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

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Abstract

This study aimed to analyze the social, economic, environmental, and policy-related factors influencing the behavior of agricultural residue burning among farmers in Khon Kaen Province, Thailand. A stratified random sampling technique was employed to select a representative sample of 542 farmers cultivating rice, sugarcane, and maize across all 26 districts. Data were collected through structured face-to-face interviews conducted by trained district agricultural extension officers. Descriptive statistics, Chi-square tests, and Binary logistic regression analyses were used to examine relationships between variables and to identify key predictors of burning behavior. The findings revealed that environmental awareness, attitudes toward soil conservation, economic constraints, access to agricultural machinery, and government policies-both in terms of sanctions and incentives - were significant determinants of farmers' decisions to burn or not to burn agricultural residues. Furthermore, individual characteristics such as age, education, and household income were found to be associated with burning practices. Older farmers with lower income and education levels tended to engage more frequently in burning. The logistic regression model demonstrated satisfactory predictive power (Nagelkerke $R^2 = 0.434$ for rice and sugarcane farmers; $R^2 = 0.711$ for sugarcane farmers specifically). These findings offer practical insights for policymakers to design targeted interventions, promote the adoption of sustainable residue management practices, and support

Keywords: agricultural residue burning, farmer behavior, attitudes and awareness, policy and incentives, logistic regression

1. Introduction

The practice of open burning of agricultural residues after harvest is widely observed across Southeast Asia, including countries such as China, India, and several South American nations like Brazil (Cassou et al., 2018). Despite policy interventions introduced by governments in many countries to regulate and reduce agricultural burning (Akahoshi et al., 2024), this practice remains prevalent in many regions. In Thailand, agricultural burning occurs across multiple regions. In the Central Plains, rice cultivation areas report the highest burning rates during the main growing season (29%) and even higher during the dry-season crop (57%). Sugarcane burning is most prevalent in the Northeastern region (47%), while maize burning is widespread in the North, accounting for approximately 35% of cultivated areas (Attavanich & Pengthamkeerati, 2018; Office of Agricultural Economics, 2020).

According to the Geo-Informatics and Space Technology Development Agency (GISTDA), in 2023, Thailand recorded a total of 168,404 fire hotspots in agricultural areas. The Northern region reported the highest number (109,518 hotspots or 65.03%), followed by the Northeastern (18.43%), Central (15.90%), and Southern regions (0.64%). In Khon Kaen province alone, from January 1 to May 31, 2024, there were 2,211 recorded fire hotspots. Of these, 35.9% occurred in agricultural areas, followed by conservation forests (24.6%), land reform areas under the Agricultural Land Reform Office (ALRO) (16.1%), community and miscellaneous areas (11.9%), national reserved forests (9.4%), and roadside areas (1.9%). Although data from 2025 shows a slight decline in the number of hotspots in Khon Kaen (down to 2,060, or a 6.83% decrease compared to the same period the previous year), the proportion of hotspots in agricultural areas (43.16%) and ALRO areas (21.99%) increased. In contrast, the proportion of hotspots in national forests, conservation areas, and communities declined.

Open burning remains a popular method of managing crop residues due to its low cost, labor efficiency, speed, and ability to control pests and diseases (TEI, 2021). However, it also causes serious negative externalities for the economy, society, and environment, particularly concerning fine particulate matter (PM2.5), which has significant health and air quality implications. Long-term exposure to severe air pollution is reported to reduce life expectancy by up to two years (Roengjit, 2019). In addition, agricultural burning is a major contributor to greenhouse gas emissions, accelerating climate change at both regional and global scales (Ravindra et al., 2016; Akahoshi et al., 2024). Soil fertility and ecosystems are also degraded through repeated burning. If agricultural burning bans were effectively enforced, it is estimated that PM2.5 emissions could be reduced by up to 30% compared to a scenario without policy intervention (ILO, 2022).

This problem is transboundary in nature, especially in Northern Thailand, which is affected by agricultural burning in neighboring countries such as Myanmar and Laos. Such practices have been linked to large-scale haze pollution affecting regional air quality, health, and visibility (Marks & Miller, 2022; Pollution Control Department, 2019). Although Thai authorities have initiated several policy and campaign-based responses—such as the "No-Burn" campaign and economic support mechanisms—agricultural burning remains widespread. This persistence indicates gaps in policy enforcement as well as a limited understanding of farmers' behavior and motivations. Government agencies and affiliated

institutions—including the Ministry of Agriculture and Cooperatives (MOAC), the Ministry of Natural Resources and Environment (MNRE), the Thailand Environment Institute (TEI), and the Highland Research and Development Institute (HRDI)—have all raised concerns about the environmental, health, and economic consequences. Nevertheless, issues surrounding enforcement, incentives, and penalties require more comprehensive and integrated solutions.

This study aims to analyze key factors—social, economic, environmental, and policy-related—that influence farmers' decisions to cease agricultural burning. Particular attention is given to the role of government support and regulatory control. The study adopts a structural analysis framework to generate policy recommendations that are both economically feasible and practically implementable, contributing to sustainable reform in the agricultural sector.

2. Methodology

This study employed a quantitative research approach, using stratified random sampling to ensure the selection of a sample that was diverse and representative of the economic, social, and agricultural contexts across the study area. The sample was stratified based on the proportion of major crops most commonly associated with post-harvest residue burning. A total of 542 respondents were selected, consisting of 384 rice farmers and 158 non-rice farmers, which included 109 sugarcane growers and 49 maize growers. The sampling frame was derived from the official agricultural registry provided by the Department of Agricultural Extension.

Data collection was carried out through face-to-face interviews using a structured questionnaire, conducted by district-level agricultural officers from all 26 districts in Khon Kaen Province. These officers were trained and provided with detailed guidelines to ensure the reliability and accuracy of the data. The fieldwork was conducted in March 2025.

The structured questionnaire consisted of 33 items, covering key topics such as demographic characteristics (including age, gender, and education level), agricultural practices (including farm size, years of farming experience, and household income), residue burning behavior (including frequency and proportion of land burned), awareness of environmental impacts, attitudes toward burning and government support, economic factors, perceptions of government policy and law enforcement, and opinions regarding the provision of agricultural machinery.

