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Sorghum Halepenses and its Cyanide Content

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Abstract: Thirty six samples of fresh green Sorghum at various stages of growth up to 180 cm length were examined for estimation of its cyanide content. The samples were collected from different farms. Results obtained revealed that the concentration increases gradually starting from the 46 cm length of the plant (about 0.698 mg/100g plant) to reach its maximum at the 80 cm length about 2.54 mg/100g plant). It then decreases gradually till it reaches 0.042 mg/100g plant at the 180 cm length.

Key words: Cyanide, sorghum, Saudi Arabia

Introduction

This study was designed by Obizoba and Atii (1991) to determine the effect of soaking, sprouting, fermentation and cooking on nutrient composition and some antinutritional factors of sorghum seeds (guinesia). Standard assay procedures were adopted to resolve both the nutrients and the antinutritional factors content of the products. Combination of cooking and fermentation improved the nutrient quality and drastically reduced the antinutritional factors to save levels much greater than any of the other processing methods tested. The content of the cyanogenic glycoside dhurrin in sorghum (Sorghum bicolor L. Moench) varies depending on plant age and growth conditions. The cyanide potentiate is highest shortly after onset of germination. At this stage nitrogen application has no effect on dhurrin content, whereas in older plants, nitrogen application induces an increase. At all stages, the content of dhurrin correlates well with the activity of the two biosynthetic enzymes, CYP79A1 and CYP79E1 and with the protein and mRN level for the two enzymes. During development, the activity of CYP79A1 is lower than the activity of CYP71E1, suggesting that CYP79A1 catalyzes the rate-limiting setup in dhurrin synthesis as has previously been shown using etiolated seedling. The site of dhurrin synthesis shifts from leaves to stem during plant development. In combination, the results demonstrate that dhurrin content in sorghum is largely determined by transcriptional regulation of the biosynthetic enzymes CYP79A1 and CYP71E1 (Busk and Moller, 2002).

Williams and James (1983) studied the effects of herbicides on the concentration of poisonous compounds in plants. Herbicides may raise, lower, or not affect the concentration of poisonous compounds in plants. The hydrocyanic acid content of wild cherry (*Prunus* spp) decreased after treatment with 2, 4-D and 2, 4, 5-T, but increased in Sudan grass (Sorghum halapense) after treatment with 2, 4-D.

Materials and Methods

Plants: Fresh plants (Sorghum halepenses) were obtained from Al-Ahsa farms. About 100 g of the whole plant for each sample were used at various stages of its growth up to 45 days old. The length average of the plant was measured and recorded before chopped into small pieces.

Methods: A more accurate , through longer procedure for the quantitation of cyanide has been described by (Gettler and Baine, 1938). The tissue is first thoroughly chilled and 100g of the finely minced tissue placed in the 500 ml Flask (B) together with 300 ml cold water, 2 ml mineral oil and 10 ml 5% tartaric acid. The flask is connected to a vertical, water-cooled condenser (C), which in turn is connected to three absorption tube (D) connected in series. Each absorption tube contains 10 ml , 0.1 N NaOH. A water aspirator is connected to the side arm of the last; absorption tube. The flask containing the tissue is heated by means of the water bath (A). The suction is regulated so that the contents of the flask are well agitated but distillation into the first absorption tube proceeds at the rate of about 5 drops per minute. Any cyanide from the first absorption tube will be to proceed for two hours. At the end of this time, the contents of the three absorption tubes are quantitatively transferred to a 100ml volumetric flask and the volume brought to the mark. After thoroughly mixing, 2 ml concentrated NH_4OH and 1 ml 10% potassium iodide solution is added. The cyanide is titrated with 0.005N silver nitrate solution. The endpoint, which is easily observed against a black background, is the bluish white opalescence caused by the formation of AgI. One milliliter 0.005 N silver nitrate is equivalent to 0.266 mg HCN.

Results

The results were showed in Table 1 and Fig. 1. Mean

$X = 104.33 \pm 12$ $Y = 1.33 \pm 0.2$

Correlation coefficient (Pearson correlation) between X (Plant height) and cyanide concentration (Y) = -0.901 **. This means that there is a negative significant (at 1% level of probability) relation between X and Y i.e. each increase in plant height was associated with marked (significant) decrease (reduction) in cyanide.

Table 1: Cyanide content in different lengths of growing sorghum halepeneses

No. Samples	Mean Length (cm)	Cyanide content/ 100 g plant
3	55	1.630
3	60	1.850
3	65	1.920
3	70	2.250
3	80	2.540
3	90	2.0
3	100	1.8
3	102	1.5
3	145	0.224
3	150	0.125
3	155	0.098
3	180	0.042

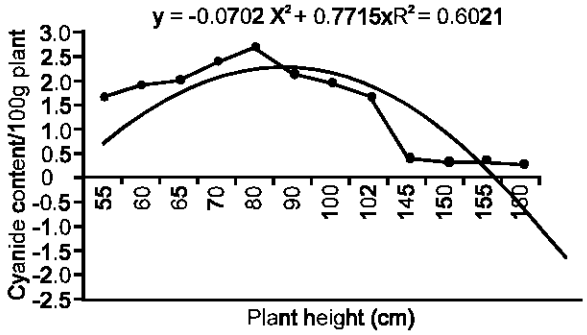

Fig. 1: Cyanide content in relation to plant height of sorghum

Discussion

Results obtained show that the cyanide content increases with the growing plant being 1.63 mg/100g plant when it is about 55-cm length and gradually increases to reach its maximum (2.540 mg/100 gm when its length is 80 cm. High concentrations of cyanide increases gradually with increase of length. It was 2.25 mg/100g when its length was 70 cm. As stated by Garner (1957), In practice animals, which eat rapidly, die from an intake of plant material equivalent to a hydrocyanic acid content of 1.8 mg/lb.b wt.

The present results show that at the length 55 cm. (Start of period of high concentration), one lb. content 7.39 mg/lb whereas it contains at time of maximum concentration 11-52 mg/lb. With start declining at 102 cm length cyanide content is 6-8mg/lb, than it decrease gradually till it reaches 0.19mg/lb at 180 cm length.

In Saudi Arabia, during the dry season, green corn represents the most available green fodder for the livestock in most parts of Saudi Arabia. Although it should be used in restricted amounts as a supplement during the dry season, yet during the period of thinning of the plant (20-30 days old) farmers usually give their animals liberal amounts which may cause their poisoning, especially if eaten rapidly as mentioned by Garner (1957) and even in few month full that lead to death of animals if given in these stages as stated by Morrison (1959); Ibrahim *et al.* (1969). Therefore farmers should be worned not to use green corn as a fodder when the plant is from 12-35 days old, a period in which cyanide is at its highest concentration.

The present results are parallel with that recorded by Ibrahim *et al.* (1969) where the maximum concentration of the cyanide reaches at 78cm of the plant (corn). The cyanide content may increase or/and decrease due to application of certain herbicide as 2, 4, 5-T and 2, 4-D. (Williams and James, 1983). It is concluded that the farmers must be ovoide to introduce S.halepenses into the ration of the animals when it not reach to 110 cm, where the cyanide content at 100 cm was about 1.8 and this cyanide content caused death to the animals as cited by Garner (1957).

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