

Executive Summary

Factor Influencing Agricultural Burning Behavior in Thailand: A Case Study in Khon Kaen Province

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1. Significance of the Problem

The practice of open burning of agricultural residues after harvest remains widespread across various regions of Thailand, particularly in areas where rice, sugarcane, and maize are cultivated. In certain seasons, the burning rate in these crop areas can reach 30–50%. According to data from GISTDA (2023), over 168,000 fire hotspots were detected in agricultural zones nationwide, with more than 80% concentrated in the northern and northeastern regions. While burning offers short-term benefits such as reduced labor and cost, it imposes severe environmental, health, and economic consequences at both national and regional levels. Most notably, it contributes to the rise of fine particulate matter (PM_{2.5}), a hazardous pollutant linked to respiratory illnesses and a potential reduction in average life expectancy by up to two years. In addition, open burning emits greenhouse gases, degrades soil structure, and contributes to transboundary haze pollution. Although the government has introduced awareness campaigns, legal prohibitions, and penalties—including the withdrawal of subsidies for non-compliant farmers—burning persists across many areas. This persistence highlights the disconnect between government policy and actual farmer behavior on the ground.

2. Research Objectives and Methodology

This study aims to identify the factors influencing farmers' decisions to adopt or avoid open burning practices for agricultural residue management. The research framework incorporates social, economic, environmental, and policy dimensions. A quantitative approach was employed in Khon Kaen Province, involving a sample of 542 farmers across 26 districts. The sample included rice, sugarcane, and maize growers. Data collection was conducted in March 2025 using structured questionnaires administered by district agricultural extension officers. The analysis utilized descriptive statistics, chi-square tests, and logistic regression to examine relationships between key variables and burning behavior.

3. Demographic and Socioeconomic Profile of Respondents

The surveyed farmers had an average age of 53.8 years and over 20 years of agricultural experience, indicating both a high level of expertise and a long-term engagement in agricultural production. Despite this experience, the majority (almost 79%) earned incomes

below the provincial Gross Provincial Product (GPP) per capita for the agricultural sector. Educational attainment was generally low, with most respondents about 82% having completed less than upper secondary education. On average, farmers managed 17.3 rai of farmland, highlighting notable variation in farm size and management capacity.

Survey results revealed that 45.4% of respondents had engaged in agricultural residue burning. Among these, more than 70% reported burning residue on at least half of their cultivated area. Notably, farmers with lower incomes and those cultivating sugarcane or maize were more likely to adopt burning practices, primarily as a means to reduce labor and input costs.

4. Conclusions

Agricultural residue burning remains a significant environmental and public health issue in many countries, including Thailand. The burning of crop residues contributes to the generation of fine particulate matter (PM_{2.5}), which adversely affects air quality and poses serious health risks to the population. Moreover, it contributes to climate change and environmental degradation, particularly soil deterioration. In response, the Thai government has implemented various policy measures to curb this practice.

Findings from this study indicate that agricultural burning behavior is influenced by multiple interrelated factors, including:

- (1) Farmers' environmental awareness of the consequences of burning;
- (2) Farmers' attitudes and understanding regarding soil conservation and ecological impacts;
- (3) Economic status, reflecting the pressures of production costs, labor shortages, and limited income;
- (4) Government policy and law enforcement, which shape both internal motivations (e.g., environmental responsibility) and external incentives (e.g., access to benefits or penalties); and
- (5) Availability of agricultural machinery, which facilitates non-burning alternatives for residue management.

Additionally, farmers' personal characteristics—such as age, income, and educational level—are significantly associated with their tendency to either continue or avoid burning practices. Although the Ministry of Agriculture and Cooperatives has developed integrated policies in collaboration with provincial and local agencies, current implementation remains largely hierarchical. This centralized structure may limit flexibility and responsiveness to local contexts. Thus, a mutual adjustment approach, emphasizing direct communication and adaptive operations, is recommended to more effectively promote sustainable behavioral change among farmers.

Government policies should be clear, practicable, and widely communicated to foster trust among farmers—a critical factor in influencing behavioral shifts. However, such changes, particularly among smallholder farmers who face constraints in land, income, and labor, cannot be expected to occur rapidly. Non-burning practices continue to face challenges related to cost and limited access to resources, especially agricultural machinery.

Promoting knowledge and awareness through a variety of channels—such as training sessions, focus group discussions, and educational programs—is essential for encouraging behavioral change. The findings from this study suggest that awareness of the environmental impacts of burning is positively correlated with farmers’ willingness to adopt alternative residue management practices.

