Major Poisonous Plants and Their Impact on Livestock

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Abstract: Poisonous plants are plants that contain harmful toxins in high enough concentration that can cause serious problem on health as well as may cause death if they are consumed or ingested by livestock. Poisoning is usually associated with management errors, starvation, accidental eating and browsing habits of animals, lack of forage due to range conditions, and other events that would cause livestock to consume vegetation normally unacceptable. The severity of poisoning is related to the quantity of material eaten, the species of animal eating the plant, portion of the plant and condition of the plant eaten, level of ground moisture, general health of the animal prior to ingesting the substance and the age of the animal. Economic losses due to livestock poisoning by plants can be either direct losses or indirect loss. Direct losses of livestock involve the economic impact of poisonous plants on the animal. Poisonous plant causes losses by reducing in the reproductive efficiency of livestock. Indirect losses include those activities or costs that are incurred by a livestock operation to prevent losses or costs incident to livestock poisonings by plants.
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1. Introduction

Plants comprise one of the largest categories of poisons known around the world. They form a major part of livestock feed, thus toxicities in both browsing and grazing animals consuming these poisonous plants can be expected and it became a major concern for the practicing veterinarian and livestock producer in every country. Poisoning in animals may occur due to either accidental ingestion of material eaten along with grass or willful consumption of poisonous plants when pasture is dry while most of these poisonous plants remain green all the year round. (Bernal *et al*., 2006).

In countries with higher plant biodiversity, the number of problematic toxic plants affecting both large and small animals may be greater. Ethiopia also possesses three traditionally recognized agro climatic zones. These are Kola (a hot zone of 500-1500 m above sea level), Weina Dega (intermediate zone of 1500 m and 2500 m), and Dega (a cold zone usually cited as being 250 m above sea level). These ecological zones are suitable for the growth and multiplication of diverse species of plants and animals (Mekonnen, 1994).

Plant poisoning essentially is a local problem occurring in areas where poisonous plants may form a large proportion of the herbage species available to grazing animals. Livestock that are highly starved consumes large quantities of toxic plant or graze over a long period of time and as a result, Livestock may be exposed for plant poisoning (Panter *et al*., 2007). Most of the livestock's are kept under semi-intensive or extensive systems of management making them susceptible to poisoning by toxic plants. With increasing human activities such as farming, deforestation and other forms of environmental degradation, which affects the fauna and the flora, it becomes very important to assess major plant that are toxic to livestock and causing adverse effect on livestock health and production (Holechek, 2002).

Therefore, the objective of this seminar paper is:

- To highlight major poisonous plants and their impact on livestock industry.

2. Major Poisonous Plants that Affect Livestock

There are various herbaceous and woody species of plants in different parts of the world. However, some of the plant species have a potential to cause poisoning to livestock and humans. Poisonous plants that are described in this paper are commonly found in Ethiopia. Notable major toxic plants of livestock importance are listed as follows (Cook *et al*., 2009).

2.1. *Lantana camara*

Lantana camara is an ornamental or wild, flowering plant that grows about 1.2-2.4 meters high. It contains approximately 270 species and sub specific taxa of woody shrubs and its root system is very strong, and it gives out a new flush of shoots even after repeated cuttings (Bhakta and Ganjewala, 2009). The genus *Lantana* ranked among the 100 worlds worst invasive alien species (Day *et al*., 2003). *Lantana camara* has a wide ecological tolerance due to diverse and broad geographic distributions of the species beyond its native range and has the ability to

conquer diverse habitats and success on a variety of soil types (Day *et al*., 2003). The plant has been declared as one of most noxious weed and thought to be a cosmopolitan invader in many parts of the world (Goulson and Derwent, 2004). It is particularly a weed of the tropics and sub-tropics becoming naturalized in approximately 60 countries (Day *et al*., 2003).

