A STUDY OF THE GIANT STAR GRASS (CYNODON SP.) FOR HCN CONTENT, YIELD AND PALATABILITY

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Introduction

Pole Evans first reported on the Giant Star grass in his note "A Grass Leviathan from East Africa" in *Nature*, July 1, 1939. Giant Star grass belongs to the genus Cynodon and is a species allied to *C. dactylon* (*hariali* or *doob*). This grass came to be introduced into cultivation at the grass plots laid down at Kabete, near Nairobi, Kenya, by the chance introduction of its seed from sod of a fine-leaved lawn grass from Uganda. The performance of this grass from the very first was so remarkable and arresting that expeditions sent by the South African Government into Central and East Africa on collection of useful pasture grasses were instructed to be on the look-out for this grass. The expedition has since reported on the natural occurrence of this grass in some parts of Kenya and Uganda.

Trials taken on this grass at the Department of Agriculture's Grass Introduction Research Station at Pretoria have shown that it is highly useful for hay, silage and erosion control. Pole Evans in his note reports that it is customary, among stock owners who have grazed their animals in the country around Nakuru and which have developed "Nakuritis," presumably a deficiency disease, to send them to grass areas round Lake Solai which are rich in Giant Star grass for recovery from this disease.

The photograph included in the note referred to above, illustrates clearly the remarkable habit of this Star grass. A single runner in five and a half months attained a length of 48½ feet besides giving rise to numerous side shoots all along its length; within the same period a single plant covered 8,000 square feet of ground. The plant is remarkable in that it anchors itself to the ground firmly by rooting itself at every node, thus proving of immense value as an excellent soil binder. In view of these excellent characteristics, it was proposed to introduce this grass into Bombay Province.

Material and Method

The first sample of seed of Giant Star grass received from Mr. D. C. Edwards of the Department of Agriculture, Kenya, totally failed to germinate. The same officer was kind enough to supply living material and sample of seeds of the Star grass a second time by airmail. In all, four rooted cuttings were received which were immediately planted in 12"

pots containing good river earth. The rooted cuttings established themselves very quickly. The second sample of seeds received germinated fairly satisfactorily and a number of seedlings was obtained. These were later transplanted into the ground where they grew very rapidly. The grass showed all the characteristics of growth reported by Pole Evans.

Soon after the Giant Star grass was established at Poona, which receives an annual rainfall of 22", and where the months of March, April and May are very warm with the temperature varying between 100° F. to 109° F. the writers came across a note by the Chief Chemist to New South Wales Government, in the *Agricultural Gazette*, 1940, Vol. 51, No. 4, in which a warning had been given against the possible danger of stock-poisoning from feeding on Giant Star grass as its HCN content was high as to be lethal. A similar warning was received from the Chief of the Division of Soil and Veld Conservation, South Africa, from whom seed sample of the Star grass had been received, but which failed to germinate. In view of these warnings, any intention of distributing the grass for introduction in various parts of the Bombay Province was given up for the time being and instead, trials were conducted to test the stock-poisoning effect, HCN content, yield, etc., of the Giant Star grass.

TABLE I

Prussic acid content of Giant Star grass grown in the Economic Botanist's area, Poona, from rooted cuttings received from Africa, on 28th January 1940*

Condition of crop at the time of sampling	Date of analysis	Hydrocynic acid content	
		Local *Hariali*	Giant Star
1. Raised from rooted cuttings. Crop not yet in flower	17-6-40	0·039	0·043
2. 1st ratoon crop from No. 1 above ..	30-9-40	0·004	0·008
3. The above crop soon after commencement of flowering	28-11-40	0·002	0·006
4. 2nd ratoon crop, shoot with plenty of young leaves. The plot was previously harvested on 11-12-40, the shoots were only 5 weeks old when sent for analysis	20 1-41	0·001	0·057
5. The above crop sent to analysis when 2½ feet tall. Crop not in flower. Leaf and stem samples analysed separately	26-2-41	Stems 0·0009 Leaves 0·002	Stems 0·019 Leaves 0·067
6. A sample of Giant Star grass raised from seeds. Crop in flower ..	24-4-41	0·003	0·013
7. Crop, 1 to 1½ feet tall	2-6-41	..	0 04

* The analysis for HCN and other content was done by the Agricultural Chemist to Government, B. P., Poona. The materials sent for analysis were from different plantings and different ratoons.

In Table I is given the HCN content of the Giant Star grass together with that of *hariali* (*doob* grass–*Cynodon dactylon*). It is observed that the HCN content of local *hariali* (*Cynodon dactylon*) is in every instance less than that of the Giant Star grass. Item (5) shows that the leaves of the Star grass contain considerably more HCN than its stem. This agrees with the observations of Acharya (1933) and Franzke *et al.* (1939) reported for *Sorghum*.