Although most farmers are aware of the Ministry of Agriculture and Cooperatives’ policy stating that those found burning residues will be disqualified from receiving government subsidies, some farmers continue to burn. This highlights the need for law enforcement to be paired with positive incentive mechanisms, such as financial support or other context-specific benefits. Economic incentives—such as subsidies or access to production inputs—remain vital for reducing burning behavior. However, these measures should be tailored to the specific needs and limitations of each farmer group to ensure maximum effectiveness.

Finally, managing large volumes of agricultural residues—such as rice straw and sugarcane leaves—without burning requires appropriate machinery and efficient collection and transportation systems. These remain major challenges due to high costs and the diverse machinery needs across crop types. Therefore, the government should provide agricultural machinery that aligns with actual farmer demands and consider establishing regional machinery distribution centers to ensure equitable and widespread access to equipment across farming communities.

5. Policy Recommendations

The policy recommendations synthesized from this research aim to provide actionable strategies for government agencies and relevant stakeholders to reduce agricultural residue burning and promote sustainable residue management practices in Thailand.

1. Conditional Support Mechanisms

Implement incentive-based conditions to encourage sustainable agricultural residue management. For instance, provide support exclusively to farmers who adopt practices such as soil incorporation or biomass processing. This approach promotes long-term environmentally friendly behaviors.

2. Establishment of Agricultural Machinery Service Centers

Establish agricultural machinery service centers at least at the district level. Local government agencies should be assigned to manage the lending and return of machinery, particularly during high-demand harvesting seasons. Farmers may co-pay certain costs (e.g., fuel), or machinery may be rented at low cost or loaned free of charge for vulnerable groups or disaster-affected areas. Public-private partnership (PPP) models may be considered to enhance project sustainability.

3. Improving Access to Agricultural Machinery

Limited access to machinery (e.g., tractors, sugarcane leaf collectors) remains a major barrier due to high costs. The government should provide financial support mechanisms, such as low-interest or interest-free loans, and consider additional measures (e.g., maintenance subsidies) to reduce farmers' operational burdens and promote broader access to machinery.

4. No-Burn Certification and Market-Based Incentives

Develop and implement a “No-Burn Certification” program for agricultural products to create positive market incentives. This approach would encourage farmers to shift toward sustainable practices while adding market value to certified products. The program could be integrated with existing sustainable agriculture and green marketing initiatives.

5. Promotion of No-Burn Agricultural Products

Support the market development of agricultural products produced without burning. Raise consumer awareness and promote the use of crop residues in circular economy models through private-sector collaboration. For example, IKEA’s “Better Air Now” initiative in India transforms rice straw into furniture in partnership with the government.

6. Community-Based Participatory Learning

Promote farmer education through community engagement, particularly by training community leaders to disseminate knowledge and shift local attitudes effectively. This should involve coordination with relevant government agencies, such as the Ministry of Natural Resources and Environment, Ministry of Education, Ministry of Interior, and the Public Relations Department, to enhance operational impact and scalability at the local level.

7. Establishment of Localized Control Mechanisms

Burning reduction efforts require cooperation from all sectors. Establish district-level command centers (e.g., with the district chief as the lead official), as demonstrated in Khon Kaen Province, where such a model significantly reduced burning. Private sector involvement, such as support from sugar mills, is also essential for tangible reductions in sugarcane residue burning.

8. Utilization of Geospatial Data (Burn Scar Analysis)

Use satellite-derived burn area data from GISTDA (Geo-Informatics and Space Technology Development Agency) to monitor at-risk zones. Such data should be integrated into a long-term database for continuous behavior analysis and policy application—e.g., blacklisting repeat offenders or reducing government benefits such as income support schemes.

9. Public Communication and Continuous Awareness Campaigns

Intensify public communication on the health impacts of air pollution, including installing real-time air quality monitoring displays in public spaces. This raises public awareness and encourages citizen participation in monitoring and reporting burning activities. Ongoing access to air quality information empowers communities to advocate for their right to a healthy environment.

10. Context-Specific and Regional Research

Conduct additional region-specific research to account for the diverse geographic and social contexts across Thailand. This should include in-depth understanding of farmer behavior and evidence-based evaluations of awareness-raising and behavior change initiatives. The findings will support the development of precise and context-appropriate policy interventions.