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PERFORMANCE EVALUATION OF A FOUR ROLLER SUGARCANE CRUSHER

S. PUGALENDHI, T. PANDIARAJAN and C.T. DEVADAS

College of Agricultural Engineering
Tamil Nadu Agricultural University
Coimbatore - 641 003.

ABSTRACT

At present juice recovery from sugarcane using conventional power crushers is about 60 percent. Nearly 10-20 per cent of juice goes as waste along with bagasse. For increased juice recovery, an improved four roller crusher has been developed. It consisted of rollers, gear train, feed chute, bagasse carrier, juice collection tray and juice outlet. The performance of this crusher over three roller vertical and horizontal crusher was evaluated and compared in terms of capacity, energy consumption and juice extraction efficiency. Juice extraction efficiency was found to be 11 and 8 per cent higher than that of the vertical and horizontal type three roller crusher respectively.

KEY WORDS: Juice extraction efficiency, Capacity, Roller clearance.

Sugarcane is one of the important cash crops grown in India. About 60 per cent of the cane produced in the country is used for production of gur, which is obtained by evaporating the juice. The efficiency of vertical and horizontal crushers in the extraction of juice varies. According to Michael and Ojha (1966) the vertical three roller type crushers yielded 50 to 70 per cent extraction efficiency. Singh (1995) reported that the horizontal roller type crushers yielded 2 per cent more juice than vertical roller crushers when the feeding was uniform.

This shows that there is a scope for increasing the juice extraction efficiency through design and development of improved cane crushers. With this objective a four roller horizontal type power operated sugarcane crusher was developed and tested for its performance.

MATERIALS AND METHODS

The four roller crusher developed is shown in Fig.1. The unit consisted mainly of a feed

hopper, splitting rollers, crushing rollers, fly wheel, juice outlet, bagasse outlet and a housing frame. The king roller was positioned at the top of the frame and the other three rollers viz., the splitting roller, the pressing roller and the extraction roller were positioned at the bottom and around the periphery of the king roller. The position of the counter shaft was arranged in such a way that the 12-teeth closed type pinion attached to the counter shaft meshed with the 50 teeth gear wheel attached to the counter shaft. A juice collection tray was fixed covering the bottom of the three rollers. The drive wheel of the unit was connected to an electric motor of 5.0 hp capacity by a suitable belt drive.

The king roller along with the crushing rollers formed the splitting pair and do the job of splitting and crushing the cane that was fed into the gap between them, thus extracting the juice. The crushed cane passed through the gap between the king and the extraction roller and thus the remaining juice was extracted. The splitting roller clearance was kept at 10 mm. The juice and the

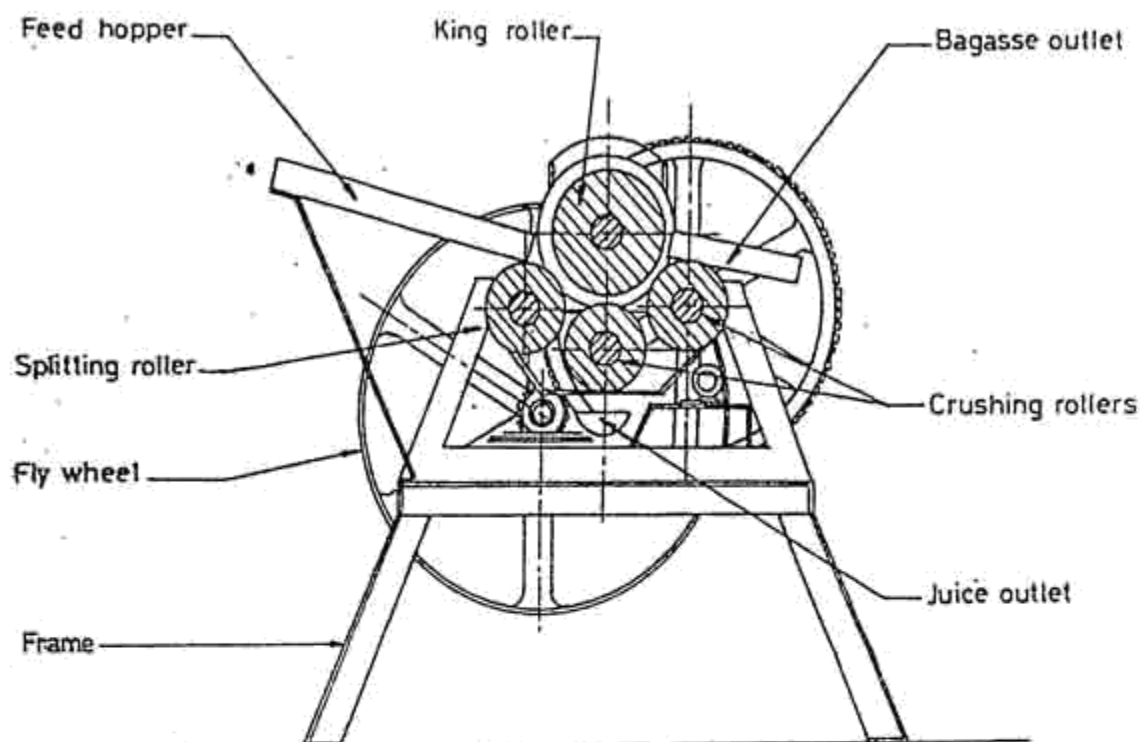


Fig. 1 Four Roller Cane Crusher

fibre content in the cane was 85.5 and 14.5 percent respectively.

