Western Beef Resource Committee

*Fourth Edition*

# Cattle Producer's Handbook

Animal Health Section 636

# Pine Needle Abortion in Cattle

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Since the early 1900s livestock producers have had problems with pine needle abortion (PNA). Cattle often eat pine needles, and pregnant cattle that are allowed to eat pine needles will abort, resulting in dead or premature calves, retained placentas, and uterine infections. The problem is found throughout the western United States and Canada.

Many PNAs are caused by ponderosa pine, but other trees including lodgepole pine, common juniper, and others also cause abortions (Table 1). Analysis of other *Pinus* species for isocupressic acid, the causative toxin, continues. Research has identified the causative toxins, a probable mechanism of abortion, and when animals are most likely to abort. Additionally, research has provided some guidelines on how to avoid PNA.

Ponderosa pine (*Pinus ponderosa*) is an abundant, extremely hardy, and drought resistant tree that is common in the western regions of the United States and Canada. Lodgepole pine (*Pinus contorta*) is also common in the western United States as it grows well at high elevations and its tall, slender growth make it excellent for commercial uses such as poles, fences, and log buildings. Common juniper (*Juniperus communis*) is a low understory shrub found in high elevation forests. Other species, listed in Table 1, grow in similar habitats. Abortions will occur if sufficient amounts of needles, duff, new growth, or bark are consumed.

## Consumption and Susceptibility

Cattle graze few ponderosa pine needles except during the winter or extreme drought conditions. However, once cattle begin eating pine needles, they learn to like needles and will sometimes consume large amounts. The amount eaten varies with weather events, nutrient status, and snow depth or the availability of other forages. Consumption appears to be related to colder temperatures and, consequently, consumption of pine needles is greatly reduced during mild winter weather.

**Fig. 1. Cattle often eat pine needles, particularly when other forage is less available or during winter weather events.**

Cattle will eat green or wilted needles directly from low branches, from felled trees, or slash piles. They will also eat dried needles from the forest bed (Fig. 1).

Pine needle abortion has been reported to occur in cattle and buffalo (*Bison bison*), but not elk, sheep, or goats. Cattle in the third trimester of pregnancy are more likely to abort or deliver premature calves when they ingest pine needles. Pine needle-induced abortions can have varying morbidity, affecting up to 100 percent of exposed animals. Common scenarios of poisoning include situations when cattle in late gestation are forced into stands of ponderosa pine trees by winter storms, when cattle are exposed to easily accessible pine needles by logging operations or blow downs, or drought conditions.

**Table 1. Concentration of isocupressic acid and related metabolic compounds from selected species and locations.**

| Species | Common name | Location | Concentration (% DW) |
|---|---|---|---|
| *Abies concolor* | White fir | Arizona | n.d.[a] |
| | | California | n.d. |
| | | Colorado | 0.04 |
| | | Utah | n.d. |
| *Abies grandis* | Grand fir | Idaho | n.d. |
| | | Oregon | n.d. |
| *Abies lasiocarpa* | Subalpine fir | Colorado | n.d. |
| | | Idaho | 0.04 |
| | | Oregon | n.d. |
| | | Utah | n.d. |
| *Abies magnifica* | Red fir | California | 0.05 |
| *Cupressus macrocarpa* | Monterey cypress | California | n.d.-0.06 |
| | | New Zealand | 0.89-1.24 |
| *Cupressus X ovensii* | | New Zealand | 0.81 |
| *Juniperus californica* | California juniper | California | 0.93 needle<br>0.05 bark |
| *Juniperus communis* | Mountain common juniper | Colorado | 2.05-2.88 |
| | | Utah | 1.50-5.0 |
| *Juniperus monosperma* | One seed juniper | Arizona | 0.14 |
| | | New Mexico | n.d. |
| *Juniperus occidentalis* | Western juniper | Oregon | 0.10<br>Imbricatoloic acid = 1.0 |
| *Juniperus osteosperma* | Utah juniper | Arizona | n.d. |
| | | Colorado | n.d. |
| | | Nevada | 0.07 |
| | | Utah | n.d. |
| | | Utah | Agathic acid = 1.50 |
| *Juniperus scopulorum* | Rocky mountain juniper | Arizona | 0.42 |
| | | New Mexico | 0.33 |
| | | Utah | 0.84 |
| *Juniperus virginiana* | Eastern red cedar | Nebraska | needles, low<br>bark, < 0.10-high |
| *Larix occidentalis* | Western larch | Oregon | n.d. |
| *Libocedrus decurrens* | Incense cedar | Oregon | 0.07 |
| *Picea engelmannii* | Engelmann spruce | California | 0.27 |
| | | Colorado | n.d |
| | | Idaho | 0.04 |
| | | Montana | 0.31 |
| | | Oregon | n.d. |
| | | Utah | n.d. |
| *Picea pungens* | Colorado blue spruce | Colorado | n.d. |
| | | Utah | 0.17 |
| *Pinus aristata* | Bristle cone pine | Colorado | 0.01-0.05 |
| *Pinus arizonica* | Arizona pine | Arizona | n.d. |
| | | California | n.d. |
| *Pinus contorta* | Lodgepole pine | Colorado | 0.29-0.47 |
| | | Idaho | 0.11 |
| | | Oregon | 0.28 |
| | | Utah | 0.66 |
| | | Canada (B.C.) | 0.45 |
| *Pinus densiflora* | Japanese red pine | Korea | n.d. |