The data obtained from the questionnaires were analyzed using SPSS software. The analysis involved descriptive statistics to present frequencies, percentages, means, and standard deviations; chi-square tests to examine relationships between each independent variable and burning behavior; and binary logistic regression to develop a model for predicting the probability of a farmer deciding whether or not to burn crop residues, using multiple independent variables to explain variations in the dependent variable.

The dependent variable (Y) was agricultural residue burning behavior, defined as a dichotomous variable (or dummy variable), coded as 1 if the farmer engaged in burning, and 0 if not. The purpose of the regression analysis was to examine the statistical relationships between the dependent variable and several independent variables (X_1, X_2, ..., X_n), such as environmental awareness, attitudes, economic factors, government support,

and law enforcement. The influence of each variable on burning behavior was assessed in terms of probability, following the structural analysis framework proposed by Suchiwa (1998), and expressed using the following regression equation:

$$Y = \alpha + ß1X1 + ß2X2 + ß3X3 + ß4X4 + \ldots + ßnXn$$

3. Results and Discussions

3.1 Demographic and Agricultural Characteristics

The sample used in this study was demographically balanced in terms of gender, with 50.2% male and 49.8% female respondents. The average age of farmers was 53.8 years, and the majority had more than 20 years of farming experience, with a mean of 23.7 years. Regarding education, 82.5% of the respondents had attained education levels below upper secondary or vocational education.

Farm sizes varied considerably, ranging from 1 to 200 rai (0.16 to 32 hectares), with an average of 17.3 rai. For specific crop types, the average rice cultivation area was 14.65 rai, while sugarcane cultivation averaged 31.23 rai. Most farmers earned relatively low household incomes. Approximately almost 79 % of households reported annual incomes below the Gross Provincial Product (GPP) per capita for Khon Kaen Province (131,987 baht), while only 21% of households earned above this threshold. Notably, those with higher incomes were predominantly sugarcane farmers.

Survey findings revealed that 45.4% of farmers had engaged in agricultural residue burning. Among this group, 72.8% reported burning once per year, while 27.2% burned more than once per year. In addition, more than 70% of these farmers indicated that they burned crop residues on more than half of their total farmland.

When income levels were analyzed in relation to burning behavior, it was found that farmers with lower incomes (≤100,000 baht per household per year) had a significantly higher tendency to burn residues compared to other income groups. Furthermore, burning was more frequently reported among farmers with larger landholdings, particularly sugarcane and maize growers. This suggests a potential link between burning behavior and the need to reduce labor costs and time associated with land preparation among these farmer groups.

Table 1 presents a summary of the general characteristics of the respondents.

Characteristic	Category	Sample (%)	Mean / Provincial Statistics
Age (years)	21–30	1.3	Mean = 53.87
	31–40	7.7	
	41–50	23.1	
	51–60	46.7	
	> 60	21.2	
Gender	Male	50.2	Provincial population:
	Female	49.8	1,772,381 people Male: 49.00%, Female: 51.00%*

Characteristic	Category	Sample (%)	Mean / Provincial Statistics
Education	No formal education	0.4	
	Primary school	37.1	
	Lower secondary school	45.0	
	Upper secondary / Vocational	8.1	
	Bachelor's degree or higher	9.4	
Farm size (rai)	1–5	19.2	Mean = 17.29 rai
	6–10	28.2	Provincial average = 15.5 rai**
	11–15	17.7	
	16–20	15.0	
	> 20	19.9	
Farming experience (years)	1–10	26.2	Mean = 23.78
	11–20	25.5	
	21–30	22.5	
	31–40	16.4	
	> 40	9.4	
Household income (baht/year)	< 50,000	20.8	GPP per capita (Khon Kaen) = 131,987***
	50,001–100,000	38.0	
	100,001–150,000	20.8	
	150,001–250,000	11.7	
	> 250,000	8.7	

Notes:

* Provincial statistics from Department of Provincial Administration, 2023.

** Provincial agricultural land average from Office of Agricultural Economics, 2023.

*** GPP per capita for Khon Kaen Province from Gross Regional and Provincial Product 2023 Edition, Office of the National Economic and Social Development Council (in baht).

3.2 Results from Chi-Square and Binary Logistic Regression Analyses

However, when analyzing the data using Chi-Square tests, disaggregated by crop type-namely, the overall group (including all crops), rice farmers, sugarcane farmers, and maize farmers-it was found that none of the variables for the maize farming group showed statistically significant relationships. This may be attributed to the relatively small sample size for this group, which may limit the reliability of the statistical analysis. To improve the accuracy of the analysis, the maize farming group was excluded from subsequent Chi-Square testing.

The results indicated that most variables in the overall group (rice and sugarcane), the rice group, and the sugarcane group continued to exhibit statistically significant relationships, and the key influencing variables remained consistent across the groups. Notably, in the overall group, educational level and household income were both significantly associated with burning behavior at the 0.05 significance level.

For the Binary Logistic Regression analysis, separate models were constructed for each group: the overall group, rice group, sugarcane group, and maize group. Upon removing the maize farming group from the analysis, the Nagelkerke R Square value - an indicator of the explanatory power of the regression model - increased from 0.376 to 0.434, indicating improved model fit and explanatory capacity regarding the variance in burning behavior.

Therefore, to maintain the validity and reliability of the findings, subsequent Chi-Square and logistic regression analyses excluded data from the maize farming group. The analysis was thus reorganized into two primary groups for further modeling: the combined group (rice and sugarcane farmers), and the sugarcane farmer group. This distinction enhances the analytical robustness of the study.

Table 2 Results of Binary Logistic Regression Analysis and Nagelkerke R^2 by Group

Sample Group	**Sample Size (n)**	**Nagelkerke R^2**	**Number Of Significant Variables**	**Remarks**
Combined Group (Rice + Sugarcane + Maize)	542	0.376	6	Includes maize; no statistically significant variables in this subgroup
Combined Group (Rice + Sugarcane only)	493	0.434	8	After excluding maize group
Rice Farmers Only	384	0.417	7	Emphasis on government support and attitude-related variables
Sugarcane Farmers Only	109	0.711	7	Model yielded the highest predictive accuracy
Maize Farmers Only	49	0.200	0	No statistically significant variables

Note. A Nagelkerke R^2 value greater than 0.4 is generally interpreted as indicating a model with moderate to good explanatory power. This statistic reflects the model's adequacy in predicting agricultural residue burning behavior. Among the groups analyzed, the combined group including all crop types (rice, sugarcane, and maize) yielded the lowest R^2 value of 0.376. After excluding the maize group, the combined group (rice and sugarcane only) showed improved explanatory power, with an R^2 of 0.434. The rice-only group had an R^2 of 0.417, while the sugarcane-only group exhibited the highest model accuracy with an R^2 of 0.711. Conversely, the maize-only group yielded the lowest R^2 value at approximately 0.200, likely due to the small sample size.

