

Field Trials

The Industrial Microbiology Section of the CISIR has conducted five field trials at different parts of the island in order to investigate the feasibility of this process. In all the trials the samples were allowed to stand for 10 hours after collecting to complete the fermentation. Tapping of coconut trees for toddy was carried out daily around 6.00 a.m. and the samples were collected around 6.00 a.m. on the following day. The first field trial conducted at the Coconut Research Institute (15/3/78—20/3/78) involved 77 trees which were grouped into nine batches. Ammonium chloride in the form of a solution was added to the toddy collecting pots at the time of tapping on alternate days. Initially, a concentration of 0.05% w/v ammonia were incorporated into the pot on the first day on the basis of the volume of toddy collected in the pot on the previous day. The results showed that there was a certain amount of suppression in the formation of hydrogen sulphide in some batches after addition of NH_4^+ in this concentration. The total yield of ethanol increased by 28% and the ethanol content of toddy increased by an average of 13.0% in experimental samples when compared with controls. When the concentration of NH_4^+ was increased to 0.08% w/v there was complete suppression of H_2S formation in all the experimental batches. At the same time the total yield of ethanol per batch had increased by 46%; the average increase in the ethanol content was 32% in experimental toddy samples when compared with controls. The residual sugar content in the samples were found to be very much less in experimental batches as compared with controls.

The second field trial which involved 324 trees (13/2/79—20/2/79) was conducted at Galawatte Land Reform Commission Estate, Bandirippuwa. Since the addition of NH_4^+ in solution was inconvenient, it was added in the form of tablets. Each ammonium chloride tablet contained 0.234 g of NH_4^+ . Ammonium chloride was added to give a concentration of approximately 0.08% to empty pots. The results were not as consistent as in the previous trial. Hydrogen sulphide formation was not completely suppressed and the average increase in the ethanol content of toddy in experimental samples was only 7%. The third field trial was conducted at Kiripallagahawatte Estate, Molligoda, Wadduwa, (30/11/79 to 5/12/79), involving 21 coconut trees. One sample was drawn from the toddy collected from each batch of three trees. The procedure of the field trial was as in the second field trial. There was total inhibition of the formation of hydrogen sulphide and also a marked increase in the utilization of sugars in NH_4^+ treated samples. The average increase in the total yield of ethanol per batch was 17% while the average increase in the ethanol content in toddy in the experimental samples were 6.65% v/v.

The final field trial conducted at Molligoda estate, Molligoda, Wadduwa, (29/10/80 — 7/11/80) involved 100 trees and were grouped into 10 batches. There was complete suppression of the formation of hydrogen sulphide and increased the utilization of sugars in experimental batches. The total yield of ethanol per batch increased by about 14%, while the average increase in the ethanol content in toddy was 4.4% in experimental samples as compared to the control samples.

Discussion

The addition of 0.08% w/v. NH_4^+ in the form of a solution or tablets to the pot at the time of tapping suppressed the formation of hydrogen sulphide completely. The use of NH_4^+ also improved the efficiency of the fermentation by enhanced utilization of sugars available in toddy. These have been clearly proved from the results obtained in all the field trials. The average increase in the total yield of ethanol per batch in all the field trials was 26% and the percentage increase of ethanol content was about 13% by the addition of NH_4^+ ions. The increase in the ethanol content in the toddy by the addition of NH_4^+ ions in the field was less than the expected value of 20% in the laboratory results. This may be due to environmental factors such as rain, temperature and humidity. The changes of these factors may vary the concentration of sugars available in sweet toddy, thus varying the percentage of ethanol produced after fermentation. The addition of NH_4^+ ions in the form of tablet to the pot prior to tapping, by tappers, may not provide the exact amount of NH_4^+ needed as the sap yield is assumed to be equivalent to the collection on the previous day.

Economic aspects

In 1978 the State Distilleries Corporation produced 1.47 million proof gallons of ethanol from 2.7 million gallons of toddy. However, 1.5 million proof gallons of rectified spirit was imported at a cost of Rs. 22/- a gallon to cope up with the demand. If the technique described above is implemented on a commercial scale the increase in the yield of ethanol from coconut toddy will be 0.36 million proof gallons (considering 25% increase in the yield of ethanol). This will be a saving of Rs. 7.9 million from the foreign exchange spent on imports of rectified spirits. On deduction of the money required for the import of 7700 kg. of NH_4^+ (commercial grade) the net saving will be Rs. 6.2 millions per year in foreign exchange.

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