**Table 1. (cont'd)**

| Species | Common name | Location | Concentration (% DW) |
|---|---|---|---|
| *Pinus echinata* | Short leaf pine | Arkansas | n.d. |
| *Pinus edulis* | Pinyon pine | Arizona | n.d. |
| | | Colorado | 0.12 |
| | | New Mexico | 0.10 |
| | | Utah | 0.45 |
| *Pinus elliottii* | Slash pine | Arkansas | n.d. |
| *Pinus flexilis* | Limber pine | Colorado | n.d.-0.06 |
| | | Utah | n.d. |
| *Pinus halepensis* | Aleppo pine | California | n.d. |
| *Pinus jeffreyi* | Jeffrey pine | California | 0.04-0.54 |
| *Pinus koraiensis* | Korean pine | Utah | Positive |
| | | Korea | 0.02 |
| *Pinus monophylla* | Single-leaf pinyon | Nevada | 0.32 |
| *Pinus montezumae* | Montezuma pine | California | n.d. |
| *Pinus palustris* | Long-leaf pine | Arkansas | n.d. |
| *Pinus patula* | Patula pine | South Africa | <0.10 |
| *Pinus ponderosa* | Ponderosa pine | Arizona | 0.49 |
| | | California | 0.08-1.35 |
| | | Colorado | 0.49-0.58 |
| | | Oregon | 0.74-1.30 |
| | | South Dakota | 0.10-1.30 |
| | | Utah | 0.51 |
| | | Wyoming | 0.58-1.11 |
| | | Germany | 0.62 |
| *Pinus radiata* | Radiata Pine | New Zealand | n.d.-0.26 |
| *Pinus taeda* | Loblolly pine | Arizona | n.d. |
| | | Arkansas | n.d. |
| *Pseudotsuga menziesii* | Douglas fir | Arizona | n.d. |
| | | California | n.d. |
| | | Colorado | 0.05 |
| | | Idaho | n.d. |
| | | Oregon | n.d |
| | | Utah | 0.04 |
| *Thuja plicata* | Western red cedar | Arizona | 0.42 |
| | | New Mexico | 0.33 |
| | | Utah | 0.84 |
| | | Germany | n.d. |
| *Tsuga mertensiana* | Mountain hemlock | Oregon | n.d. |

[a] n.d. = not detected (< 0.01%)

## Abortion and Disease

Response to pine needle ingestion is variable and largely dependent on gestational age, amount of needles consumed, and the concentration of ICA in the needles. Current research suggests that an ICA content of 0.5 percent in the needles, or greater, is necessary for an abortion to occur, with most abortions occurring when the ICA content of the needles is greater than 1.0 percent. Most animals will abort within the first several days of ingesting pine needles, but some may not abort until 14 to 16 days later. The dose required varies as some cattle abort after a single exposure of 1 to 2 kilograms of pine needles, whereas others require several sustained days of pine needle ingestion.