3.2 Awareness Factor

Farmers' awareness of the environmental impacts of agricultural residue burning - such as its contribution to air pollution - is a crucial factor influencing their behavior. The survey found that more than 88% of farmers demonstrated moderate to very high levels of awareness regarding the environmental consequences of burning crop residues. Furthermore, over 87% of respondents agreed or strongly agreed that agricultural burning contributes to air pollution and is one of the causes of climate change.

The Chi-Square test confirmed a statistically significant relationship ($p < .001$) between environmental awareness and burning behavior. However, when analyzed by subgroup, this statistical significance was observed only among rice farmers, whereas no significant relationship was found among sugarcane farmers.

With respect to public policy communication, a large proportion of farmers (92.8%) reported being aware of government announcements regarding penalties for agricultural burning. These include the revocation of subsidies, the withdrawal of seed support, and the loss of land rights in Agricultural Land Reform zones (ALRO). However, the Chi-Square test showed no statistically significant relationship between this policy awareness and burning behavior. This may suggest that, despite being informed of the consequences of violating public policy, such information alone has not been sufficient to alter farmer behavior.

This phenomenon is comparable to the case of traffic law enforcement - such as the legal requirement for motorcycle riders to wear helmets. Although most riders are aware of the penalties for non-compliance, a substantial number continue to ignore the regulation. This reflects the notion that "awareness alone is not enough" to induce behavioral change.

Nevertheless, previous research has indicated that enhancing farmers' environmental awareness can positively influence their willingness to adopt more sustainable residue management practices and significantly reduce the frequency of burning (Okpara & Toman, 2023; Ruto, 2021; Si et al., 2020).

3.3 Attitude Factor

Farmers' attitudes toward agricultural practices - particularly their perceptions of the environmental consequences of burning crop residues - are a crucial factor influencing post-harvest residue management behavior. The findings revealed that over 87% of farmers believed that residue burning negatively affects soil fertility and soil ecosystems, which in turn directly impacts crop productivity. However, Chi-Square test results indicated that this relationship was statistically significant only among rice farmers ($p < .001$), while no significant association was found among sugarcane farmers.

Regarding the willingness to shift toward environmentally friendly residue management practices, if supported by the government, 92.8% of farmers expressed readiness to change, with only 7.2% remaining uncertain. Interestingly, Chi-Square test results showed that statistical significance ($p < .01$) was found only among sugarcane farmers, despite this group generally exhibiting lower environmental awareness compared to rice farmers. One possible reason is that sugarcane farmers, who often cultivate large areas and face high harvesting costs due to substantial leaf residue, seek stronger economic incentives. They prefer higher prices for unburned sugarcane to motivate change, leading to greater demand for government support compared to rice farmers.

When examining the types of support preferred by farmers, both rice and sugarcane farmers shared similar preferences. The majority (50.2%) favored financial support, followed by access to production inputs (31.9%), knowledge (14.6%), and other forms of assistance (3.3%). These findings suggest that farmers tend to favor tangible and practical forms of assistance, whether in the form of budgetary support or agricultural supplies.

As for alternative methods that farmers considered most suitable for managing crop residues instead of burning, 57.6% preferred incorporation into the soil or composting, followed by establishment of agricultural residue collection points (25.8%), value-added processing (11.4%), and biomass fuel production (5.2%). Notably, most farmers who favored residue collection points were sugarcane growers (44.3%), likely due to the high volume of sugarcane leaves per unit area and the reliance on machinery for residue management. In contrast, rice farmers - whose average cultivated area is less than half that of sugarcane farmers - most commonly adopted residue incorporation or composting practices (67.2%). This is likely due to the smaller volume of residue, which is easier to manage and allows farmers to handle the process independently. These findings underscore the importance of developing residue management policies and interventions that are tailored to the specific agricultural contexts and crop types of each region to ensure practicality and effectiveness.

When asked about the perceived difficulty of switching from burning to alternative methods, 29.2% of farmers reported that such changes would be difficult or very difficult, with sugarcane farmers accounting for 50% of that group. Another 42.1% perceived it as moderately difficult, while 28.8% believed it would be easy or very easy. According to Chi-Square test results, a statistically significant relationship ($p < .001$) was found among rice farmers, but not among sugarcane farmers.

Behavioral change away from burning typically requires time for adaptation (Wangwongwatana, 2022). However, encouraging farmers to shift their attitudes-from viewing behavioral change as difficult to perceiving it as achievable-could substantially reduce burning behavior. Research by Okpara and Toman (2023) supports this view, suggesting that attitude adjustment is a more effective tool for changing behavior than legal enforcement alone.

3.4 Economic Factor

In addition to attitudinal and awareness-related factors, which play a crucial role in influencing farmers' decisions regarding post-harvest residue management, economic factors also significantly affect farmers' choices-particularly their decision to burn crop residues. Survey results indicated that the primary reason farmers chose to burn was to save time and labor, accounting for 52.6% of responses. This was followed by cost savings in production (22.1%), time constraints for preparing the next planting season (12.5%), adherence to traditional farming practices (10.3%), and lack of suitable alternatives (2.4%).
Chi-Square analysis revealed that sugarcane farmers were significantly associated ($p < .05$) with these economic motivations. Specifically, 54.1% of sugarcane farmers cited time and labor savings as the main reason for burning, followed by low production costs (19.3%). These findings are consistent with research by the Thailand Development Research Institute (TDRI, 2023), which emphasized that convenience and low cost are the main reasons why burning remains a widespread practice in the agricultural sector.