In order to determine the relation of age to the HCN content of the grass, a large number of cuttings was simultaneously planted on a day and samples from different cuttings were cut periodically and were analysed. Table II gives the results of such analyses.

TABLE II

Hydorcynic acid content of Giant Star grass raised from cuttings, planted on 15th July 1941

(Samples for analysis were obtained only once from each cutting)

Date of cutting specimens for analysis	Age of samples from date of planting in days	Moisture content %	Prussic acid content %	Remarks
13—8–41	29	78·00	0·049	There was no irrigation or rain after planting till 13/14–9–41
27—8–41	43	74·00	0·048	
9—9–41	56	33·00	0·03	
20—9–41	67	68·00	0·041	Hand watering on 9–9–41 after the sample was cut on 9·9·41. Heavy rain on 13/14–9–41.
1–10–41	78	69·00	0·053	
16–10–41	93	67·00	0·044	
28–10–41	105	63·00	0·029	
28–11–41	135	51·00	0·0093	
18–12–41	156	51·00	0·003	
9—1–42	178	50·00	0·0057	
30—1–42	199	49·00	0·005	

The above table shows that with the advance in age of the plants raised from cuttings the HCN content does not show any steady decrease as observed in *Sorghum* by Acharya (1933) and Franzke *et al.* (1939). On the other hand the HCN content of the Giant Star grass somewhat fluctuates in amount showing no exact correlation with the age of the plant. Table II however shows what appears to be some correlation between the moisture content of the grass and its HCN content. High moisuture content is associated with high HCN content although this agreement is not quite perfect. Acharya points out that *Sorghum* plants growing under drought

condition had greater HCN content than those receiving sufficient water for their growth. So far as the Giant Star grass is concerned this observation does not appear to hold good.

Feeding and Palatability Trial

Acharya quoting Couch states that 0·02 per cent. and above of potential prussic acid may cause death of cattle and horses if as little as 5 lbs. is eaten. Green material of the Giant Star grass was fed to different types of animals to test for its stock-poisoning effect, if any. The results of the feeding trials are given in Table III.

TABLE III

Summary of feeding trials of Giant Star grass

Kind of Animal	Dates of feeding	Quantity of Giant Star grass consumed
1. Adult bull weighing over 1000 lbs. ..	12-9-40 to 14-9-40	48 lbs. in 48 hours
2. Adult female buffalo weighing over 1000 lbs.	10-12-40 to 11-12-40	34 lbs. in nearly 31 hours
3. Young male buffalo calf aged 6 months and 2 days weighing 258 lbs.	15-4-41 to 26-4-41	78½ lbs. in 11 days and 9 hours
4. Young male buffalo calf aged 7 months weighing 274 lbs.	25-5-41 to 3-6-41	114½ lbs. in 9 days and 6½ hours
5. Three adult farm bullocks	26-4-41 to 28-4-41	285 lbs. in 2 days and 7 hours
6. Adult farm animals (3 or 4 bullocks) ..	17-6-41	Actual quantity sent 118 lbs. Actual quantity consumed 81 lbs.
7. Pony weighing 280 lbs.	10-11-41 to 15-11-41	52 lbs. for 6 days
	22-11-41 to 24-11-41	26 lbs. for 3 days
8. Sheep	One week	3 to 4 lbs. per sheep per day

During the above feeding trials the prussic acid content of local *hariali* varied between 0·001% to 0·039% and that of the Giant Star grass from 0·006% to 0·057%. In all four different types of animals both young and adults were tried. The feeding trial lasted from one to as many as eleven and half days. The quantity of the Star Grass fed during the period varied from a few lbs. per animal to 114 lbs. None of the animals showed any ill-effect at any time during the trials.

Of the animals to which the Giant Star grass was fed none relished the grass. The animals had to be forced to feed on the grass by starving them of all other feeds. Thus they were obliged to eat the grass. Sometimes when the grass was mixed with other fodder, the animals would pick out the fodder to which they were accustomed and leave out the Star grass. Our experience shows that the Star grass is not relished by animals and that they avoid it if other fodders are available.

Yield Trial

To estimate the yield of the Giant Star grass it was compared with that of Guinea grass (*Panicum maximum*). Table IV gives the yield of the two grasses.

