International Journal of Science, Environment and Technology, Vol. 8, No 5, 2019, 1023 – 1027
ISSN 2278-3687 (O)
2277-663X (P)

QUANTITATIVE DETERMINATION OF HCN IN GUNDRIJOWAR (*SORGHUM VULGARE*) FODDER CROP DURING DIFFERENT STAGES OF GROWTH IN SUMMER SEASON

C.N. Jadav, R.B. Makwana*, S.S. Parikh, K.S. Murthy and P.U. Gajbhiye
Cattle Breeding Farm, Junagadh Agricultural University,
Junagadh- 362001, Gujarat, India
E-mail: rinkeshvets@gmail.com (**Corresponding Author*)

Abstract: The present experimental work was conducted in summer season from year 2013-2015 at Cattle Breeding Farm, Junagadh agricultural University, Junagadh, Gujarat, India. Gundrijowar fodder samples were collected for quantitative HCN (mg/100 gm dry matter) concentration from eight sown plots from 15 DAS (Day after sowing) up to 60 DAS at fifteen days intervals and one more sampling was carried out when Gundrijowar fodder crops exhibit 25% flowering stage. Result revealed that concentration of HCN (mg/100 gm dry matter) in Gundrijowar fodder crop was decreased significantly ($p<0.05$) up to 25% flowering stage in summer season during the year 2013 and 2015. While in the year 2014 significant decline was up to 60 DAS and the concentration was at par at 60 DAS and 25% of flowering stage. Pooled data showed similar trend to that of the year 2014 with reference to HCN concentration. It was concluded that freshly cut Gundrijowar (*Sorghum vulgare*) fodder can be fed safely without any poisonous effect to animals at 25% flowering stage.
Keywords: Gundrijowar, Summer, HCN, DAS (Day after Sowing).

1. Introduction

Cultivation of sorghum compare to other forage crops is widely practiced due to suitability to wide variation in soil and climatic conditions, its high tolerance to various stresses and having many advantages like high biomass accumulation, quick growth, high dry matter content and wide adaptability besides drought withstanding ability (Reddy *et al*., 2004). Gundrijowar (*Sorghum vulgare*) is commonly grown single cut variety of sorghum in Saurashtra region of Gujarat. It is nutritious, palatable fodder crops and it can be fed as green, dry or as conserved fodder in the form of silage or hay.

Sorghum is considered to be a good feed in ordinary conditions but when its normal growth is constrained by drought or imbalanced soil nutrients, hydrocyanic acid (HCN) content may develop to such an extent that the toxic level may reach lethal level when fed to animals (Fjell *et al*., 1991). Cyanide occurs in the leaves of sorghum as cyanogenic glycoside dhurrin. Degradation of dhurrin yields equimolar amount of hydrocyanic, glucose and P-hydroxybenzaldehyde (P-HB). Ruminant animals are very susceptible to HCN poisoning

*Received Aug 30, 2019 * Published Oct 2, 2019 * www.ijset.net*

because environment of rumen is slightly acidic, more water content and microflora present in rumen can rapidly convert cyanogenic glyocosides available in plants to free cyanide gas "Prussic acid poisoning or hydrocyanic acid poisoning (HCN)". The patient can't use caloric oxygen and cellular respiration stops immediately and death occurs due to histotoxic anoxia. The death of animals and even at doses as little as 0.5 gm is sufficient to kill a cow.

The risk of HCN toxicity decreases with maturity of the plant, older plants and leaves contain less cyanogenic glycoside (Carlson and Anderson, 2013). The safe limit of HCN in green forage for livestock is 500 ppm on fresh weight basis and 200 ppm on dry weight basis (Karthika and Kalpana, 2017). Present experiment was planned to estimate varying levels of HCN in Gundrijowar (*Sorghum vulgare*) fodder crop during their growth period to keep dairy farmers informed to feeding to ruminant animals at safe level of HCN.

2. Materials and Methods

2.1. Sampling materials:

Gundrijowar fodder samples were collected for quantitative HCN (mg/100 gm dry matter) concentration from eight sown plots from 15 DAS (Day after sowing) up to 60 DAS at regularly fortnightly intervals and one more sampling was carried out when Gundrijowar fodder crops exhibit 25% flowering stage.

2.2. Design of Experiment:

The present research trial was conducted in randomly selected 8 plots (100x100 sq meter sizes) in which Gundrijowar (*Sorgum vulgare*) fodder crops were cultivated in summer season from year 2013-2015.