When asked about perceived cost implications of shifting to alternative, non-burning residue management methods, 28% of farmers believed costs would increase significantly, 47.8% expected moderate increases, 14.2% anticipated minor increases, and only 9.8% believed there would be no additional costs. The chi-square test results for rice and sugarcane farmers revealed a statistically significant difference at the 0.001 level, highlighting the varying perceptions of potential cost burdens associated with transitioning to alternative agricultural residue management practices. These findings emphasize the need for policy measures that account for differences in residue type and quantity-such as rice straw versus sugarcane leaves-as these factors directly affect management costs. Tailored support mechanisms and cost-sharing strategies may therefore be essential to promote the adoption of more sustainable practices.

Additionally, the study examined farmers' ability to access financial resources for investing in machinery or tools for alternative residue management. Results showed that 42.3% of farmers reported being able to access funding or use their own capital. Among those who could access funding, the majority were rice farmers (70.7%). This may be explained by the fact that machinery for managing rice stubble is generally less expensive than that required for sugarcane fields. However, the Chi-Square test found no statistically significant difference between groups regarding access to funding, suggesting that while some disparities exist in perception and experience, they are not statistically conclusive.

3.5 Policy and Law Enforcement Factor

The Thai government, particularly through agencies under the Ministry of Agriculture and Cooperatives, has continuously implemented both incentive-based and regulatory policies to encourage farmers to reduce or cease burning practices in agricultural areas. This is due to the recognition that burning is a major contributor to particulate matter (PM2.5) pollution, which severely impacts public health and the environment. In response, a range of control and reduction measures have been introduced, which can be categorized into four main policy domains namely: Legal and enforcement measures, such as clearly defined no-burn zones and periods, accompanied by stricter penalties; Economic incentive measures, including subsidies for non-burning farmers and compensation for potential losses, such as government-led purchase of rice straw for alternative uses; Technological and innovation support, involving the provision of agricultural machinery (e.g., straw incorporation equipment) and the development of innovations such as composting or biomass fuel production; and Community engagement, including the establishment of no-burn farmer networks, educational workshops on burning impacts, and training on viable alternatives (Office of the Permanent Secretary, Ministry of Agriculture and Cooperatives, 2025).

During the 2025 harvest season, which saw an increase in agricultural burning, the government enacted a specific policy announcement, published in the Royal Thai Government Gazette under the Ministry of Agriculture and Cooperatives' regulation titled: "Management Measures for Preventing and Mitigating PM2.5 Pollution in the Agricultural Sector", dated January 17, 2025. The regulation delegated operational responsibility to agencies such as the Office of the Permanent Secretary and the Department of Agricultural Extension, which were tasked with collaborating with village committees, local leaders, and farmer groups to monitor and suppress burning, as well as to organize public forums at the district and sub-district levels.

Despite these efforts, current policy implementation remains predominantly hierarchical in structure (Bhuvaneshwari et al., 2019). Prior studies have suggested that a more flexible, mutual adjustment–based governance model, which adapts to local contexts, is more effective in promoting behavioral change among farmers and achieving sustainable outcomes (Zusman, 2020; Faulder, 2023).

In terms of farmers' perceptions of government policy, 46.4% expressed strong concern about losing government subsidies or benefits if caught burning, 26.4% reported moderate concern, 13.5% slight concern, and 13.7% expressed no concern. Altogether, 86.3% of farmers expressed some level of concern over losing state benefits due to policy violations. When asked about the perceived effectiveness of government measures in deterring burning, 52% believed they were highly effective, 35.4% moderately effective, 9.8% minimally effective, and 2.8% ineffective. The chi-square analysis revealed that rice farmers showed a statistically significant level of concern ($p < 0.001$) regarding the potential loss of government benefits if caught engaging in open burning, and perceived government measures as significantly effective in deterring burning ($p < 0.05$). In contrast, no statistically significant patterns were observed among sugarcane farmers. These findings suggest that policy interventions linking government benefits-such as financial assistance, input subsidies, and price support-to compliance with burning regulations may be more effective for crops where farmers receive substantial government support. For crops like sugarcane, where farmers receive fewer benefits, additional policy tools or targeted incentives may be necessary to promote compliance.

Regarding measures perceived as most effective in reducing burning behavior, 60.9% of respondents identified financial or input-based incentives as most influential, followed by stricter penalties (26.0%), educational support (8.9%), and community-level enforcement through social sanctions (4.2%). Chi-Square results indicated that these preferences were statistically significant among rice farmers ($p < .05$) but not among sugarcane farmers. A key observation is that rice farmers tend to have lower annual incomes (50,000 - 100,000 THB) compared to sugarcane farmers (100,000 -150,000 THB), making them more dependent on government financial and input-based support.

In addition, previous research has noted that weak law enforcement undermines the effectiveness of current measures in reducing burning behavior (Prasertsri & Kittipongvises, 2024). Therefore, state policy implementation must place greater emphasis on combining positive incentives with robust enforcement mechanisms, especially by enhancing farmers' trust in government policies. This trust is a crucial factor in transforming residue management practices toward more sustainable approaches (Sun et al., 2023).

3.6 Machinery Support Factor

In recent years, the Thai government has launched policies to promote the use of agricultural machinery in order to enhance productivity and reduce the labor burden on farmers. However, state-supported machinery programs aimed specifically at land preparation in line with goals to reduce crop residue burning remain limited in both scope and scale. Consequently, tangible outcomes have yet to be clearly observed in practice.

According to the survey, 58.1% of farmers believed that government-provided machinery would significantly reduce burning, while 30.1% saw a moderate reduction, 11.6% anticipated only a slight reduction, and just 0.2% believed it would have no impact at all. Many farmers pointed out that the main reason for continuing to burn crop residues is the lack of access to appropriate machinery. If the government were to provide low-cost machinery-either for sale, rental, or lease-purchase-the likelihood of reducing burning would increase, with 41.5% of respondents indicating a high likelihood, 32.7% moderate, 22.5% low, and 3.3% no likelihood. Notably, the proportion of farmers who perceived a high likelihood of reduction dropped from 58.1% (if machinery is fully subsidized) to 41.5% (if self-funded), reflecting the limited purchasing power among farmers.