Lantana camara is very pungent plant and not palatable, but at times of famine cattle may eat it in large quantities sufficient to cause toxic effects. The mode of action of *Lantana* toxin appears to be inhibiting the active secretion of bile canaliculi in liver and result in secondary photosensitization in all grazing animals (Csurhes and Edwards, 1998). *Lantana camara* was introduced to Ethiopia as an ornamental plant due to its beautiful aromatic flowers (Binggeli and Desalegn, 2002). However, because of prolific seed production and easy dispersal, it escaped cultivation and become a pest in the social, ecological and economic concerns. Presently, it has spread almost all over the country, but still it is not much perceived as a chronic environmental problem, except in few parts of Ethiopia, such as Oromia and Somali regions (Binggeli and Desalegn, 2002).

2.2. *Datura*

Datura appears to be the main (species) genus involved in poisoning by tropane alkaloids (hyoscyamine, scopolamine and atropine). *Datura* prefers rich, calcareous soil. Adding nitrogen fertilizer to the soil will increase the concentration of alkaloids present in the plant. *Datura* can be grown from seed, which is sown with several feet between plants. The plant is harvested when the fruits are ripe, but still green. To harvest, the entire plant is cut down, the leaves are stripped from the plant, and everything is left to dry. When the fruits begin to burst open, the seeds are harvested (Chopra, 2006). Being annuals, *Datura* weeds, particularly *D. stramonium* and *D. ferox,* invade and contaminate especially annual crops like corn (maize), sorghum, soybeans and linseed. Both these spp. now have a cosmopolitan distribution and are annual pioneer weeds on waste land and are particularly troublesome, serious invaders on fertilized soil with annual crops (Henderson, 2001) all over the world, thus their significance concerning livestock.

All parts of *Datura* plants contain dangerous levels of the tropane alkaloids which are classified as anticholinergics. The amount of toxins varies widely from plant to plant. As much as a 5:1 variation can be found between plants, and a given plant's toxicity depends on its age, where it is growing, and the local weather conditions. Additionally, within a given *Datura* plant, toxin concentration varies by part and even from leaf to leaf. When the plant is younger, the ratio of scopolamine to atropine is about 3:1; after flowering, this ratio is reversed, with the amount of scopolamine continuing to decrease as the plant gets older (Preissel *et al*., 2002).

Although *Datura* poisoning is possible in most animal species, it is particularly a practical problem in equines. The reason for this is that equines are particularly sensitive to atropine and related tropane alkaloids. Being hindgut fermenters, the alkaloids are absorbed as the contaminated feed passes through the stomach. The mechanism of action of *Datura* plant after ingestion is that muscarinic receptor antagonists compete with acetylcholine (ACh) for a common binding site on the muscarinic receptors and thus block the action of ACh at muscarinic neuro effector sites on smooth and cardiac muscle, gland cells, in peripheral ganglia and in the central nervous system (CNS). In general they cause little blockade at nicotinic receptor sites (Brown and Taylor, 2001).

Datura intoxication produce signs such as hyperthermia, tachycardia, painful photophobia and the presence of pronounced amnesia have been reported (Freye and Enno, 2009). In the horse, additionally, the motility of the large intestine is seriously affected and either an acute paralytic ileus results with consequent death from acute complications like torsion, strangulation or tympany, or in more chronic causes recalcitrant impaction and colic may develop. The onset of symptoms generally occurs around 30 to 60 minutes after ingesting the herb. The duration of the symptom generally last from 24 to 48 hours. In severe case of Datura poisoning in livestock intravenous pysostigmine can be administered as an antidote. Death may occur within 24 hour of poisoning if not managed properly (Naudé *et al*., 2005).