2.3. Statistical Analysis:

All the recorded data were subjected to statistical analysis by "factorial and completely randomized design" (FCRD) employing one-way analysis of variance as per Snedecor and Cochran (1994). A p-value of <0.05 was considered as significant difference among the treatments groups and the comparison of means were tested as per Duncan's multiple range test (DMRT) described by Duncan (1955).

2.4. Procedure for quantitative estimation of HCN (mg/100 gm dry matter) concentration in Gundrijowar (*Sorgum vulgare*):

Quantitative estimation of HCN (mg/100 gm dry matter) was done according to AOAC (1995) as under:

- Two gram of green chopped Gundrijowar fodder sample was taken in a test tube and moistened with distilled water. Few drops of chloroform were added to the contents of the test tube.
- Sodium Picrate filter paper strips (1x10 cm Whatsman filter paper no.1) were prepared by dipping the strips into solution containing 1% Picric acid and 10% Sodium Carbonate and air dried.
- Filter papers were inserted into the test tube containing fodder sample and closed with a rubber cork.
- Change in color of filter paper happened immediately after five minutes, however strips were allowed to remain for about six hours in the test tube.
- Filter paper turned from yellow color to brick red color as per the concentration of HCN.
- After evaluating qualitatively, filter paper strips were removed from the test tube chopped to small pieces in to another test tube containing 10 ml distilled water.
- Filter paper strips were thoroughly mixed in a Cyclomixer and centrifuged at 5000 rpm for 10 minutes and color intensity was read using Spectronic 20 @ 520 nm.
- Standard curve was prepared by following the above method using Potassium Cyanide.

3. Observations Recorded

3.1. HCN (mg/100 gm dry matter) concentration in Gundrijowar (*Sorghum vulgare*):

Concentration of Hydrocyanic acid (HCN-mg/100 gm dry matter) measured at fortnightly intervals from 15 DAS (Day after sowing) up to 60 DAS from Gundrijowar fodder samples from eight sown plots and one more sampling was carried out when Gundrijowar fodder crops exhibit 25% flowering stage.

Table 1. Concentration of HCN (mg/100 gm dry matter) in Gundrijowar (*Sorghum vulgare*) fodder crop at different stages after sowing during summer season from 2013-2015

Treatment	Summer-2013	Summer-2014	Summer-2015	Pooled
15 DAS	376.13	297.13	273.50	315.58
30 DAS	291.25	171.25	180.25	214.25
45 DAS	137.00	92.00	98.00	109.00
60 DAS	33.00	35.88	53.25	40.71
25% Flowering	10.25	13.50	18.63	14.13
S.Em.±	7.15	12.93	9.76	19.42
C.D. at 5 %	20.54	37.16	28.03	63.33
C.V. %	11.93	30	22.13	20.85
Year				
S.Em.±				15.04
C.D. at 5 %				49.05
YXT				
S.Em.±				10.22
C.D. at 5 %				28.70

4. Results and discussions

Concentration of HCN (mg/100 gm dry matter) in Gundrijowar fodder crop was decreased significantly ($p<0.05$) up to 25% flowering stage in summer season during the year 2013 and 2015. While in the year 2014 significant decline was up to 60 DAS and the concentration was at par at 60 DAS and 25% of flowering stage. Pooled data showed similar trend to that of the year 2014 with reference to HCN concentration (Table 1).

Muthuswamy *et al.* (1976) reported that HCN content was more at the early stage of crop and it decreased at maturity stage. They found that the HCN content was high 18 days after sowing and decreased gradually up to 53 days in CSH 5 type of hybrid variety of sorghum. Chaturvedi *et al.* (1994) reported that HCN content decreased significantly from 65 days after sowing to gain maturity stage. Wheeler *et al.* (1990) also reported decrease in HCN content with plant age in sorghum.

5. Conclusion

It could be concluded that irrespective of the initial HCN concentration (mg/100gm dry matter) in Gundrijowar (*Sorghum vulgare*) at 15 DAS, it declined to safe level of feeding to ruminant animals at 25 % flowering stage.

Acknowledgments

Authors thank the University authorities, Research scientist and Head, Cattle Breeding farm, Junagadh agricultural University, Junagadh, Gujarat for facilities provided and cooperation extended for this work.

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