When analyzed by crop group, non-rice farmers were more optimistic, with 67.7% believing that government support for machinery could significantly reduce burning, compared to only 54.2% among rice farmers. Moreover, non-rice farmers were more likely to reduce burning behavior if low-cost machinery were available (53.2% vs. 36.7%). These differences suggest that while both groups support machinery provision, the level of sensitivity to such -supportparticularly among sugarcane farmers-is higher, likely due to greater dependency on mechanization and larger farm sizes.

In terms of the types of machinery desired, 32.5% of farmers preferred straw, leaf, or residue balers, followed by plowing and tilling equipment (31.7%), shredders or residue choppers (29.0%), sugarcane harvesters (4.6%), leaf strippers (1.8%), and other types (0.4%). These findings emphasize the importance of tailoring machinery support to the specific needs of different crops and regional farming systems (Leena & Prashar, 2021). Regarding barriers to machinery access, 77.3% cited high cost, followed by high maintenance costs (14.4%), familiarity with traditional practices (4.2%), and lack of knowledge in machinery operation (4.1%).

A case study from South Korea-particularly in Yangpyeong County-demonstrates a successful model in which the local government established an Agricultural Machinery Rental Center to facilitate access for local farmers. All residents of Yangpyeong are entitled to use this service, which primarily supports small-scale farmers who cannot afford to purchase machinery. The initiative aims to reduce production costs and promote efficient machinery use. The service operates on a low-cost rental basis, and in special cases such as natural disasters or vulnerable farmer groups, machinery may be provided free of charge (Korea Rural Economic Institute, 2003).

Nonetheless, multiple studies have indicated that while machinery support plays a role in reducing burning, the integration of cross-sector collaboration and raising awareness of the environmental consequences of burning are even more influential in driving behavioral change. In addition, financial incentives have also proven effective in influencing farmer decisions (Prasertsri & Kittipongvises, 2024). Therefore, to ensure a sustainable solution, it is essential to adopt a multi-dimensional approach, incorporating technical, economic, and social strategies simultaneously.

3.7 Correlation between Farmers' Characteristics and Agricultural Burning Behavior

The analysis of the relationship between farmers' personal characteristics and their burning behavior revealed that factors such as age, educational level, and income influence their attitudes, awareness, and likelihood of changing post-harvest residue management practices. The details of each factor are discussed as follows.

3.7.1 Age

Although farmers of all age groups showed a high preference for government support in the form of subsidies, it was observed that farmers under the age of 40 were less likely to demand government assistance compared to those aged 50 and above. Older farmers tended to express greater demand for financial support, with the level of dependency increasing with age.

In terms of concern about losing state benefits if caught burning, only 7.9% of farmers under 40 years old expressed strong concern, whereas 70.9% of farmers aged 40 - 60 reported high levels of concern. This indicates a notable generational difference in awareness and sensitivity toward government enforcement measures.

Statistical analysis revealed a significant correlation ($p < .05$) between age and the likelihood of switching from burning to alternative residue management methods. Older farmers were less likely to change their behavior, suggesting that age can be a barrier to behavioral adaptation. These findings are consistent with research conducted by the Thailand Environment Institute (TEI, 2020), which found that increasing age negatively affects receptiveness to new technologies and practices, particularly among senior farmers who may face challenges in accessing digital information channels. In contrast, younger farmers, who are generally more familiar with technology and have better access to information, tend to adapt more easily and are more responsive to behavioral change initiatives.

3.7.2 Education Level

The education level of farmers was found to be associated with several factors related to agricultural burning behavior, particularly awareness of environmental impacts and the demand for government support. Farmers with education levels of upper secondary school or vocational training and above showed a high level of awareness regarding the environmental consequences of burning (69.5%), while only 44.1% of those with lower education levels reported strong awareness.

Regarding government support, it was found that less-educated farmers expressed a greater need for subsidies to stop burning (52.8%) compared to those with higher education levels (37.9%), which may reflect limited self-investment capacity among the former group.

Research in several areas, including Chiang Rai Province, has shown that many farmers still lack knowledge about the environmental consequences of burning. Farmers with lower levels of environmental knowledge tend to continue burning at higher rates than those who are more informed (Raksanam et al., 2013). Studies by Kaushal and Prashar (2021) and Wangwongwatana (2022) also confirm that educating farmers about environmental impacts and appropriate residue management alternatives can significantly reduce burning behavior.

In terms of perceptions of cost, farmers with lower education levels were more likely to believe that shifting from burning to alternative methods would result in significantly higher expenses than those with higher education levels. The Chi-Square test revealed a statistically significant relationship ($p < .05$) between education level and farmers' behavior and perceptions.

3.7.3 Income

Household income was another important factor influencing agricultural burning behavior, particularly in terms of how farmers respond to policies and support measures provided by the government. The study found that lower-income farmers were more willing to switch to environmentally friendly residue management practices than higher-income farmers, possibly because government assistance is more readily available to lower-income groups.

When examining attitudes toward the difficulty of switching from burning to alternative methods, lower-income farmers were more likely to perceive the transition as difficult, compared to higher-income farmers. This may reflect constraints in financial capital, technical readiness, or access to machinery and technology required for alternative residue management.

Interestingly, when asked about the anticipated costs associated with changing residue management practices, farmers earning more than 150,000 baht per year were more likely to estimate that costs would increase significantly if they stopped burning - more so than farmers with lower incomes. This is a noteworthy finding, as it suggests that perceived cost burdens are not determined solely by income level, but may also relate to factors such as production scale, management expectations, or reliance on labor and machinery.

These findings suggest that income influences farmers' attitudes, adaptive capacity, and perceptions of cost burden, and should therefore be taken into consideration when designing flexible support policies that effectively respond to the differing needs of farmers across income levels.

3.8 Binary Logistic Regression Analysis

3.8.1 Binary Logistic Regression Analysis: Case of Rice and Sugarcane Farmers

The binary logistic regression analysis of the combined crop group - specifically, rice and sugarcane farmers - revealed that several factors significantly influenced farmers' decisions to either adopt or avoid burning as a method of crop residue management. The resulting model is as follows:

$$Y = -0.557 - 0.787X_1 + 0.689X_2 - 0.615X_3 + 0.429X_4 + 0.370X_5 + 0.307X_6 + 0.388X_7 - 0.302X_8$$

In this model, the dependent variable Y represents the residue management behavior of farmers, coded as 0 or 1. A value of Y closer to 0 indicates a higher likelihood that the farmer chooses non-burning methods of residue management. Conversely, a value closer to 1 suggests a greater tendency toward burning.

