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Use of Renewable Source of Energy for Burning Building Bricks in Bull's Trench Kiln

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ABSTRACT

Bull's Trench Kilns are largely used in India for firing building bricks, using coal as a main fuel. In view of the great shortage of coal and to conserve coal resources, the use of rice husk as an alternative fuel in such kilns has been considered feasible. A technique has been developed at the Central Building Research Institute, Roorkee, which can be utilised to fire bricks with rice husk alone or in partial substitution with coal. Field trials have been undertaken, the results of which show a consumption of 30 tonnes of rice husk and 12 tonnes of dry fire wood or 30 tonnes of rice husk and 7 tonnes of coal to fire one lakh bricks. The technique is simple & economical; whenever rice husk is easily available it can be adopted in field without affecting the quality of bricks, results of which are detailed in the paper.

Introduction

India is an agricultural country and paddy is the one main crop. About 20 million tonnes of rice husk is obtained every year as a waste material which is not being utilised in an economical way. In several developing countries also, rice husk is abundantly available as they are rice growing countries. Some of these countries do not have reserve for brick firing. Even countries rich in oil resources try to save oil and restrict the firing of brick using oil as fuel. Some developing countries have ample agricultural wastes like rice husk, groundnut husk, saw dust etc. These waste materials are produced every year and can be utilised at renewable source of energy for burning bricks where coal is a scarce material.

For major construction activity in the country annual requirement of brick i.e. of the order of 2,500 crores, which needs about 5 million tonnes of coal for firing. Transportation and diminishing reserve of coal has caused high cost of fuel by the time it reaches a kiln site. Hence necessity arises to search out some technique and alternative fuel which arises to search out some technique and alternative fuel which can be used as a substitute to coal for firing bricks. A simple technique has been developed at Central Building Research Institute, Roorkee for its adoption in running Bull's Trench Kiln to get maximum possible saving in coal through use of rice husk, groundnut husk, saw dust, bagasse etc.

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Rice husk is a hard fibrous material which contains about 20% ash. It has got very little nourishing value and not easily digested by cattle. Hence bulk of rice husk can not be consumed as fodder. It can not be used as manure either as it does not easily decay in the fields and helps in harbouring insects which are harmful to crops. Hence it creates a disposal problem to rice mills where it is found in heaps every year. Attempts are being made all over the world to search out techniques for the use of such agricultural wastes as renewable source of energy.

Rice husk has got calorific value round about 2800 Kcal/Kg against that of 7000 Kcal/Kg for best quality of coal. Hence it can be utilised in different ways as fuel alongwith wood and coal to get desired saving. In some cases complete elimination of coal has been achieved. Field trials have been carried

over to achieve the desired saving in coal in different ways. Photographs 1 & 2 show the field trials conducted for the use of rice husk in commercial Bull's Trench Kiln and setting pattern of bricks in such kilns using rice husk as fuel in small scale brick kiln. Use of rice husk in different ways can be classified as below :

Small Scale :

For firing bricks upto 30-40,000 bricks at a time in batch type intermittent kiln using rice husk and fire wood as fuel. The fuel consumption and cost of firing were found as given in Table-1. The rates are subjected to local variation and availability of materials. The rates quoted here were applicable in May 1980 when a field trial was conducted in Roorkee.

