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Assessment of fuel consumption for tobacco

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ABSTRACT

India stands 3rd in production of tobacco (about 800 M.Kg) and its exports after Brazil and the USA. Tobacco offers significant employment opportunities both in On-farm and Off-farm situation and provides livelihood to millions of people in India. The Central Tobacco Research Institute (CTRI) has estimated that tobacco provides livelihood security to 45.7 million people including farmers and farm laborers engaged in tobacco farming besides those working in processing, manufacturing, and exports, in India (CTRI, 2018). Among various types of tobacco, Flue Curing Virginia (FCV) type of tobacco is grown in Karnataka and Andhra Pradesh and requires fuel as a source of energy for curing. The present study looks at the aspects of overall energy management in flue-curing of tobacco through the use of fuel-efficient technologies in the barns, usage of alternative fuels and Energy plantation to bring self-sufficiency in fuelwood requirement. The study was conducted across the FCV crop growing regions with a survey of 1500 farmers and 31 Focused group discussion. The study details about the specific fuel consumption in tobacco, adoption status of energy conservation technology in the barns, alternative fuels used for tobacco curing, sources of different types of fuelwood, Industry effort's to grow trees as a sustainable source for tobacco curing and energy plantation requirement to bring self-sufficiency for tobacco curing. The study validates and confirms the self-sufficiency and sustainability in fuel usage for Indian FCV tobacco curing.

Keywords— *Tobacco, FCV, Tobacco curing, Specific fuel consumption, Alternative fuel, Energy conservation, Energy plantation*

1. INTRODUCTION

The major tobacco producing States of India are Karnataka, Andhra Pradesh, Gujarat, Maharashtra, Bihar, and Tamil Nadu. The share of tobacco production from Andhra Pradesh, Gujarat, and Karnataka alone accounts for around 80%. Tobacco offers significant employment opportunities both in On-farm and Off-farm situation and provides livelihood to millions of people in India. The Central Tobacco Research Institute (CTRI) has estimated that tobacco provides livelihood security to 45.7 million people including farmers and farm laborers engaged in tobacco farming besides those working in processing, manufacturing, and exports, in India (CTRI, 2018).

Depending on the type of the tobacco, four principal methods of curing can be distinguished, namely, i) Flue-curing, ii) Air-curing, iii) Fire-curing and iv) Sun-curing. Though some of the characters that govern quality in tobacco are gene-controlled, a good curing management can play a significant role in determining the quality of the commercial leaf. The Tobacco Board under the Ministry of Commerce regulates the production and marketing of Flue-cured Virginia (FCV) tobacco in India, its regulation motivated by the need to ensure the suitability of land, agro-climatic zones, appropriate rotation of crops, quality of leaves and fair prices (Tobacco Board, 2011). The Board requires all FCV tobacco growers and barn owners to register with the Tobacco Board in each state and to obtain a license for growing tobacco. Every year the Board fixes the crop size under FCV taking into consideration National and International demand with crops grown over and above the notified quantity treated as unauthorized for which a penalty is imposed.

Flue curing is the process that involves drying of tobacco leaves in structures called barns. Barns are generally built of mud or cement with tiled/thatched/zinc or cement roofs. Flue curing of tobacco requires fuel as a source of energy for curing. The present study looks at the aspects of overall energy management in flue-curing of tobacco through the usage of fuel-efficient technologies in the barns, usage of alternative fuels and Energy plantation to bring self-sufficiency in fuelwood requirement. The objectives of the study were:

- To estimate total fuelwood requirement for tobacco curing per year.
- To understand the custody of fuelwood for curing.
- To quantify the energy plantation by the Industry to fulfill the requirement of fuel wood for curing.
- To find energy plantation requirement per year to bring self-sufficiency in fuelwood for curing.

2. STUDY METHODOLOGY

In order to consider the best approach for achieving the above objectives, the implementation strategy includes a set of survey instruments both at Individual and group levels. This was developed by IFMR LEAD research team, after thorough field assessments and preliminary consultation with the farmers undertaking tobacco cultivation and maintaining barns for curing. The research team at IFMR LEAD prepared a detailed

grower questionnaire, carried out a preliminary field survey and then initiated the field work. The questionnaire collected all the personal details pertaining to respondents including their identification number, date, starting time and ending time, location information, license details, detailed socio-economic data such as the annual source of income, household land holdings, asset ownership data etc. Specific details were collected on the type of barns operated by them, ownership, fuel consumption, tobacco cultivation, harvest, curing operations, type and source of fuel, soil type etc. The sampling frame was designed so as to represent tobacco curing demands as per study objectives. Information was obtained through questionnaires. Sampling families were visited and their owners were interviewed. Fuel consumption in various types of the barn was studied through real-time data collection at barns.