2.3. Euphorbia

Euphorbia is a very large and diverse genus of flowering plants, commonly called Baala diimtuu in afan oromo. The plants share the feature of having a poisonous, milky, white, latex-like sap, and unusual and unique floral structures (Carter *et al.,* 1997). *Euphorbia* species are among the most commonly confused plant taxa with cacti, especially the stem succulents. *Euphorbias* secrete a sticky, milky-white fluid with latex, but cacti do not (Pritchard and Albert, 2003). Individual flowers of *euphorbias* are usually tiny and non descript (although structures around the individual flowers may not be), without petals and sepals, unlike cacti, which often have fantastically showy flowers (Pritchard and Albert, 2003). *Euphorbias* from desert habitats with growth forms similar to cacti have thorns, which are different from the spines of cacti (Pritchard and Albert, 2003) and taxonomist Carl Linnaeus assigned the name *Euphorbia* to the entire genus in the physician'shonor (Singh and Meena, 1994). The genus can be found all over the world. The forms range from annual plants

laying on the ground to well-developed tall trees, Which causes skin burn for livestock after consumption. In deserts in Madagascar and southern Africa, convergent evolution has led to cactus-like forms where the plants occupy the same ecological niche as cacti do in deserts of North and South America (Carter *et al.,* 1997).

2.4. Brugmansia

Brugmansia are large shrubs or small trees, with semi-woody, often many-branched trunks that grows in a moist, fertile, well-drained soil, in sun to part shade, in frost-free climates. They begin to flower in mid to late spring in warm climates and continue into the fall, often continuing as late as early winter in warm conditions. Like many ornamental plants, all parts of *Brugmansia* are potentially poisonous, with the seeds and leaves being especially dangerous (Pratt*, 2007). Brugmansia* are rich in scopolamine (hyoscine), hyosc amine, and several other tropane alkaloids. Effects of ingestion can include paralysis of smooth muscles, confusion, tachycardia, dry mouth, diarrhea, migraine headaches, visual and auditory hallucinations, mydriasis, rapid onset cycloplegia, and death (*Wagstaff, 2008).*

2.5. Nightshades (*Solanum spps*)

There are several species of nightshades that are toxic to horses, cattle, swine, sheep and poultry. The principal species that serve as examples of the genus are black nightshade *(Solanum nigrum),* silver leaf nightshade *(Solanum eleagnifolium),* and buffalo burr (*Solanum rostratum). Nightshade* species are not very palatable to livestock. However, these plants often grow as weeds in hay and silage crops and small grains where they can be harvested with the crop and then fed to livestock (Panter *et al*., 2011). Flowers are white; berries are black when ripe. It grows peripherally in moist areas of fields and pastures of disturbed loamy or gravelly soils. Leaves are simple, thick, lanceolate to linear, entire to sinuate. Stems and ribs usually have short stiff spines (Stegelmeier *et al*., 1999).

The clinical signs associated with nightshade poisoning depend on the amount of plant/toxin ingested, the plant species eaten and the animal species consuming the plant. Poisoning by this group of plants does not always end in death. In acute poisoning the nervous symptoms develop rapidly. Signs range from mild digestive upset to severe colic in horses when contaminated hay is fed, to neurological dysfunction, seizures and death in sheep and cattle, to “big head” and calcification of the blood vessels to teratogenesis, salivation and nasal discharge, body temperature may be slightly elevated, gall bladder may be distended, gastrointestinal irritation including inflammation, hemorrhage, and ulceration (Panter *et al*., 2011). Animals showing severe neurological signs such as tremors, ataxia, and dilated pupils may be treated with physostigmine. Oral activated charcoal as an adsorbent may be effective if administered timely. However, most animals’ will recover if treated symptomatically and if the animals are not overly stressed. Harvested forage such as hay, grain, or silage can be contaminated with nightshades. Contaminated forage can be fed if it is diluted (mixed) with nightshade-free forage: an on/off feeding strategy should be used. Animals being fed this diluted forage should be kept under close surveillance and immediately removed from the contaminated feed if signs of poisoning appear (Panter *et al*., 2011).

2.6. Prosopis juliflora

Prosopis juliflora is a perennial thorny deciduous shrub or a large crowned evergreen tree with a deep taproot and a well-developed lateral root system; height ranges between 1-18 meters, depending on the type of soil in arid and semi-arid conditions; armed with stout yellowish nearly straight poisonous spines arising in pairs (Kassahun, 1999; Hailu *et al*., 2004; Kassahun *et al*., 2004).