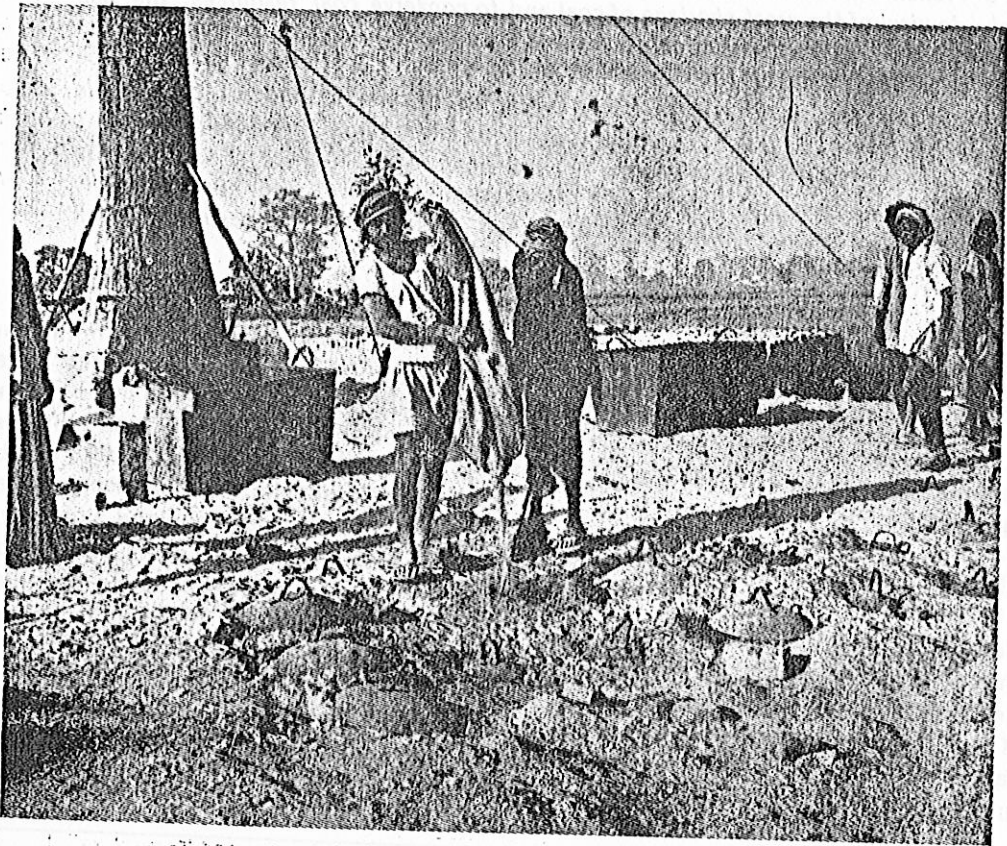


Fig. 1 Feeding of rice husk in Commercial Bull's Trench Kiln to save Coal.

Table-1 Basis :- per lakh of Bricks :

i) Fire Wood 15 Tonnes	
@ Rs. 300/- tonne —	= Rs. 4,500/-
ii) Rice husk 30 Tonnes	
@ Rs. 40/- tonne —	= Rs. 1,200/-
iii) Firemen Expenditure	— Rs. 500/-
Total	— Rs. 6,200/-

i.e. Rs. 62/- thousand bricks.

In Commercial Bull's Trench Kiln

Rice husk can be used in running Bull's Trench Kiln using coal as main fuel for saving coal upto 30-40%. There would be no change in setting pattern of the bricks. Rice Husk can be fed in alternative lines without any hindrance in normal firing of bricks. It has been found that normal firing temperature $1000 \pm 20^\circ\text{C}$ has been achieved in alternate line feeding technique of coal and rice husk. Thus saving of about 40% in total coal consumption was achieved. Table No. 2 shows the fuel consumption and cost of firing in this type of mixed feed technique :

Table-2 Fuel consumption and cost of firing using Rice Husk alongwith coal as Fuel :

i) Coal 7 tonnes	@ Rs. 600/- tonne—	Rs. 4,200/-
ii) Rice Husk 30 tonnes	@ Rs. 40/- tonne—	Rs. 1,200/-
iii) Firemen expenditure	Rs. 500/-
Total		— Rs 5,900/-