Table 1: Region-wise sample size of the study

Region	KLS (Mysore and Hassan districts)	NLS (West Godavari district)	TRAD (Prakasam and Nellore districts)	Total Sample Size (farmers)
Sample size	750	300	450	1500

Focused Group Discussions (FGDs)- Besides the quantitative survey, 31 Focused Group Discussions (FGDs) were conducted (one at each of the Tobacco Auction Platforms) for understanding the qualitative requirements.

3. RESULTS AND DISCUSSION

The results of the "Assessment of fuel consumption for tobacco" study is detailed under the following heads:

1) Specific fuel consumption
2) Adoption status of energy conservation technology in barns
3) Alternative fuels for tobacco curing
4) Sources of different type of fuelwood
5) Energy plantation requirement to bring self-sufficiency
6) Industry effort's to grow trees as a sustainable source for tobacco curing

3.1 Specific Fuel Consumption (SFC): Specific fuel consumption is the quantity of fuel required per Kg of tobacco. It was observed that the farmers have started adopting various energy conservation technologies (usage of insulators at the roof and forced convection of heat inside the barn) to reduce the fuel consumption in the curing process. Hence, SFC of conventional barns and the barns with energy conservation technology was measured separately.

a) Conventional barn: The weighted average SFC for conventional barns in all FCV tobacco growing regions, as per our field assessment was found as 4.58.

b) Conventional barns with turbo ventilator and glass wool insulation: The weighted average SFC for conventional barns with turbo ventilator and roof insulation in all FCV tobacco growing regions districts, as per our field assessment was found as 3.34.

It is clear that there is a decrease in fuelwood consumption as and when there is better technology up gradation. The data on the total average number of hours cured shows that in conventional barns the number of hours of curing ranges from 109 to 192 hrs. In glass wool insulated barns and glass wool insulated turbo ventilated barns, it ranged from 108 to 172 and 100 to 160 hrs. respectively. The study revealed that the SFC has been reduced on weighted average by 27% in all FCV tobacco growing regions after the adoption of energy conservation initiatives. The table below details the region wise and barn type specific fuel consumption and % fuel savings due to the adoption of energy conservation technologies.

Table 2: Region wise, barn type specific fuel consumption and % fuel savings

Specific fuel consumption (SFC)	Karnataka (Mysore and Hassan)	Andhra Pradesh (Prakasam & Nellore)	Andhra Pradesh (West Godavari district)
Convention barn	4.60	4.40	4.80
Conventional barns with energy conservation technology (turbo-ventilator and glasswool insulation)	3.31	3.21	3.60
% fuel savings due to the adoption of energy conservation technology	28%	27%	25%

3.2 Adoption status of energy conservation technology in the barns: 28% of total barns are brought under energy conservation activity across all FCV crop growing regions. A collaborative effort of Tobacco Board, Farmers and Industry are in progress to increase the number of barns under energy conservation year on year. The table below details the region-wise barns with adopted technologies for energy conservation.

Table 3: region-wise barns with adopted technologies for energy conservation

Particulars	Number of Barns under energy conservation initiative			Grand Total
	Karnataka (Mysore and Hassan)	Andhra Pradesh (Prakasam & Nellore)	Andhra Pradesh (West Godavari district)	
Total Barn covered under energy conservation initiative	13677	2399	7659	23735
% of barns covered under energy conservation initiative	24%	19%	54%	28%

3.3 Alternative fuels for tobacco curing: Survey revealed that farmers in Karnataka and Andhra Pradesh are aware of the usage of alternative fuel sources for tobacco curing. Coconut shell and Coffee husk and Coffee stem are the major alternative fuel source accounting for 48% of total fuelwood usage in Karnataka. In Prakasam and Nellore districts, the major alternative fuel is *Prosopis*, which is a weed in the region. Usage of *Prosopis* accounts for 75% of total fuelwood usage in Prakasam and Nellore districts, while Coconut fronds, Carpentry waste are the major alternative fuel in West Godavari region. Alternative fuel in West Godavari district accounts for 18% of total fuelwood usage in West Godavari district. The cumulative % of fuelwood usage for Curing in Andhra Pradesh is 58%. The various alternative fuels and the fuelwood getting used for tobacco curing is given in the table below:

Table 4: Various alternative fuels and the fuelwood getting used for tobacco curing

S. No.	Karnataka	Andhra Pradesh
Alternate Fuel	Coffee husk & stem/ Coconut shell : 48%	Prosopis weed, Carpentry waste, Coconut fronds: 58%
Other Fuel	Eucalyptus root: 35%	Eucalyptus + Other fuels: 23%
	Orchard Wood :17%	Acacia : 19%

3.4 Sources of different type of fuelwood: The data from Karnataka indicated that the percentage of a major source of fuel (95%) was from the local wood traders, and the remaining 5% is sourced through own plantation of farmers. The procurement of wood through forest department auction is insignificant. Local wood traders of Karnataka sources 96% the wood from the commercial plantation by the farmers or commercial plantation at their own field and remaining 4% of the wood is sourced from another supplier.

