log mushrooms.

As more Californians become health conscious and interested in the medicinal values of mushrooms and other fungi and herbs, the state also offers unusual social and market benefits. There are 86 edible mushroom species growing in the San Francisco Bay Area, of which 42 have medicinal value.
Nutritional and Medicinal Value

Besides their diverse and interesting culinary uses, mushrooms have nutritional and medicinal value. Some mushrooms contain cancer-fighting properties and some aid the body's immune system. Shiitake contains vitamins A, B₃, B₁₂, C, D₂, niacin, phosphorus, iron and other minerals. According to Dr. Kanichi Mori, the shiitake lowers serum cholesterol, has both strong anti-tumor and anti-viral properties, has very low fat, no starch, and more vitamin B₁₂ than milk and fish. He considers shiitake nutritionally more valuable than the western staples of corn, turnips, potatoes, tomatoes, and carrots. Although they have less protein than meat, the amount is comparable to peas and green beans.

Edible Mushroom Varieties

The Chinese have cultivated the mushroom for centuries. Of the 300 edible mushroom species, about 30 have been domesticated. More varieties appear every year. Only about 14 species can be commercially grown because of the difficulties in artificial growing. These 14 species are:

- Bottom mushroom
- Shiitake
- Common oyster mushroom
- Phoenix tail mushroom
- Golden top oyster mushroom
- Enoki
- Straw mushroom
- Money head mushroom
- Wood ear
- Hair wood ear
- Silver ear
- Ling zhi
- Bamboo mushroom
- Agaricus bisporus
- Lentinus edodes
- Pleurotus ostreatus
- Pleurotus sajor-caju
- Pleurotus citrinopileatus
- Flammulina velutipes
- Volvariella volvacea
- Hericium erinaceus
- Auricularia auricula
- Auricularia polytrich
- Tremella fuciformis
- Ganoderma lucidum

Education and Research

Landowners and managers need both experience and education on mushroom ecology and management. Although mushrooms are often thought of as an easy cash crop to produce with a high profit, people often find mushroom cultivation is not as easy as they anticipated. Much of the necessary knowledge must be acquired through practical experience, but understanding the principles of mushroom cultivation demystifies the process, allowing the grower to successfully adapt and develop cultivation methods. Mushroom cultivation demands a level of care and attention to detail much beyond the scope of ordinary gardening and agriculture. The current demand for more information is increasing.

Dr. Mo-Mei Chen is a visiting scholar in the Department of Environmental Sciences, Policy and Management at the University of California, Berkeley. This article has been reprinted from Oaks 'n' Folks, November 1993, Volume 8, Issue 2, from the University of California, Integrated Hardwood Range Management Program, with permission by Richard B. Standiford.