Prosopis juliflora has become an invasive weed in several countries where it was introduced. It is considered a noxious invader in Ethiopia, Hawaii, Sri Lanka, Jamaica, the Middle East, India, Nigeria, Since 1980s this plant has spread rapidly in eastern Ethiopia, from the Middle Awash Valley in to the Upper Awash Valley and Eastern Hararghe and some localities of Raya Azebo plains of South Tigray. The invasion has also reported in the town of ArbaMinch and neighboring localities in South region of the country (Rezene, 2006).

The edible nature of the pods and prosopis seed dispersal mechanisms by cattle, sheep, goats and wild animals and coppicing nature of the plant after stumping are some of the characteristics that facilitate its invasion (Hailu *et al*., 2004). *Prosopis* clearly poses a major threat to rangelands, croplands and cause health problems of animals and human. It causes the overall loss of natural pasture, displacing of native trees, reduction in stocking rate, toxicity to livestock, formation of impenetrable thickets and increased incidence of crop pests (Senayit *et al*., 2004; Taye *et al*., 2004).

Although the seed pods of *Prosopis* are indeed palatable to livestock, the chemical content is thought to cause problems for goats, cattle, camel. A diet high in pods can cause mortality in sheep and goats due to digestive problems like impaction. Cattle can die if they feed heavily on *P. juliflora* leaves over a prolonged period of time owing to its tannin contents (Mwangi and Swallow, 2005). Senayit *et al*., (2004) also reported that thorns damage eyes and hooves of camels, donkeys, and cattle with poisons eventually leading to death of animals. Some local people in

Ethiopia believe that consumption of *Prosopis* leaves by camels causes flatulence, diarrhea and sometimes constipation and thorns of prosopis are harmful to human beings and livestock (Abdillahi *et al*., 2005. *Prosopis* also has an effect on human health. The most important effect of *Prosopis* on human health is that its thorns cause itching and bring tetanus. Its thorns can even cause blindness (Senayit *et al*., 2004). *Prosopis* causing problems to cattle breeders, because camel consumption of leaves lead to their sickness, eating their solid seed pods may result in falling out cattle teeth and reduction of their ability to graze).

2.7. Poison hemlock (*Conium maculatum*)

Conium maculatum is a tall, branched, biennial plant, usually 1-2.5m high, and thought to be one of the most toxic members of the family Apiaceae (formerly Umbelliferae) of plant kingdom. The stems are rigid, smooth, and hollow except at the nodes. The plant has a bitter taste and white flower. The leaves are large, triangular; fern like, and alternate on the erect stem. The plant usually grows in waste places where moisture may accumulate and protected from cultivation, damp ground, and banks of streams, rivers, road sides, woodland and pastures. Poison hemlock (*Conium maculatum*) has a worldwide distribution and reported as a very common weed in Europe, North and South America, North Africa, Australia and New Zealand, and there are data about its occurrence in Ethiopia (Mekonnen, 1994), and in Pakistan (Ahmed *et al*., 1989).

There are numerous reports of deaths for a wide range of animal species including humans. The juice or the extract of *Conium maculatum* was allegedly administered to criminals or political prisoners in ancient Greece which the Greek philosopher Socrates was condemned to drink in 399 BC. The 70-year-old was found guilty of heresy in a trial in Athens. His sentence was death by hemlock, and he had to drink the poison by his own hand. Socrates drank up, then walked around until he noticed his legs were heavy (Holm, 1997; Scutchfield and Genovese, 1997). Symptoms described by Socrates were: a rapid loss of power of the lower extremities (muscular weakness), ataxia, staggering and trembling. As the effects ascended, there was loss of control of the upper extremities. Total paralysis of the legs and arms followed. There was loss of the power to chew and loss of sensation and the pupils became fixed. If ingested, *conium* will cause paralysis of various body systems. Finally, death was due to paralysis of respiration and asphyxia; but is aware of what is happening as the mind is unaffected until death is imminent the intellect was clear until death occurred (Panter and Keeler, 1989).