The coefficients (B values) of the independent variables (X_1–X_8) represent the direction and magnitude of influence on the burning behavior. A negative coefficient implies that the variable tends to reduce the probability of burning, while a positive coefficient suggests an increased likelihood of burning.

Table 3 Variable Coefficients for the Sample Group: Case of Combined Crop Group (Rice and Sugarcane)

Variable	Coefficient (B)	Standard Error (S.E.)	Wald Statistic	Significance (Sig.)
X1	–0.787	0.195	16.323	0.000 ***
X2	0.689	0.167	17.016	0.000 ***
X3	–0.615	0.179	11.795	0.001 ***
X4	0.429	0.153	7.880	0.005 **
X5	0.370	0.142	6.831	0.009 **
X6	0.307	0.146	4.457	0.035 *
X7	0.388	0.184	4.457	0.035 *
X8	–0.302	0.127	5.632	0.018 *

Note: ***$p < 0.001$, *$p < 0.01$, $p < 0.05$

The accuracy of the logistic regression model was assessed using the Nagelkerke R Square, which, in this case, was 0.434537. This value serves as an approximation of the coefficient of multiple determination for logistic regression models, indicating the proportion of variance in the dependent variable that can be explained by all independent variables included in the model. In other words, the model accounts for approximately 43.45% of the variability in agricultural residue burning behavior among farmers. This level of explanatory power is considered moderate and is deemed suitable for preliminary policy applications.

Furthermore, the Nagelkerke R Square reflects the goodness-of-fit of the model. A value closer to 1 suggests a better fit and a stronger ability of the model to explain the relationship between variables. Given this, the current model can be used not only for predictive purposes but also for assessing the determinants of farmers' decision-making regarding residue management. It also offers valuable insights to support the formulation of evidence-based policy interventions aimed at reducing the prevalence of open burning in the agricultural sector.

The results of the binary logistic regression analysis (see Table 3) revealed that eight independent variables were statistically significantly associated with the behavior of burning agricultural residue. These findings can be categorized into two groups: (1) Inhibiting factors, which reduce the likelihood of burning, and (2) Promoting factors, which increase the likelihood of burning.

Significant Predictors from the Binary Logistic Regression Model

Inhibiting Factors (Factors that Reduce the Likelihood of Burning):

X1 (Environmental Awareness): The coefficient for this variable is significantly negative ($B = –0.787$, $p < 0.001$), indicating that farmers with greater awareness of environmental impacts are considerably less likely to engage in burning practices.

X3 (Attitude Toward Soil Degradation from Burning): A negative coefficient (B = –0.615, p = 0.001) reflects that farmers who perceive burning as detrimental to soil fertility tend to avoid burning as a residue management method.

X8 (Perceived Effectiveness of Government Policy): A negative coefficient (B = –0.302, p = 0.018) suggests that farmers who believe government policies are effective are less likely to burn agricultural residues.

Promoting Factors (Factors that Increase the Likelihood of Burning):

X2 (Perceived Cost of Behavioral Change): The positive coefficient (B = 0.689, p < 0.001) indicates that farmers who view non-burning alternatives as more costly are more inclined to continue burning.

X4 (Desire for Government Support): A positive relationship (B = 0.429, p = 0.005) implies that farmers who express a need for governmental assistance are more likely to continue burning, potentially due to their current inability to implement alternative practices independently.

X5 (Concern Over Losing State Benefits if Caught Burning): Although the coefficient is positive (B = 0.370, p = 0.009), this suggests that even those who express concern may continue burning in the absence of viable alternatives or support mechanisms.

X6 (Perceived Difficulty in Changing Behavior): The coefficient (B = 0.307, p = 0.035) reveals that the more difficult farmers perceive the behavioral change to be, the more likely they are to engage in burning practices.

X7 (Willingness to Cease Burning if Affordable Machinery Were Available): Although this variable has a positive coefficient (B = 0.388, p = 0.035), within the context of the questionnaire, it reflects that farmers who expressed a willingness to stop burning if affordable machinery were available are still likely to continue burning in the current situation due to lack of access to such machinery.

Based on the results of the logistic regression analysis, the significant variables identified in the model indicate that various factors influence farmers' decisions on whether to burn or not burn agricultural residues. The government should formulate policies and implement measures in several areas, such as promoting knowledge and raising awareness, with particular emphasis on environmental concerns, which have proven to be the most effective in reducing burning practices. Reducing the cost of non-burning alternatives—such as supporting access to affordable agricultural machinery—would help decrease the incentives for burning. Government policies must be effective and capable of fostering genuine confidence among farmers, while communication efforts should ensure that farmers clearly understand the measures. In addition, targeted assistance should be provided for specific groups, such as low-income farmers or those who perceive behavioral change as particularly challenging.

3.8.2 Binary Logistic Regression Analysis: Case of Sugarcane Farmers

A focused binary logistic regression analysis was conducted specifically for the group of sugarcane farmers to explore the determinants influencing their decision to either burn or not burn agricultural residues. The resulting regression model can be expressed as follows:

$$Y = -50.205 + 4.986X_1 + 3.200X_2 + 2.513X_3 + 2.037X_4 - 1.628X_5 - 1.101X_6 - 1.011X_7$$

In this model, Y represents the dependent variable referring to residue management behavior (1 = Likely to Burn, 0 = Unlikely to Burn), while X_1 to X_7 denote independent variables reflecting attitudes, perceptions, and support-related factors influencing farmer behavior.

The analysis revealed that this model has a Nagelkerke R Square value of 0.711, indicating that the model accounts for 71.1% of the variance in burning behavior among sugarcane farmers. This high level of explanatory power demonstrates the model's strong suitability and predictive accuracy for this specific subgroup.

The results highlight the importance of the included factors in explaining the decision-making process of sugarcane farmers with regard to burning. As such, these findings can serve as a valuable foundation for the development of targeted policies or interventions specifically designed to reduce open burning in sugarcane farming systems effectively.

