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## DEVELOPMENT AND PERFORMANCE EVALUATION OF BIOMASS PELLET MACHINE FOR ON-FARM SUSTAINABLE MANAGEMENT AND VALORIZATION OF PADDY STRAW

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### Abstract

The availability of an extremely limited window of 15 days between the harvesting of paddy and subsequent field bed preparation for the next crop, forces the farmers to adopt on-farm burning of paddy straw as an easy and economical approach for managing their huge straw stockpile. The unwarranted burning of straw prompts enormous soil and environmental pollution leading to numerous health hazards. The conversion of paddy straw into densified pellets can be an eco-friendly and economical alternative. Therefore, this study aims to develop a small-scale pellet-making machine suitable for on-farm sustainable management of residues and its utilization to convert paddy straw into pellets which can be used as an alternative source of fuel. Three different ratios of paddy straw to sawdust (100:0, 80:20, and 50:50) with an initial feed length of 4mm were tested for making pellets. At a feed rate of  $24 \pm 0.5$  kg/h, the output of the machine was  $12.80 \pm 0.5$  kg pellets/h at a 50:50 ratio of paddy straw and sawdust followed by  $12.50 \pm 0.5$  kg/h (100:0) and  $12.60 \pm 0.5$  kg/h (80:20). The average length of pellets ranged between 21.2-87.58 mm with a mean bulk density of  $675 \text{ kg/m}^3$ . The maximum calorific value of pellets ( $14510 \pm 107.23$  kJ/kg) was recorded at a feedstock ratio of 50:50 with 18% moisture content wet basis (wb) while the minimum ( $13366.67 \pm 112.98$  kJ/kg) was in 100% paddy straw and at 14% moisture content wb. The economic feasibility of the machine was thus ascertained.

*Key words:* biofuels, characterization, paddy straw, pellet machine, palletization

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