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NUTRITIONAL ASPECT OF TAPIOCA PEEL FOR LIVESTOCK FEED AS INFLUENCED BY VARIETIES AND FERTILIZER APPLICATION

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In Tapioca, peel constituting about one-sixth of the whole tuber yielded 3.8 to 6.7 t/ha. Variety H 165 had higher HCN content (160 ppm) than Burma variety (464 ppm). The high HCN content could be detoxified by sun drying the material and could be used safely. The mean crude protein, P and Ca contents were 11.03, 0.18 and 1.11 per cent respectively which is comparable to that of cereal fodders. Among the micronutrients Fe was present at higher concentration followed by Zn Mn and Cu. So tapicoa peel which is a nutritious fodder can be fed to the cattle safely after detoxification by drying in sun.

Tapioca (*Manihot esculenta crantz*) tuber after removing the rind was mainly used as a source of human food and raw material for the extraction of starch in starch industries. Therefore most of the chemical analyses earlier were made on the peeled tuber portion. At present the use of tapioca peel as animal feed has increased due to its availability in large quantities from starch industries. Therefore a knowledge on the chemical composition of tapioca peel will be useful from the animal nutrition point of view. With this focus in view the study on the chemical composition of tapioca peel as influenced by fertilizer application was made.

MATERIALS AND METHODS

A field trial was conducted in a sandy loam soil analysing low, medium and high in available N, P, and K status. The treatments consisted of four levels in each of N (0, 50, 100 and 150 Kg/ha) and K_2O (0, 100, 200 and 300 Kg/ha) and two tapioca varieties (Burma and H. 165). The tuber was harvested at tenth month age of crop. The proportion of the peel to the whole tuber was assessed from a weighed quantity of tuber. The dry matter content of the peel was determined The N content was determined to assess the crude protein content. Phosphours was determined in the triple acid extract (HNO_3 : H_2SO_4 : $HClO_4$: 9:2:1) by vanadomolybdo phosphoric yellow colour mothod (Jackson. 1967). All the four micronutrients *viz*. Fe, Mn, Zn and Cu were determined in the triple acid extract using atomic absorption spectrophotometer. The hydrocyanic acid content of the fresh peel was estimated by the method of Gilchrist *et al* (1967) as modified by Indira and Sinha (1969).

RESULTS AND DISCUSSION

The mean peel yield and the composition of peel as influenced by the treatments are presented in tables 1 and 2.

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Table 1. Tapioca peel yield (t/ha, fresh weight basis)

Nitrogen levels kg/ha	Varieties		Mean	Potash levels (kg/ha)			
	Burma	H 165		0	100	200	300
0	5.03	3.78	4.40	4.02	4.61	4 53	4.46
50	7.18	5.16	6.17	5.88	6.64	5 60	6.36
100	5.98	5.02	5.50	4.72	4.98	5.85	6.44
150	6.68	4.95	5.82	5.05	6.40	6 09	5.72
Mean	6.22	4.73	5 48	4 92	5.66	5.57	5.74
SE	0.25		0 35	0.17			
CD at 5%	0.75		1.07	0.48			

Peel yield : The mean fresh Peel yield ranged from 3. 78 to 7. 18 t/ha (Table 1). Burma variety yielded significantly higher peel than H 165. This was due to thicker rind in Burma variety than in H 165. Application of nitrogen had significantly increased the peel yield over control. But among the different levels of N the yield did not differ significantly. Similarly, K fertilization had produced higher peel yield over contorl.

Peel per cent : The proportion of peel in the tuber was found to be significantly influenced by varieties only. Burma variety had highest peel (16.7 per cent) content than H 165 (12.6 per cent) (Table 2). The lower proportion of peel to the total tuber in H 165 variety was due to its thinner rind than Burma. Barrios and Bressani (1967) had also recorded 16-20 per cent peel in the varieties investigated. Application of N and K did not influence the proportion of peel in the tuber as observed by Vijayan and Aiyer (1969).