Table 4 Variable Coefficients for the Sample Group: Case of Sugarcane Farmers

Predictor Variable	B (Coefficient)	S.E. (Standard Error)	Wald	Sig. (p-value)
X_1	4.986	2.144	5.406	.020*
X_2	3.200	1.562	4.199	.040*
X_3	2.513	1.173	4.585	.032*
X_4	2.037	0.776	6.895	.009**
X_5	–1.628	0.736	4.890	.027*
X_6	–1.101	0.527	4.370	.037*
X_7	–1.011	0.460	4.841	.028*

Note: ***p < 0.001, *p < 0.01, p < 0.05

Explanation of Independent Variables in the Model

Variables with Deterrent Effects (Reducing the Likelihood of Burning):

X_5 (Perceived Ease of Behavioral Change): The negative coefficient (B = –1.628, p = .027) indicates that when farmers perceive it is easy to switch from burning to alternative residue management practices, the likelihood of burning significantly decreases. This underscores the importance of providing clear knowledge, guidance, and concrete support. Educational efforts and showcasing successful case studies can help reduce farmers' psychological barriers and the perception that "behavior change is difficult."

X_6 (Likelihood of Ceasing Burning if Affordable Machinery is Available): The negative coefficient (B = –1.101, p = .037) suggests that farmers who believe they would stop burning if affordable machinery (e.g., for rent or lease-to-own) were available are less likely to burn in contexts where such machinery is sufficiently accessible. This finding supports the need to establish low-cost machinery rental centers at the subdistrict or district level.

X_7 (Perceived Effectiveness of Government Policies): The negative coefficient (B = –1.011, p = .028) indicates that farmers who perceive government policies as effective in addressing the burning issue are less likely to burn. This highlights the importance of policy credibility and trust.

Variables with Promotive Effects (Increasing the Likelihood of Burning):

X_1 (Awareness of Environmental Impact): Although this variable would typically be expected to reduce burning behavior, the coefficient is positive (B = 4.986, p = .020). This paradoxical result implies that higher awareness of environmental harm may actually coincide with a greater likelihood of burning. It suggests that awareness alone - especially when not accompanied by viable alternatives - does not translate into behavior change. Farmers may recognize the harm of burning but continue the practice due to a lack of feasible options.

X_2 (Perceived Cost of Behavioral Change): The positive coefficient (B = 3.200, p = .040) shows that when farmers perceive alternative methods to be more expensive or to entail high costs, they are more likely to continue burning. This implies that government support is needed in the form of cost subsidies or affordable services for managing crop residues.

X_3 (Desire for Government Support): The positive coefficient (B = 2.513, p = .032) indicates that farmers who express a need for government support are more likely to engage in burning. This may reflect gaps in current support mechanisms or the inadequacy of existing programs. Concrete interventions - such as subsidies, machinery provision, or labor support for residue management - should be expanded and better targeted.

X_4 (Concern Over Losing State Benefits if Caught Burning): Despite this concern, the positive coefficient (B = 2.037, p = .009) indicates that farmers still tend to burn. This result suggests that punitive policies alone are insufficient. Even if farmers fear losing benefits or facing penalties, they may still resort to burning due to the lack of viable alternatives.

Based on the analysis of sugarcane farmers, it can be concluded that although these farmers are aware of the negative impacts of open burning, they continue to use this method due to three key reasons: (1) lack of access to agricultural machinery and financial support for alternative practices, (2) the perception that changing behavior entails high costs and considerable difficulty, and (3) the belief that current government measures are ineffective or inaccessible. Therefore, the design of policy interventions should adopt an integrated approach, which includes: (1) economic incentives, such as affordable agricultural machinery or centralized crop residue management services, (2) effective policy communication to foster understanding and trust, and (3) promotion of learning and community participation to support sustainable behavioral change.

A comparative analysis and synthesis between the overall farmer group (including both rice and sugarcane growers) and the specific group of sugarcane farmers revealed that certain variables included in the sugarcane-specific model did not appear in the overall model, and vice versa. This divergence reflects the crop-specific nature of farmers' behaviors and the influencing factors behind their decisions. Consequently, it underscores the importance of formulating targeted policy measures tailored to the characteristics of each farming group. Such differentiated policy design would enhance the effectiveness of interventions by aligning them with the specific contexts and needs of farmers in each production sector.

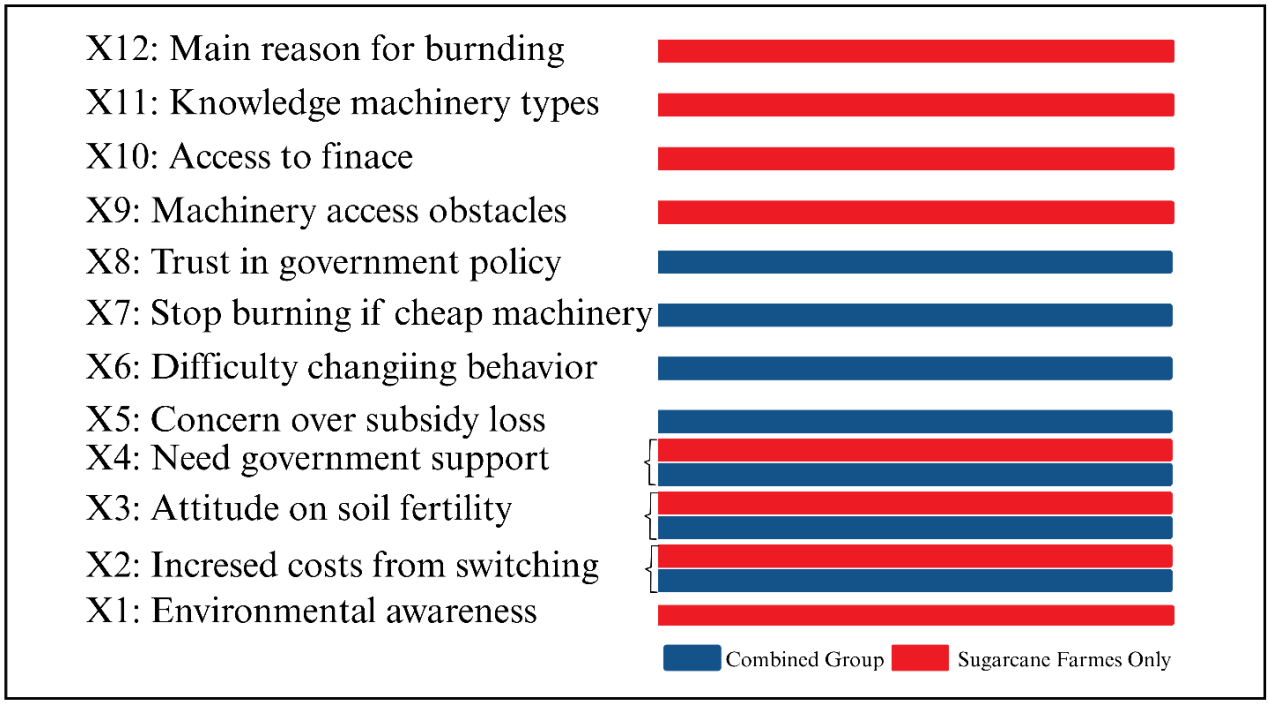
Table 5. Comparison of Variables in the Models between the Overall Group and Sugarcane Farmer Group

