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Harnessing clean fuel energy through pelletization of agricultural waste: An economically viable technology for rural household use

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Extended Abstract

Key Words: Agricultural waste, pelletization, cost-benefit ratio, adoption feasibility of pellets, economics of pellet use.

1. Introduction

India is mainly an agricultural country, having a huge potential of agricultural waste in the form of crop residues and as by-product from many agro-based industries. Direct burning of loose agricultural waste/biomass in conventional mud-stoves is associated with very low thermal efficiency and widespread air pollution. This indoor air pollution causes serious health problems, especially among women and small children, like difficulty in breathing, irritation in eyes, chronic respiratory diseases, headache and large number of premature deaths among pregnant women. It has also been identified as one of the four most critical global environmental problems by World health Organization (2010). Conversion of agricultural waste into pellets can help not only to overcome these problems but will also create employment opportunities in rural areas. Therefore, the present research was conducted with the following objectives:

1. To work out the economic viability of making pellets as a small scale entrepreneurial unit.
2. To study the use and adoption feasibility of pellet-stove among rural women.
3. To compare the economics of pellet stove over traditional mud stove in terms of time, money and fuel saving while cooking.

2. Methodology:

The study was conducted in 3 phases. In phase 1, a pellet making unit was installed in the selected village and ten rural women were trained in making of pellets. Economic viability of biomass pelletizing was calculated on the basis of cost-benefit ratio over a period of one month. In second phase, to work out the adoption feasibility, a sample of 110 women was selected purposively, based on their willingness to cooperate in the research work. Pellet stoves were distributed to the selected sample and they were trained in use of pellet stoves and requested to use pellets regularly for cooking for atleast three days. In third phase, 10 respondents were requested to prepare a standardized meal, comprising of 20 chapattis and ½ kg potato curry, both, on traditional mud stove and pellet stove. Savings in terms of time, fuel and money were calculated.

3. Results

3.1 Economic Viability of Biomass Pelletizing: Fixed costs i.e., rent of building, depreciation on machine and equipments, and interest on fixed capital amounted to Rs.1,525.06 (2.90% of the total cost per month) while the variable costs (raw material, labour, transportation, electricity, and interest on variable cost) were Rs. 50,982.4 (97.09% of the total cost). Thus, the total cost of production over one month was Rs. 52,507.46. Total production of pellets was 10,800 kg in a month and at selling price of Rs. 10 per kg., the gross returns per month were Rs. 1,08,000. After deducting the total costs from the total gross value of production, the total net returns were Rs. 55,492.54 per month. Cost benefit ratio of pelletizing unit worked out to be 1:2.05. Hence, investment in pelletizing unit is considered to be economically viable.

3.2 Use and Adoption Feasibility of Improved Biomass Pellet Stoves: Maximum respondents used ½ kg pellets at a time (88.18%) and the stove burnt continuously for upto 45 minutes (74.22%). A vast majority of respondents used it for water and milk boiling (90.0 and 89.09 % respectively), chapatti making (89.09%), and for *daal* preparation (68.18%). Respondents perceived this technology as simple and clean (100.0%), easy to store (96.36%), smoke free (95.45%) and time saving (89.09%). Respondents also perceived other advantages like no blackening of utensils, clothes and walls (88.18%), very low ash content (84.45%) and economical (82.72%). However, respondents expressed grave concern over continuous supply of pellets within the village (100.0%) and initial cost of the pellet stove (92.72%). As far as adoption feasibility of the stove was concerned, it was found to be most feasible on all parameters of adoption viz., profitability, cultural compatibility, simplicity, practicability, cost, and triability. On the whole, adoption feasibility of pellet stove was found to be high in rural households.

3.3 Economics of Pellet Stove over Traditional Mud Stove while Cooking: Preparing the standardized meal on pellet stove indicated a saving of 26.34 per cent in time, 64.10 per cent in fuel, and 40.00 per cent in money cost of fuel over traditional mud stove.

4. Conclusion and Implications: There is a vast scope of harnessing and using this clean green fuel from agricultural waste at household level. Improving access to this affordable and sustainable clean fuel is critical for improving health of women and overall quality of life in rural areas. It can also contribute significantly in generating employment opportunities in rural areas, besides reducing our carbon footprints on earth and maintaining sustainable health of the environment. Government should promote making and utilization of this renewable clean green energy to the maximum possible extent at household level by establishing end-user markets on a massive scale.

5. Reference

1. World Health Organization. 2010. The World Health Report 2010. Geneva: World Health Organization. Available online at: <http://www.who.int/whr/en/>