Data from Andhra revealed that the local wood traders were the only source of fuelwood. Local wood traders of Andhra sources 99% the wood from the commercial plantation by the farmers or commercial plantation at their own field and remaining 1% of the wood is sourced from another supplier. No deforestation has been noticed for tobacco cultivation in any of the FCV crop growing regions.

Different types of fuel wood: In Karnataka, all the villages majorly showed dependence on *Eucalyptus*. Many villages also showed a distributed usage of *Spathodea*and *Artocarpus*. In Andhra Pradesh, data revealed that *Prosopis* seems to be the only preferred fuel type. *Eucalyptus* forms the next category of preferred fuelwood, followed by a small proportion of Old Cashew orchards, *Borassus* and *Pongamia.* All other sources viz., Neem, Tamarind, *Melia dubia, Sapota* etc. seem to be of very insignificant or nil use.

3.5 Energy plantation requirement to bring self-sufficiency: The analysis shows that the 215 M.Kg tobacco crop size requires 418 M.Kg of fuelwood, after excluding alternative fuel and considering the reduction in SFC due to the adoption of energy conservation activity in the barns. With the increasing number of barns under energy conservation initiative year on year, the required volume of firewood shall further come down in future. To fulfill the existing required volume of firewood, a total of 7607 Ha of energy plantation is needed. Availability of energy plantation firewood from 7607 Ha brings self-sufficiency in fuelwood requirement for tobacco curing. The average yield of fuelwood from energy plantation is found as 55 Tons per Ha and is considered for the calculation.

3.6 Industry effort's to grow trees as a sustainable source for tobacco curing: Industry is encouraging farmers for growing *Eucalyptus, Leucaena* and *Casuarina* in Karnataka and Andhra, under the agro-forestry model and promoting farmers for commercial plantation of the trees to fulfill the requirement of fuel for tobacco curing. All the selected tree species under Energy plantation initiatives are fast growing species and are ideal short rotation crops. These tree species provides wood 2-3 times even after 1st cutting. This will go a long way to support tobacco curing. *Eucalyptus* and *Leucaena* have the shortest rotations with about 3-4 years whereas *Casuarina* could take more than five years. Till 2017-18, a total of 39,315 Ha of energy plantation has been completed by the industry across all FCV crop growing regions. The industry is supporting farmers to add a green cover year on year, for sustainable fuel sourcing.

4. SUMMARY AND CONCLUSION

The report provides an in-depth analysis and assessment of fuelwood consumption specifically for tobacco curing based on the research conducted in the villages of Karnataka and Andhra.

- The current study clearly delineates that there is a visible difference in the amount of fuelwood usage between the conventional barns and barns with adopted upgraded technology. Therefore energy efficiency increased with up-gradation of the barn technology. The study shows that there is still a good scope to reduce the fuelwood usage by increasing more coverage of barns under energy conservation initiative.
- On an average 49% of fuel requirement for tobacco curing is getting fulfilled through the use of alternative fuel viz., *Prosopis*, Coffee husk and stem, Coconut shell, Coconut fronds, Carpentry waste etc.
- The analysis shows that currently 418 M.Kg of fuelwood is required per year for Indian FCV tobacco curing, after excluding alternative fuel and considering the reduction in SFC due to the adoption of energy conservation activity in the barns. With the increasing number of barns with energy conservation initiative year on year, the required volume of fuelwood shall further come down in future. To fulfill the existing required volume of fuelwood, a total of 7,607 Ha of energy plantation is needed every year at the ground.
- The current study reflected the usage of energy plantation as a major source of fuel. Industry along with farmers has already established energy plantation base for 39,315 Ha till 2017-18 and continuing to add more energy plantation base as per the growing requirement, demonstrating the self-sustainability in fuelwood requirement for tobacco curing.
- Sustainable sourcing of fuel for tobacco curing is observed due to the yearly plantation from farming community and usage of alternative fuel viz., *Prosopis* (weed) and agricultural waste. No deforestation has been observed due to tobacco cultivation or tobacco curing.
- The study hence validates the self-sufficiency and sustainability in fuel usage for Indian FCV tobacco curing.

5. REFERENCES

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