Variable Code	Description of Independent Variable	Present in Overall Model	Present in Sugarcane Model	Policy Implication
X1	Perception of environmental impacts from burning	✓ (–0.787)	✗	The overall group is more responsive to environmental concerns; sugarcane farmers may not alter behavior despite awareness.
X2	Perceived cost increase from behavioral change	✓ (+0.689)	✓ (+2.037)	Both groups are concerned, but sugarcane farmers are more cost-sensitive.
X3	Attitude toward the impact of burning on soil fertility	✓ (–0.615)	✓ (–1.628)	Both groups recognize the impact, but sugarcane farmers are more directly affected due to yield concerns.
X4	Desire for government support	✓ (+0.429)	✓ (+4.986)	Sugarcane farmers have significantly higher expectations for government assistance.
X5	Concern about losing subsidies/benefits if caught burning	✓ (+0.370)	✗	The overall group (especially rice farmers) is more sensitive to punitive measures.
X6	Perceived difficulty of behavioral change	✓ (+0.307)	✗	The overall group perceives difficulty as a key determinant of behavior; no significant effect for sugarcane farmers.
X7	Likelihood of ceasing burning if low-cost machinery is available	✓ (+0.388)	✗	The overall group sees machinery as a deterrent to burning, whereas sugarcane farmers may be influenced by other factors.
X8	Belief in the effectiveness of government policies	✓ (–0.302)	✗	The overall group responds to policy confidence; sugarcane farmers' belief in policy effectiveness was not significant.

Variable Code	Description of Independent Variable	Present in Overall Model	Present in Sugarcane Model	Policy Implication
X9	Barriers to using machinery (e.g., high cost, unavailability)	✗	✓ (+3.200)	A unique constraint for sugarcane farmers; targeted support is needed.
X10	Access to financing for machinery purchase/leasing	✗	✓ (+2.513)	Sugarcane farmers are more responsive to financing accessibility.
X11	Awareness of appropriate machinery types	✗	✓ (–1.101)	Sugarcane farmers who are aware of suitable machinery are less likely to burn.
X12	Primary reasons for burning (e.g., labor saving, lack of alternatives)	✗	✓ (–1.011)	Understanding specific motivations in sugarcane farming can help tailor behavioral interventions.

The chart (Figure 1) illustrates a comparison of statistically significant variables included in the binary logistic regression models for two groups: the overall farmer group (rice and sugarcane growers) and the sugarcane farmer group. The blue bars represent variables that appeared in the model for the overall group, while the red bars represent variables included in the model for the sugarcane group. The chart highlights key differences in behavioral patterns and determining factors between the two groups, providing empirical support for the development of targeted policy interventions.

Figure 1 Comparison of Statistically Significant Variables Across Regression Models



The logistic regression analysis conducted in this study aimed to identify the factors influencing farmers' open burning behavior. The analysis was divided into two groups: (1) the overall group, comprising both rice and sugarcane farmers, and (2) the sugarcane farmer group, which exhibited the highest burning rates in the study area of Khon Kaen Province. The key findings of the analysis can be summarized into the following core themes:

1. Behavioral Insights

(1) Understanding and Attitudes

The overall group demonstrated greater responsiveness to environmental concerns and long-term impacts—such as soil degradation—and showed a higher degree of confidence in government policies. In contrast, sugarcane farmers appeared more driven by immediate concerns related to production and costs, rather than long-term sustainability.

(2) Cost and Labor Concerns

The cost associated with ceasing burning was found to be a significant factor in both groups. However, sugarcane farmers showed greater sensitivity to cost-related issues. This may stem from limited financial resources needed to acquire agricultural machinery and from labor shortages within the farming sector.

(3) Demand for Targeted Support

Sugarcane farmers exhibited a consistently higher demand for government support across all variables and faced more complex behavioral obstacles to change, such as problems with machinery accessibility and financing—issues not as prominent among the overall group.

2. Targeted Policy Design Recommendations

(1) Rice Farmers:

There is a need for meaningful communication and awareness-raising—moving beyond superficial awareness to deep understanding. Messaging should emphasize the environmental and public health impacts of burning. Strict enforcement of legal measures should be accompanied by appropriate incentive structures to foster behavioral change.

(2) Sugarcane Farmers:

Policies must prioritize support for machinery, particularly for harvesting and residue collection. Financial support mechanisms should be tailored to match the specific needs of this group. In addition, technical knowledge is essential—both in terms of high-yield cultivation practices and environmentally friendly harvesting techniques—to address underlying structural constraints.

(3) Both Groups:

Both rice and sugarcane farmers require diversified forms of state support, including subsidies, affordable machinery, access to financial resources, and incentives for behavioral change. The analysis clearly demonstrates that agricultural burning behavior is not driven by a single factor, but rather by a combination of behavioral, economic, and structural determinants.

This is especially true for sugarcane farmers, who face more substantial constraints. Therefore, effective and sustainable reduction of agricultural burning necessitates the development of group-specific policies that are context-sensitive and responsive to the real-world conditions of each farming sector.

4. Conclusion

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 (PM2.5), 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.

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