

Determination of Hydrocyanic Acid (HCN) in *Sorghum vulgare* (Gundrijowar) Fodder during Kharif Season

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ABSTRACT

This study was undertaken in kharif season from year 2013-2015 at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh, Gujarat, India. *Sorghum vulgare* (Gundrijowar) fodder samples were collected for determination of 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 *Sorghum vulgare* (Gundrijowar) fodder crops exhibit 25% flowering stage. Result revealed that Concentration of HCN (mg/100 gm dry matter) in *Sorghum vulgare* (Gundrijowar) fodder crop was decreased significantly ($p < 0.05$) up to 25% flowering stage in kharif season during 2013 and 2014, respectively. In the year 2015, the concentration declined significantly up to 60 days of flowering, while concentrations were at par on 60 DAS and 25% flowering. In the year 2015, HCN concentration though declined from 15 DAS to 45 DAS significantly and it was at par at 60 DAS and 25% flowering. In the pooled data, HCN concentration decline was similar to that of the year 2015. It was concluded that freshly cut *Sorghum vulgare* (Gundrijowar) fodder can be fed safely without any poisonous effect to animals at 25% flowering stage.

Keywords: *Sorghum vulgare*, DAS (Day after Sowing), Kharif, Hydrocyanic Acid (HCN)

INTRODUCTION

Cultivation of sorghum compare to other forage crops is widely practiced due to suitability to wide variation in soil climatic conditions and soil, its good tolerance to various stresses and having many advantages like quick growth, wide adaptability besides drought withstanding ability high dry matter content and high biomass accumulation (Reddy et al., 2004). *Sorghum vulgare* (Gundrijowar) 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).

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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 because environment of rumen is slightly acidic, more water content and microflora present in rumen can rapidly convert cyanogenic glycosides 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 & 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 & Kalpana, 2017). Present experiment was planned to estimate varying levels of HCN in *Sorghum vulgare* (Gundrijowar) fodder crop during their growth period to keep dairy farmers informed to feeding to ruminant animals at safe level of HCN.

MATERIALS AND METHODS

Sampling materials:

Sorghum vulgare (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 *Sorghum vulgare* (Gundrijowar) fodder crops exhibit 25% flowering stage.

Design of Experiment:

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

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).

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

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

- Two gram of green chopped *Sorghum vulgare* (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 Whatman 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.

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

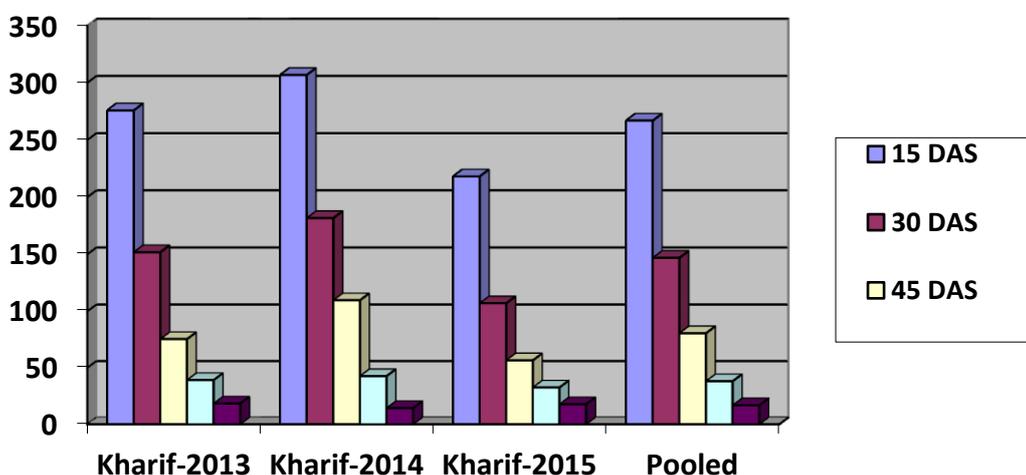
Concentration of Hydrocyanic acid (HCN-mg/100 gm dry matter) measured at fortnightly intervals from 15 DAS (Day after sowing) up

to 60 DAS from *Sorghum vulgare* (Gundrijowar) fodder samples from eight sown plots and one more sampling was carried out when *Sorghum vulgare* (Gundrijowar) fodder crops exhibit 25% flowering stage.

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

Treatment	Kharif-2013	Kharif-2014	Kharif-2015	Pooled
15 DAS	275.88	306.88	218.13	266.96
30 DAS	151.88	181.75	107.13	146.92
45 DAS	75.38	109.75	56.63	80.58
60 DAS	39.13	42.63	32.63	38.13
25% Flowering	18.38	14.38	17.75	16.83
S.Em.±	9.95	7.55	8.15	11.86
C.D. at 5 %	28.58	21.69	23.42	38.67
C.V. %	25.09	16.29	26.67	22.16
Year				
S.Em.±				9.19
C.D. at 5 %				29.96
YXT				
S.Em.±				8.61
C.D. at 5 %				24.17

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



RESULTS AND DISCUSSIONS

Concentration of HCN (mg/100 gm dry matter) in *Sorghum vulgare* (Gundrijowar) fodder crop was decreased significantly ($p < 0.05$) up to 25% flowering stage in kharif season during 2013 and 2014, respectively. In the year 2015, the concentration declined significantly up to 60 days of flowering, while

concentrations were at par on 60 DAS and 25% flowering. In the year 2015, HCN concentration though declined from 15 DAS to 45 DAS significantly and it was at par at 60 DAS and 25% flowering. In the pooled data, HCN concentration decline was similar to that of the year 2015 (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. (2013) 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.

CONCLUSION

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

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