Conium maculatum produces and contains piperidine alkaloids but the synthesis and accumulation sites have not yet been unequivocally identified. The location of secretory structures and the presence of essential oils and alkaloids were investigated (Corsi and Biasci, 1998). The consumption of varying parts of the plants (leaves, fruits) can cause different degrees of clinical effects and there appears to be different susceptibility to toxicity between species. The primary time of year for poison hemlock is spring; often when there is insufficient forage available. At this time the plant may also be more palatable. The toxicity increases throughout the growing season and the roots become toxic only later in the year. Once dried, the toxicity is considered to be reduced but not eliminated. The plant causes different signs and lesions in different species of animals (Dougall and Maureen, 1996).

2.8. Parthenium Hysterophorus

Parthenium is an annual herbaceous member of the Asteraceae, with a deep tap root and an erect stem that gradually branches itself out usually up to about 1-2 meter. It has bi-pinnate field and pale green leaves covered with soft fine hairs (Prasanta *et al.,* 2005). Its growth is slow and less prolific on a wide range of other soil types (Adkins *et al.,* 2005; Rezene *et al*., 2005). The spread of seeds plus their ability to remain viable in the soil for many years pose one of the most complex problems for control. This fact makes eradication difficult for many seed producing weeds (Monaco *et al.,* 2001).

In Ethiopia, *parthenium* has become a notorious weed since its discovery in the 1980's. It has been spreading from the eastern route of Ethiopia along the Dire Dawa, Addis Ababa railway presumably between 1974 and 1980. Some believe that the weed might have been transported into the country with imported or donated grain (Seifu, 1990; Fasil, 1994; Frew, 1996; Tamado, 2000). Others hold the belief that the weed entered the country during the Ethio-Somali war in 1976/77 through military vehicles (Frew *et al.,* 1996). The weed is abundant in Dire Dawa, Fedis, Babile, Errer, Jijiga, Durwale, Haroreys, Fafen, Dhiba, Gabogabo, Fik, and Haramaya and in some of the coffee growing areas of the region. In these areas it has causing a serious damage to grazing and crop areas. Due to its impacts, the palatable species are disappearing (SERP, 1995; Frew *et al.,* 1996). Currently, the weed is expanding fast, and is prevalent down to the Ogaden lowlands in the south east and up until to Nazareth following along the rail way. In eastern Ethiopia, the weed is commonly called 'Kildnole' (living alone) (SERP, 1995; Tamado, 2001; Belaynesh, 2006). It is said so because the weed lives alone by excluding or expelling other species found in its vicinity.

P. hysterophorus affect livestock through poisoning. Evans (1997) indicated that the impact of

parthenium on livestock production is direct as well as indirect. The weed affects grazing land, animal health, milk, meat quality, the marketing of pasture seeds, and grain. In addition, the presence of *parthenium* caused the need for establishment of new improved pasture and production of extra cultivated forage, both of which added to the cost of beef production (Chippendale and Panneta, 1994).

2.9. Bracken fern (western bracken)

Bracken fern *(Pteridium aquiline var. pubescens*) are deciduous and grow from brown to black woody rhizomes, forming large often dense patches. The leaves emerge from erect fronds and are pinnately compound, scattered, erect, coarse, narrowly or broadly triangular, to 2 m in height. Fronds (leaves) are pinnules (ultimate segments), entire in the apices of the pinnae, lobed toward the stalk. Reproduction is by spores produced in sporangia lining the under surface margins of the photosynthetic fronds when reproductive, covered by the narrow recurved edge of the leaf (Burrows and Tyrl, 2001; Panter *et al*., 2011).