The abortion is similar to a normal parturition, however, most animals have a retained placenta and many have mucoid or hemorrhagic vaginal discharge (Figs. 2 and 3), depression, minimal mammary development, incomplete vaginal dilation, weak uterine contractions or uterine inertia, and finally dystocia. The retained fetal membranes (placenta) may persist

**Fig. 2. A common symptom of pine needle-induced abortion is retained placenta and a mucoid or hemorrhagic vaginal discharge.**

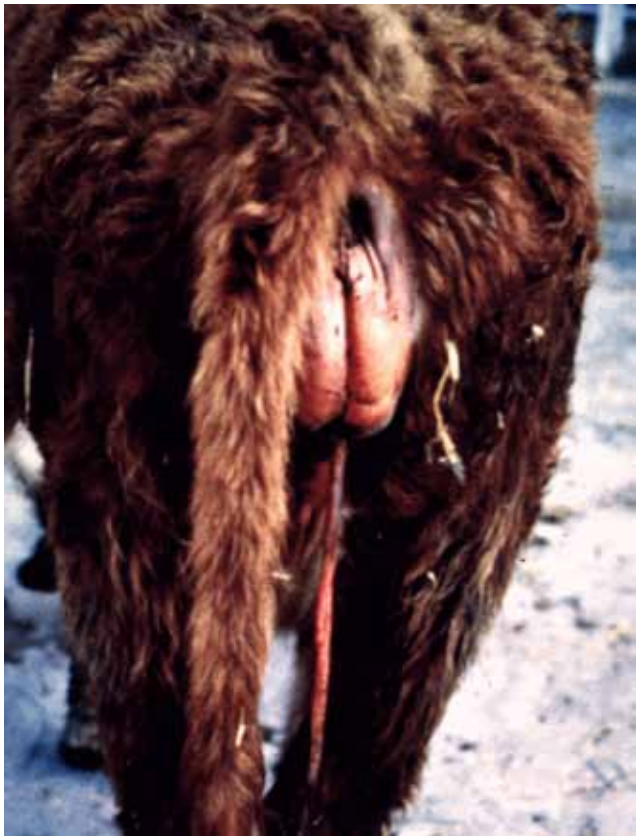

**Fig. 3. Closer view of excessive mucoid or hemorrhagic vaginal discharge.**

for 2 to 3 weeks. As a result, the common sequelae of abortion include septic metritis, pyometra, agalactia, and occasionally death.

If abortion occurs in late gestation, the calves may live, but they are generally weak, may not suckle, and require extensive care and nursing. Aborted calves do not have lesions, and fetal development (size, hair, and teeth) is normal for the gestation age. Some cows may not abort but they develop sporadic vaginal discharges, anorexia, and rumen dysfunction. If they recover, these animals may also deliver small calves that fail to thrive.

## Toxin and Mechanism of Action

The pine needle toxins that cause the abortion have been identified as labdane resin acids, including isocupressic acid and its acetyl and succinyl derivatives. Interestingly, isocupressic acid was originally identified in Monterey cypress (*Cupressus macrocarpa*), a tree commonly used in New Zealand as a windbreak, and which has also been shown to cause abortion in cattle in that country. Ponderosa pine needles also contain several abietane acids, which are not abortifacient but are toxic. These toxins may contribute to both the maternal and fetal toxicity seen in naturally occurring pine needle-induced abortions.

Current studies suggest pine needle toxins induce parturition, causing abortion by increasing placental vascular resistance and fetal anoxia. This is supported by histological studies, which found fetal and placental development similar to those of animals of similar gestation.

## Treatment and Management Recommendations

Presently there is no antidote or treatment to reverse or avoid the abortifacient effects of pine needles. As a result, the current recommendations are that livestock producers avoid exposing pregnant cattle, especially during late gestation, to pine needles, pine bark, and pine tips. Providing adequate food and shelter can help reduce losses. Recent research suggests that pregnant cows be maintained in at least moderate to good body condition when grazing on pine needle-infested rangelands to reduce consumption of pine needles and risk of abortions. Moving to a late spring or fall calving period may also be helpful.

If an abortion problem does occur, the recommended therapy is to treat the secondary changes or sequelae of abortion. Veterinary care and supervision may be indicated to initiate antibiotic, hormone, and steroid therapy for treatment of retained placenta, endometritis, and septicemia. Also, many of the calves that are born alive may require colostrum and milk supplementation, oxygen therapy, fluid and electrolyte replacement, and antibiotic therapy to survive.

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