Rs. 59/- thousand bricks

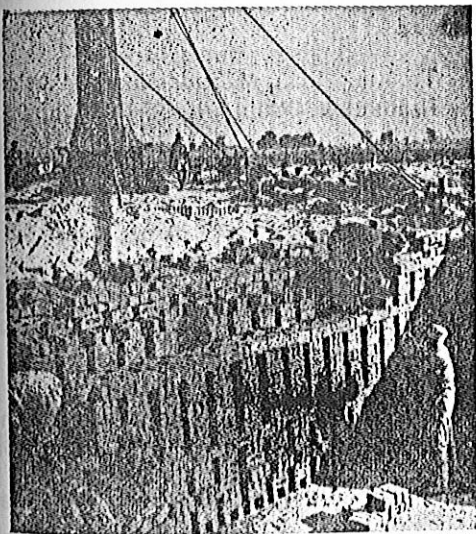


Fig. 2 Setting of Bricks

For Complete Elimination of Coal

Rice husk can be utilised alongwith fire wood or saw dust for complete elimination of coal. In this type of technique a minor change in setting pattern is adopted. One firewood feeding line is invariably given after every two rice husk feeding lines. The setting of rice husk feeding line is kept similar to coal feeding line as usually done. For fire wood feeding line, holes should be made open from top to bottom and with wider opening at the top. The steel covers of fire wood feeding holes should be made of large diameter. An average brick setter can do the setting job of bricks in rice husk and fire wood feeding lines easily. Table No. 3 shows the fuel consumption and cost of firing bricks, using rice husk and fire-wood (or saw dust) and eliminating coal completely.

Table-3 Basis : Per lakh of bricks (Fuel Consumption)

i) Fire wood-12 tonnes	
@ Rs. 300/- tonne —	Rs. 3,600/-
ii) Rice husk 30 tonnes	
@ Rs. 40/- tonne —	Rs. 1,200/-
iii) Firemen expenditure	— Rs. 500/-
Total :	Rs. 5,300/-

or Rs. 53/- thousand bricks

Table 4 (Field Trial Data)

1. Number of columns in one line of brick setting	— 26
2. Number of courses in one	— 19
3. Number of bricks in one line	— 3350
4. Distance between two columns	— 10 cms.
5. Length of one fireline	— 88 mtrs
6. Distance between two fire lines	— 15 cms.
7. Depth of the kiln	— 2.15 mts.
8. Number of chambers in the kiln	— 25
9. Overall length of the kiln	— 162.4 mts.

10. Width of the trench	— 8.8 mts
11. Capacity of the kiln	— 7 lakh bricks per round firing of kiln
12. Height of Chimney	— 10.5 mts.
13. Number of Chimneys	— 2
14. Number of rice husk feeding holes in one line	— 14
15. Number of bricks fired per day	— 25-26,000 bricks
16. Temperature of firing achieved	— $1000 \pm 20^{\circ}\text{C}$
17. Retention time of temperature	— 3-4 hours
18. Number of feeding holes in firewood feeding line	— 9

Bricks Fired by Coal Exclusively

The coal consumed per lakh bricks is given in Table No. 5. The actual cost depends on the distance of kiln site and freight charges.

Table-5

i) Coal 18 tonnes @ Rs. 600/- tonne	— Rs. 10,800/-
ii) Firemen expenditure	— Rs. 300/-
	Rs. 11,100/-

or Rs. 111/- thousand bricks.

Firing details

To initiate fire wood is burnt in the very first line to enable the next fire line to attain temperature upto 900°C when rice husk feeding is started. About 15-20 quintals of dry fire-wood is required to initiate the firing. One fire-wood line is invariable given after every two rice husk feeding line. Rice husk is fed in quantity of about 5 Kgs (half full bag) after every 20-25 mts. The technique can be easily followed by skilled firemen in running kiln also.

Quality of Bricks

The brick fired in Bull's Trench Kiln by rice husk and wood (or Saw Dust) were tested as per I.S. 1077-1970 and I.S. 3495, 1976. Table No. 6 gives the following results :

Table 6—Crushing Strength and Water Absorption of Bricks Fired by Rice Husk & Wood :

Crushing Strength Kg/cm ²	Water Absorption %	Production on Quality %
Above 150	12—14	20—25
100—150	12—15	60—65
50—100	13—16	10—25
Below 50	15—17	5—8
Minimum I.S. value 50kg/cm ²	Maxi. I.S. value	15%

Conclusion

(1) Rice husk can be used for saving coal upto 30-40% in running Bull's Trench Kiln. (2) It can be utilised for firing 30-40,000 bricks at a time in intermittent kiln. (3) It can be utilised to eliminate coal completely along with fire wood or saw dust. (4) Technique is simple and can be adopted by skilled workers having some experience. (5) Technique conserves fossil fuel reserve of the country and utilises a waste material as renewable source of energy. (6) Disposal problem of wastes in rice mills is solved.

References

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