TABLE IV

Comparison of yields of Guinea and Giant Star Grass from 27–2–41. *Six equal sized plots of each. Both plots sown on* 2–12–40 *and replicated according to ABBA plan*

Dates of cuttings	Guinea Grass		Giant Star Grass	
	lbs.	ozs.	lbs.	ozs.
26—4–41	166	5	201	..
11/16—6–41	262	2	..	..
17—6–41	..	..	199	8
15/17—7–41	260	10	..	..
24—7–41	..	..	84	..
23/25—8–41	138	7	..	..
3—9–41	..	..	57	1
27/29—9–41	149	4	..	..
8–10–41	..	..	23	..
31–10–41) 2–11–41)	109	..	..	..
26–11–41	..	..	33	2
19/20–12–41	87	8	..	..
2—2–42	..	..	38	8
17/19—2–41	56	14	..	..
11/13—4–42	153.	2	..	..
14—4–42	..	..	97	1
19—5–42	..	..	50	7
Total of 9 harvests	1,383	4	783	11

Except for one occasion the two grasses were not cut on the same day as the rate of growth of each differed considerably. Although both the grasses were planted on the same day, Guinea grass was far in advance of the growth of the Giant Star grass. Both the grasses were periodically irrigated. Under irrigated condition it is seen that Guinea grass out-yields the Giant Star grass by 76·5%. The comparative yield of the same two grasses under dry condition is yet to be ascertained.

A comparison of the proportion of stem to leaf of *hariali* (*Cynodon dactylon*) and the Giant Star grass showed that the latter contained a greater proportion of stem which on account of being very fibrous and tough are not eaten by the cattle.

TABLE V

Proportion of stem to leaf of Cynodon dactylon *and of Giant Star grass*

Name of the grass	Proportion of fresh			
	Leaves		Stems	
	ozs.	%	ozs.	%
Giant Star	13	44·8	16	55·2
Local *hariali* (*Cynodon dactylon*) ..	12	48·0	13	52·0

The rate of growth of the Giant Star grass was compared with that of *hariali*. A germinated seedling and a sprout from a cutting of the Star grass were planted on the same day with a sprouted cutting of the *hariali*. The longest runner of the Star grass from the cutting measured 42 feet after 22 months' growth, while that from the seedling measured 57 feet. In this period two runners of the *hariali* had each grown 9 feet in length only. Although the growth of the Star grass is not as rapid as that reported by Pole Evans for conditions under Pretoria, yet the Star grass is decidedly a very rapid grower compared to *hariali*.

TABLE VI

Rate of growth of Star Grass and Hariali

Name of the grass	Date of planting	Date of measuring	Longest runner in ft.
Star Grass—			
(*a*) seedling	30–7–40	10–6–42	57
(*b*) cutting	do.	do.	42
Hariali—			
cutting	do.	do.	9

Discussion

The Giant Star grass, a species of Cynodon, is considered to be of great importance in its home in Kenya and Uganda. It is an extremely rapid grower, produces luscious green fodder which has the property of reconditioning and effecting recovery in animals suffering from " Nakuritis, " from which disease cattle suffer in areas round Nakuru (Kenya). Its habit

of covering very extensive areas in a short period, profusely branching and rooting at every node makes it of importance as a very useful soil binder. Trials carried out in the Veld in South Africa have shown that the grass is higly susceptible to frost injury and appears to be more suitable to warm climates. Tests carried out at Poona, in the Bombay Deccan, has shown that the grass is a quick grower and in spite of the higher degree of prussic acid content than that of *hariali* (*C. dactylon*) it has not caused any stock-poisoning in cattle, horse or sheep. The drawback of this grass appears to be mainly its unpalatability. Animals fed on this grass do not relish it unless forcibly fed. Another defect appears to be that the grass completely dies down during the hot months when the temperature ranges between 100° F. to 108° F. Therefore its drought-resistant characteristics are doubtful. It is a poor yielder compared to Guinea grass which is much relished by cattle.

Summary

(1) The Giant Star grass grows very rapidly and has a good soil binding effect.

(2) The HCN content of the Giant Star grass varies from 0·003 to 0·053 per cent. while that of *hariali* (*Cynodon dactylon*) varies from 0·001 to 0·039 per cent.

(3) Feeding trials carried out on bullock, buffalo, pony and sheep showed no stock-poisoning effect.

(4) Animals fed on Giant Star grass have not relished the grass.

(5) Under irrigated conditions Guinea grass (*Panicum maximum*) has yielded 76·5 per cent. more than Giant Star grass.

(6) The proportion of stem is greater than leaf in the Giant Star grass as compared to *hariali* (*C. dactylon*) in which the proportion is very nearly equal.

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Giant Star (*Cynodon* sp.) grass grown to a height of three and half feet