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DETECTION OF NITRATE ACCUMULATION IN FORAGE CROP (SORGHUM) OF SALEM DISTRICT

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Abstract:-

Nitrates transpire in drought conditions in poor pastures and reduce forage yields. Producers use barren or low producing grain crops as replacement forage. These forages may be toxic due to high nitrate level accumulation from water. Nitrate analysis from Panamarathupatti zone of Salem district revealed high level of prevalence and hence veterinarians and livestock owners should be aware of the prevailing nitrate contents in forage which would decline the health of livestock.

Keywords:-

Nitrate, Sorghum forage and livestock health. Nitrates in forages do not in themselves cause the poisoning of farm animals. Instead, they are converted to nitrites in the animal, and nitrites are toxic. When the temperature is high and moisture is adequate, plants may undergo a process called photorespiration. Photorespiration produces carbon dioxide rather than assimilating carbon into energy building blocks (i.e., sugars, carbohydrates, etc.). This may cause nitrates to accumulate in cows and sheep this conversion takes place in the rumen (paunch). If forage contains too much nitrate the animals cannot complete the conversion and nitrite levels build up and the animal suffers from a type of asphyxiation.

Materials and methods:

Sorghum forage crops commonly used as fodder for farm animals were evaluated for the nitrate content. The nitrate content was detected in samples of sorghum crops that were collected randomly from 26 different areas of Panamarathupathi block of Salem district. Nitrate detections were done in freshly split plant stems.

The diphenylamine test is comprised of diphenylamine salt (0.1 grams) dissolved in sulfuric acid (30 ml-36N). A single drop of this acid reagent is placed on a freshly split plant stem. If a dark blue color develops immediately (in the first 5 seconds), nitrate is present. If there is no immediate change in color there is no nitrate; however, a dark color (brown/black) will eventually develop if the reagent remains on the plant tissue for an extended time. The dark color is caused by acid caramelizing the plant sugars and carbohydrates (T.L. Provin *et al.*, 1914). The pictures below illustrate results of the nitrate spot test (Fig 1).

Results and discussion:

The amount of nitrate accumulated within the plant depends upon the rate of nitrogen uptake by the plant from the soil and the rate of its reduction by the plant. There is no accumulation when the rate of reduction equals the rate of uptake and when uptake exceeds the rate of reduction, nitrate starts getting accumulated. Some species, viz., sorghum, oats, sudan grass, etc., are known nitrate accumulators and may cause sudden death in animals (Burrows GE *et al.*, 1989). About 26 samples of Sorghum forage crops were analyzed for nitrate analysis from Panamarathupatti block of Salem district. In those samples 22 experimental plants (84.61%) showed the presence of nitrates in them. (Graph 1). Panamarathupatti falls under the over exploited zone of ground water according to NADP, 2009. Jain and Vivek Sharma (2011) from Central Ground water board reported 335 mg/l of nitrate level in the water of Panamarathupatti region. Nitrate can be detected in traceable amounts in all plants but it becomes dangerous when it exceeds the safe limit of 2500 ppm NO₃-N and forages having more than 4500 ppm NO₃-N are considered highly toxic. Seven outbreaks due to consumption of fodder having excessive amount of nitrate have been recorded in bovines in Punjab during 2002–2007 (Annual Progress Reports, Animal Disease Research Centre, GADVASU, Ludhiana; 2002-2007). Two dreadful outbreaks associated with consumption of fodder containing toxic amount of nitrate occurred recently in Tajpur and Haibowal Dairy Complexes, Ludhiana, Punjab, and 105 dairy cattle died in these unfortunate incidents. Even the low level of nitrate in fodder may lead to slight respiratory distress and help respiratory infections to flourish. Reduced weight gain and impaired fertility has been reported in cattle grazing pasture having NO₃-N in the range of 801–3400 ppm (Richards SA, 2007). Therefore, Sorghum forage crops commonly used as fodder for farm animals were evaluated for nitrate content and the factors influencing its accumulation were studied. Besides the above factors, weather conditions influence nitrate accumulation in plants significantly. Unfavorable weather conditions for plant growth, viz., drought, frost, extreme cold and cloudy weather, may increase nitrate accumulation in plants (Kahn CM, 2005). In the present study, nitrate level was significantly higher in forages when determined in hot drought conditions than the nitrate concentrations found in same fields under normal weather conditions.

Deep blue/black colour appeared which indicated the presence of nitrates in the zone. As reported by Radiositis OM, 2000, Sorghum is one of the most notorious accumulators of nitrate. Nitrates that are present in Sorghum can easily enter into the body of livestock and hence the farmers should be cautious of the feed which are provided to livestock and veterinarians should alert the farmers regarding the environmental pollution in the concerned areas. The forage containing high nitrate content (sorghum, oats and toriya) may be used by mixing with other crops having a low amount of nitrate to reduce the chances of toxicity in dairy animals. The forages should not be grown in the fields receiving sewage water or sludge or industrial effluents which may lead to serious nitrate toxicities in the farm animals. Besides high levels of nitrate, other commonly used chemicals (pesticides, other fertilizers, etc.) in agricultural practices also occur in the environment. Synergistic or additive effect of these chemicals needs to be determined to minimize the risk of adverse effects on human and animal health.

Conclusion

Nitrate poisoning can be a serious problem for livestock producers if not considered in their management plan. Drought, excessive soil nitrogen, shade, certain herbicides, acid soils, low growing temperatures and nutrient deficiencies can contribute to high nitrate levels in plants. Stems usually have higher nitrate content than leaves. Problem arises when nitrate content of water is neglected. Avoid poisoning by routinely testing any forage suspected of containing excessive nitrate. High nitrate forages can be used by diluting it with other feedstuffs and supplementing it with energy. Excessive nitrate in feedstuffs and water is an important consideration in animal health. Nitrate poisoning can be rapidly fatal. When nitrate is suspected, remove the contaminated feed and provide a high energy feed such as corn. A veterinarian should be called immediately to confirm the tentative diagnosis. Because death is a result of oxygen shortage, handle cattle as little and as quietly as possible to minimize their oxygen needs.

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Graph 1: The Graph shows the percentage of nitrate detection in total of 26 samples of Sorghum crop in Salem district.

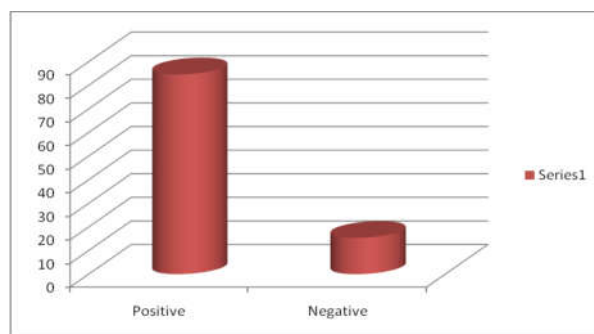


Fig 1: Experimental sample showing the presences of Nitrate detection in the freshly cut stem of Sorghum plant along with control sample.