Bracken fern is widely distributed in many places around the world. Bracken fern grows on burned over areas, in wood lands and other shaded places, on hillsides, open pastures and ranges in sandy or gravelly soils. The plant starts growth in the early spring and usually remains green until the leaves are killed by frost (Stegelmeier *et al*., 1999). Bracken fern *(Pteridium aquiline var. pubescens*) is poisonous to cattle, sheep and horses; sheep, however, are more resistant. Bracken fern contains thiaminase inhibitors that lead to the development of thiamine deficiency in horses that can be remedied by giving thiamine. Milk from cows that graze bracken fern may be hazardous to humans. All portions of the fern both green and in harvested hay are poisonous to livestock (Panter *et al*., 2011). Bracken fern causes a wide range of syndromes that have been described in livestock including thiamine deficiency in monogastrics, acute hemorrhagic disease associated with bone marrow aplasia and ulceration of the upper GI tract, “bright blindness” progressive retinal degeneration, and neoplasia of the urinary bladder and upper digestive tract (Smith, 2004).

Bracken fern Poisoning often occurs in cattle after they have consumed large amount of plant containing anor-sesquiterpene glycoside called Ptaquiloside, which causes bleeding and damage to the bone marrow. The disease has a delayed onset: cattle may graze the plant for several weeks and then get sick and die. Poisoned animals seldom recover. If consumed over time, Ptaquiloside can also cause cancer in the urinary bladder and gastro intestinal tract. These tumors often bleed, causing red urine (enzootic hematuria or red water disease). All Ptaquiloside samples of rhizome, the apices of the fronds or primordial taken from below the soil surface had no Ptaquiloside; however, very immature croziers only a few centimeters above the surface showed the presence of the toxin (Smith, 2004).

Signs and lesions of bracken in cattle and sheep include: high fever, loss of appetite, depression, difficulty in breathing, excessive salivation, nasal and rectal bleeding, bloody urine, anemia, leucopenia, thrombocytopenia, hemorrhagic syndrome, hemorrhages on mucous membranes, plastic bone marrow and bladder tumors in cattle (Davis *et al*., 2011).

Bracken fern poisoning in horses can occur when they are fed hay containing about twenty percent bracken fern over a period of 30 days. Signs of poisoning include weight loss, incoordination and lethargy. Horses may stand with their legs apart as so bracing themselves and may assume a crouching position with an arched back. Muscle tremors develop and the animal is unable to stand despite violent attempts to do so. Death will occur in several days to a week (Gardner *et al*., 2011).

Animals seldom eat bracken fern if sufficient forage is available; so grazing should be delayed until adequate forage is available. Young shoots are the most toxic and are relatively palatable in early growth stages. Poisoning can be treated with thiamine hydrochloride, saline cathartics, and possibly activated charcoal. Few cattle have recovered after signs of acute poisoning appear; however, horses in early stages of poisoning may be saved by intravenous injections of thiamine hydrochloride parenteral at 0.5-1 g followed by decreasing doses over the next few days. Symptomatic care with good feed and fresh water accompanied by administration of a laxative but not *mineral* oil is helpful. In ruminants, the bone marrow suppression and deficiency of blood platelets and neutrophils is best treated with antimicrobials to counteract any bacterial infection that might occur because of diminished immune function. Good veterinary care, symptomatic treatment, clean water and quality feed in a quiet clean environment is recommended. In areas where cultivation is practical, the plants can be destroyed by cultivating the soil for two to three years (Ralphs *et al*., 2011).

3. Economic Impacts of Poisonous Plants on Livestock

The deliberate or accidental introduction of non-indigenous species to new habitats has become an increasingly important aspect of global environmental change (Malik and Husain, 2007) and can cause important economic, environmental and social losses. Many research works have shown that invasive plant species have broad distribution throughout the world and can directly or indirectly affect the food security of local residents by destroying natural pasture,

displace native trees, crops, and reduce grazing potential of rangelands and set limitations for economic development (Goulson and Derwent, 2004).