Juice Extraction Efficiency

$$= \frac{\text{Weight of actual juice extracted}}{\text{Weight of total juice in cane}} \times 100$$

From the time taken (h) for crushing a known quantity of the cane (kg), the capacity (kg/h) was worked out as the ratio of cane fed and time taken.

RESULTS AND DISCUSSION

The juice extraction efficiency and the capacity of the three crushers are presented in Table 1. The juice extraction efficiency and the capacity of vertical type roller cane crusher were lower compared to the horizontal type rollers. The juice extraction efficiency varied from 42 to 58 per cent under different roller settings and the capacity varied from 160 to 195 kg/h. The average juice extraction efficiency and the capacity were 52 per cent and 178 kg/h respectively in the vertical type roller crusher. The average juice extraction efficiency and the capacity of horizontal type three roller crusher were 55 per cent and 216 kg/h respectively. The increase in recovery and

Table 1. Performance of cane crushers

Working clearance of extraction roller (mm)	Juice collected (Kg)	Capacity (Kg/h)	Juice extraction efficiency (%)
I. VERTICAL THREE ROLLER CRUSHER			
5.0	4.25	195	42.5
4.0	4.65	185	46.5
3.0	5.40	176	54.0
2.0	5.68	165	56.8
1.0	5.80	160	58.0
II. HORIZONTAL THREE ROLLER CRUSHER			
5.0	4.82	230	48.2
4.0	5.00	222	50.2
3.0	5.75	215	57.5
2.0	5.95	209	59.5
1.0	6.15	205	61.5
III. HORIZONTAL FOUR ROLLER CRUSHER			
5.0	5.45	200	54.5
4.0	6.05	190	60.5
3.0	6.35	181	63.5
2.0	6.75	175	67.5
1.0	6.95	170	69.5

capacity of this crusher is due to the uniform feeding throughout the length of the horizontal roller and addition of its self weight during crushing. In the vertical type, the feeding has to be done within the short length of the rollers.

In the horizontal type four roller crusher, the average juice extraction efficiency and the crushing capacity was 63.1 per cent and 183.2 kg/h respectively. Juice extraction efficiency was 11 and 8 per cent more respectively than the three roller vertical type and horizontal type crushers. The average capacity of this improved four roller crusher was 33 kg/h lower when compared with the horizontal three roller crusher. But it was slightly higher over the vertical three roller crusher.

The cost of crushing 1000 kg of sugarcane was calculated as Rs. 22.70 in the case of three roller crusher, whereas it was Rs. 28.50 in four roller crusher. But net return was found to be Rs.

326 for four roller crusher and Rs. 289 for three roller crusher. Thus, by using the four roller crusher an additional income of Rs. 37 could be obtained per 1000 kg of cane crushed. This is 13 per cent higher over the three roller crusher.

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CHANGES IN THE MINERAL METABOLISM OF *GANODERMA* WILT AFFECTED COCONUT PALMS

M. SURIACHANDRASELVAN, H. VIJAYARAGHAVAN, R. BHASKARAN and N. RAMADOSS

Coconut Research Station,
Tamil Nadu Agricultural University,
Veppankulam - 614 906
Tamil Nadu.

ABSTRACT

The changes in the micronutrients content of *Ganoderma* wilt affected and apparently healthy coconut palms were studied. There was a progressive increase in the content of Fe in leaf, root and bark with increase in disease severity. The content of Zn was reduced due to wilt infection in all the tissues studied. Eventhough, there was not much variation in the Mn content of leaf, root and bark from bleeding area, it increased in leaf and root tissues of wilt affected palms.

KEY WORDS : Coconut, *Ganoderma* wilt, Mineral metabolism

Coconut (*Cocos nucifera* L.) palm is affected by many diseases of which *Ganoderma* wilt is a lethal one. The characteristic symptoms of the disease include discolouration, decay and death of roots, oozing of reddish brown fluid from the base of the trunk, drooping of leaves and premature death of the palms (Bhaskaran *et al.*, 1982). Bhaskaran *et al.*, (1991) isolated *Ganoderma lucidum* and *G. applanatum* from the roots of affected palms and proved the pathogenicity. Attempts were made to study the changes in micronutrients content of *Ganoderma* wilt affected coconut palms and the results are reported in this paper.

MATERIALS AND METHODS

Three palms in each category showing mild, moderate and severe infection were selected based on the disease index computed by the method reported by Vijayan and Natarajan (1975).

Four leaflets on either side of the 14th frond and matured roots near the base of the trunk were collected. The bark and cortex from bleeding area and above the bleeding area (healthy portion) from wilt affected palms, and bark and cortex from apparently healthy palms were also sampled for this study. The samples collected were washed with 0.1 N HCl and distilled water and oven-dried at 70° C for four days.