1 —28

HUSKING CHARACTERISTICS OF DIFFERENT VARIETIES OF RICE

- Husking Long and Short Grain Rice by Rubber Roll and Impeller Husker -

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1. INTRODUCTION

The husking characteristic of the impeller husker is such that the broken ratio is high for the long grain rice but low for the short grain rice. The converse occurs for the cracked ratio. The relationship between the impeller speed, the husking energy and the husked ratio is well expressed by the Weibull's distribution function. For the rubber roll husker, husking occurs by shearing stress resulting from the difference in speed and the applied pressure on the grain. The specific energy w (J/kg) is given by;

$$w = \mu p \Psi_g l_c \qquad (1)$$

where μ, ψ_g, p (N/kg) and l_c *(m)* are the coefficient of friction, peripheral speed difference ratio, specific normal force and the contact length between the rolls and the paddy rice respectively. The peripheral speed difference ratio ψ_g is given by;

$$\Psi_g = \pi(DN - dn)/v_g \qquad (2)$$

where D(m), N (rpm), d (m) and n (rpm) are the large rolls diameter and speed and the small rolls diameter and speed respectively. v_g (kg/s) is the grain speed.

II. PROCEDURE

Husking characteristics of short grain rice, Akitakomachi (AKITA) and long grain rice, Delta and L201 were analyzed using an experimental rubber roll husker (SATAKE) having rolls with the same diameter of 0.1m. Tests were done at the high speed roll rated speed of 1895 rpm and also varied from 1600 rpm to 2700 rpm. The roll speed difference ratio was kept constant where as the roll clearance was varied from 0.5 mm to. 1.8 mm during the tests. Rough rice at 15% w.b moisture content was fed into the husker at a rate of about 0.0125 kg/s. The parameters determined were moisture content, grain width, grain thickness, husked ratio, broken ratio and cracked ratio. The grain cracks were observed by use of a grain scope (KETT TX200).

III. RESULTS AND DISCUSSION

The short grain (Akitakomachi) had a width of about 2.3 mm compared to 2.2 mm for Delta and 1.9 mm for L201. Husked and broken ratios of the three varieties of rice decrease with the increase of the roll clearance. The husked ratio and the roll clearance were well expressed by an exponential curve. At the rated speed and roll clearance of 1.6 mm, the husked ratio of Akitakomachi was 97.5%. It however decreased significantly to 86.6% at a clearance of 1.8 mm. For Delta, its husked ratio reduced from 94.3% at 1.4 mm to 61.2% at 1.6 mm clearance where as for L201 the husked ratio reduced from 93.4% at 1.2 mm to less than 75% at 1.4 mm clearance (Figure 1). Thus at less than 68% of the grain width, a high husked ratio is obtained. Variation of roll speed at a constant roll speed difference ratio had no significant effect on the husked ratio of the grain. At the rated speed and optimal clearance, the rubber roll husker had high husked ratio but low broken ratio compared to the impeller husker. Thus it's more suitable for long grain rice (Figure 2, 3).

The rubber roll husker had a maximum broken ratio of about 2% for L201 compared to about 16% for the impeller husker operated at the rated speed (Figure 4). However, the grains were scratched on one side due to the high shear force in the roll husker especially at low roll clearance. Although the broken ratio generally decreased with the increase of the clearance for the long grain rice, a sudden unstable region was observed between 0.6 mm and 0.9 mm clearance.

IV. CONCLUSION

The physical properties of the grain had a significant effect on their processing characteristics. The short grain rice was less brittle compared to the long grain rice due to its spherical structure. Compared to the impeller husker, the rubber roll husker is more suitable for husking grains of various sizes and shapes due to the easily varied roll clearance and low broken ratio for long grain rice. To be able to optimize the performance of the rubber roll husker, there is need for further evaluation of the performance characteristics and perfection of the feeding mechanism so as to minimize breakage for the long grain, reduce husking energy and optimize the husking ratio. Further work will include the determination of the parameter in the specific work equation.

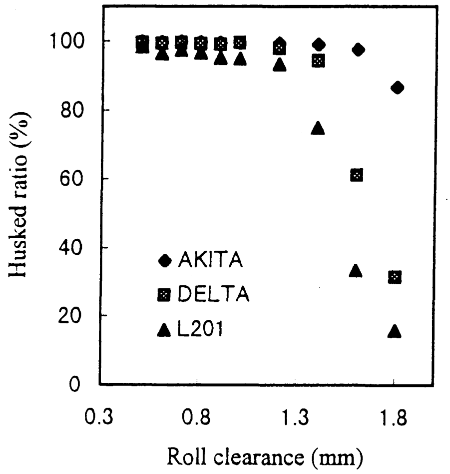

Fig. 1 Effect of roll clearance on husked ratio

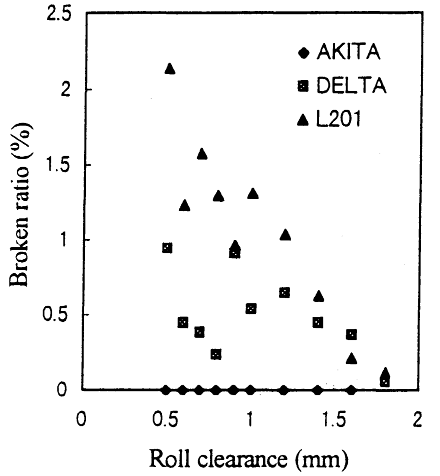

Fig. 2 Effect of roll clearance on broken ratio

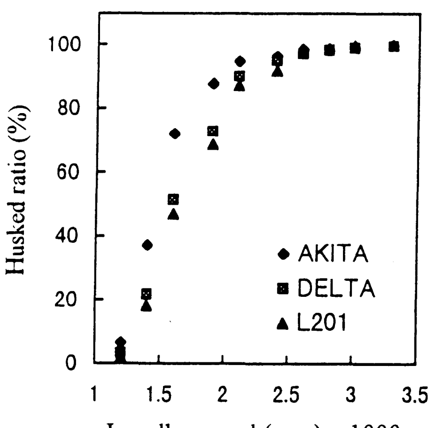

Fig. 3 Effect of impeller speed on husked ratio

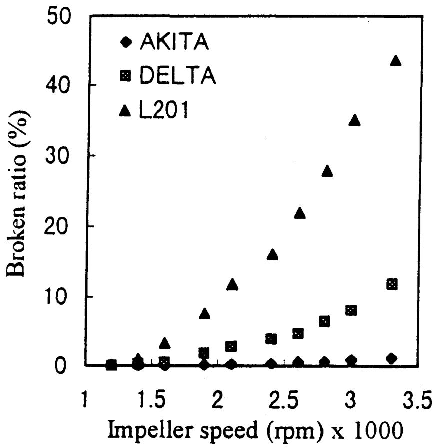

Fig. 4 Effect of impeller speed on broken ratio