Hydrocyanic acid : The study on the cyanogenetic glucoside concentration in the fresh tapioca peel is of great importance because the compound is known to cause acute and chronic poisoning in cattle. The toxic properties associated with cyanogenetic glucosides are due to the HCN released from the glucoside compounds by the activity of the enzyme linamarase. It had been reported that the HCN present in the peel was the highest compared to other parts of the tapioca plant. Gownde (1974) reported HCN levels in mg/kg of fresh parts as 568-620 in young leaves, 400-530 in mature leaves, 590-608 in root bark and 33-45 in tuber pulp. Vander Walt (1944) stated that the degree of poisoning in livestock depends upon the quantity of the material taken in by the animal, previous diet and per cent of total HCN content in the feed. Garner (1957) observed that an intake of plant material equivalent to HCN intake of 4 mg/kg body weight could be regarded as lethal if it is consumed fairly quickly. Considering the available information on lethal dose of HCN, feeding large quantities of fresh material at a time should be avoided as a safeguard against poisoning. Since tapioca peel has good potential as livestock feed, the

Table 2. Chemical composition of tapioca peel

	Fresh weight basis		Dry matter content	Dry matter basis						
	Peel %	HCN ppm		Crude protein content	P%	Ca%	Fe (ppm)	Mn (ppm)	Zn (ppm)	Cu (ppm)
Varieties										
Burma	16.72	464	20.77	11.14	0.18	1.20	406	15.4	59.5	6.1
H 165	12 65	601	23.00	10.92	0.19	1.02	345	15.4	59.3	5.8
S.E.	0.56	36.6	0 21	0.30	0 01	0.07	25	0.48	2.4	0.16
CD at 5%	1.71	105.1	0.60	—	—	—	—	—	—	—
N (kg/ha)										
0	13.87	499	22.52	10.16	0.18	1.14	322	15.7	60.7	6.3
50	14.73	508	21.71	10.82	0.18	1.10	402	16.0	60.0	5.8
100	14.59	548	21.82	11.29	0.19	1.08	410	15.7	59.6	5 9
150	15.55	576	21 50	11.84	0 19	1.13	370	14.9	57.4	6.0
S.E.	0.67	32.4	0,38	0 24	0.01	0.09	28	0.54	2.1	0.12
C.D. at 5%	—	—	—	0.69	—	—	—	—	—	—
K_2O (kg/ha)										
0	15.04	576	21.92	11.13	0.13	1.18	373	15.3	57.9	6.2
100	15 00	566	21.72	10 86	0.19	1.08	317	15 0	59.6	5.2
200	14.25	532	21.91	11.10	0 18	1.07	404	15.7	60 4	6.5
300	14.46	462	22.00	11.02	0.18	1.13	410	15.7	59.7	5.9
S,E.	0.60	30 6	0.16	0,22	0.01	0.06	32	0 34	2.3	0.17
CD at 5%	—	—	—	—	—	—	—	—	—	—

detoxification studies were conducted by several investigators. Mere sun drying is one of the traditional methods of detoxification of tapioca products. Charavanapavan (1944) reported that sun drying alone could remove upto 90 per cent of HCN. Razafinahery (1953) indicated that two thirds of the HCN present was lost during sun drying for sevendays.

In the present investigation the HCN content of H 165 vatiety was higher than that of Burma. Similar varietal variation in the HCN content was also reported by earlier workers (Barrios and Bressani, 1967) Gownde, 1974; Obigbesan, 1977.) Nitrogen and potash fertilization failed to have any significant effect on the HCN content of peel.

Dry matter content: The dry matter content of the peel was observed to be a varietal character. Maximum value of 23.0 per cent being recorded in H 165 variety as against 20.77 per cent in Burma. Fertilizer levels had no effect on the dry matter content of peel.

Crude protein: The crude protein content in the dry matter of the peel ranged from 9.07 to 12.19 per cent. The varieties did not differ in their crude protein. Nitrogen fertilization significantly increased the crude protein content of the peel over control in both the varieties. The protein content of tapioca peel was comparable to cereal fodders such as sorghum and maize

Mineral constituents: The content of p, Ca, Fe, Mn, Zn and Cu in the peel was not influenced either by varieties or fertilizer application. The mean P and Ca contents in the dried peel were 0.18 and 1.11 per cent. The Ca content in the peel was comparatively higher than that of maize, sorghum and grasses such as napier and dinanath. Among the micronutrients studied Fe was present at high concentration (375.5 ppm) followed by Zn (59.4), Mn (15.4) and Cu (6.0). Thus the study also indicated that tapioca peel is also rich in mineral content.

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