Economic Losses: Poisonous plants and the secondary compounds they produce cause large economic losses to the livestock industries throughout the world**.** The elusive, hard-to-define, almost impossible-to-count nature of the problem has made it very difficult to set an actual dollar value on the economic losses sustained because of livestock poisoning by plants. Yet despite the fact that cost figures are hard to obtain and are somewhat tenuous, if we are to deal with the problem of livestock poisoning by plants, we must at least describe the impact that poisonous plants have on livestock production and develop a best estimate of economic losses. Management decisions are based on an understanding of costs and benefits associated with the decision-making process. In the case of poisonous plants, we must have some idea of cost if we are to say something about risk and evaluate improvements, range programs, land values and other factors in livestock production programs where poisonous plants are involved (Nielsen and James, 1991).

The research finding of Hailu *et al.,* (2004) and Kassahun *et al*. (2004), showed the high spread of invasive plant species in Ethiopia becoming a great concern in national parks, lakes, rivers, power dams, and urban green spaces causing huge economic and ecological losses. They had become major threats to biodiversity loss and socio-economic welfare of the Ethiopians. The prominent ones in which the government declared the need for their control and eradication include *Parthenium hysterophorus*, *Prosopis juliflora*, *Eichhornia crassipes*, *Lantana camara* and Acacia species (McKee, 2007). Economic losses due to livestock poisoning by plants can be divided into 2 parts: (1) direct losses and (2) indirect losses (James, 1987).

Direct Losses: Direct losses of livestock involve the economic impact of poisonous plants on the animal. Poisonous plant causes losses by reducing in the reproductive efficiency of livestock. Several poisonous plants cause females to abort, to be infertile, to give birth to weak offspring that cannot survive or to give birth to deformed offspring that are worthless. They also may cause infertility in males. Infertility can be permanent or temporary, but it still impacts reproduction cycle. The end result is that the calf, lamb or kid crop is less than it would have been if the poisonous plants had not been present. Poisonous plant also causes losses by decreasing immune response, functional inefficiency due to damage to organs such as the nervous system, lungs, liver (Nielsen and James, 1991).

Indirect Losses: Indirect losses include those activities or costs that are incurred by a livestock operation to prevent losses or costs incident to livestock poisonings by plants. Livestock owner are spending a high amount of cost for managing their livestock health and production in areas where poisonous plants are common. These costs include labor to find, treat, and remove affected animals; the cost of building and maintaining fences to keep livestock away from the plants; and underutilization of forage resources. Costs incurred in controlling the plant, which would include spraying with herbicides, grubbing or plowing, pulling the plants, burning, mowing, or other control programs, are added costs due to poisonous plants. Indirect losses also includes the cost that is spent for fences built and maintained to manage livestock at risk due to poisonous plants; herding livestock to prevent poisoning; supplemental feeding to prevent poisoning; altered grazing programs which may result in increased costs or grazing inefficiency; medical costs incident to poisoning; and forage lost because it could not be harvested at the proper time or intensity (Nielsen and James, 1991).

Conclusion and Recommendations

Browsing or grazing animals may have limited access to high-quality forage at certain times of the year and are forced to survive by grazing some poisonous plant species. Hay or forages harvested in areas where poisonous plants are abundant may be contaminated with a high percentage of poisonous plants and when animals are fed contaminated hay, they may be poisoned. There are many different types of plant species in and along pastures and range land and sometimes in hay that can cause toxicity problems to livestock. Plant poisonings will undoubtedly increase in wildlife populations also, as humans continue to encroach on their native ranges and interrupt their migratory pathways. There are times such as early spring, during summer or droughts when forage supplies are low and this is when one needs to be most aware of what livestock is grazing. Based on the above conclusion the following fundamental recommendations are pinpointed:

- Understand and recognize the plants on your range or pastures and know the potential hazards of grazing where poisonous plants grow.
- Giving adequate feed during drought season.
- Avoid introducing animals to poisonous plant-infested ranges when adequate, good quality forage is not available.
- Creating awareness of the season of most poisonous plants when they are growing.

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