

Extended Abstract

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Paper/Poster Title	Savior or Driver? Retailer recommendation and pesticide overuse
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Abstract prepared for presentation at the 98th Annual Conference of The Agricultural Economics Society will be held at The University of Edinburgh, UK, 18th - 20th March 2024.

Abstract	200 words max
<p>Pesticide overuse is often attributed primarily to farmers, with limited attention given to pesticide retailers due to challenges in observing their actual sales behavior. This study employs an audit experiment to scrutinize the pesticide recommendation practices of retailers. In the control group, 79.80% of retailers suggest dosages exceeding the labeled maximum, but this percentage decreases to 51.58% when the retailer discovers the customer will read the label. This discrepancy underscores the prevalence of over-recommendation behavior among retailers regarding pesticide dosages. Encouragingly, our findings reveal a significant association between retailer recommendations and pesticide package size. Optimal alignment of package size (net weight) with labeled dosage results in a substantial reduction of recommended dosages. Based on these findings, we develop a theoretical framework for retailer recommendation decisions to illustrate the underlying mechanisms. These insights offer a foundation for mitigating pesticide overuse through retailer-oriented interventions.</p>	
Keywords	pesticide retailer; overuse; packaging size; audit study
JEL Code	Microeconomics: Micro-Based Behavioral Economics D9 Agriculture: Micro Analysis of Farm Firms, Farm Households, and Farm Input Markets Q12 see: www.aeaweb.org/jel/guide/jel.php?class=Q)
Introduction	100 – 250 words
<p>The excessive use of pesticides is a crucial concern in both China and worldwide in the context of sustainable agricultural practices. Farmers, as primary users, are a focal point for research aiming to regulate their pesticide use, notably through initiatives like the Farmer Field School. In practice, farmers' decisions regarding pesticide dosages tend to be made at the point of purchase rather than during application due to dynamic pest characteristics and high storage costs, prompting them to purchase only the necessary amount of pesticide. Consequently, the behavior of retailers becomes crucial as a significant information source for farmers.</p> <p>Despite the pivotal role of retailers, there is a scarcity of research on this aspect, and divergent views exist on the impact of pesticide retailers on usage, potentially stemming from challenges in data collection. Previous studies either relied on farmer interviews to gather information on retailers' recommendations and selling behavior, incurring endogeneity issues, or directly interviewed retailers, facing challenges in observing actual behavior due to the Hawthorne effect. To overcome these challenges, this study employs an audit experiment for a precise portrayal of retailers' sales and recommendation behavior.</p>	

Furthermore, previous research has shown that the size of product packaging not only shapes consumers' purchase and usage decisions but also influences the seller's sale strategy, closely tied to their profitability. Consequently, this study attempts to mitigate over-recommendation by exploring ways to optimize pesticide packaging size, utilizing both theoretical modeling and empirical testing.

Methodology	100 – 250 words
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The audit study serves as a valuable method for acquiring reliable data on individual behavior, utilizing trained researchers (auditors) possessing all relevant characteristics except for the specific attribute under investigation for potential discrimination. In the context of pesticide transactions, a between-subject design was employed, randomly assigning customers as either label-reading or non-label-reading, who were then sent to a pesticide retail store for purchasing. All simulated customers adhered to a standardized script during the pesticide purchase process.

To evaluate retailers' diagnostic capabilities and communicate the severity of the infestation, customers presented a photograph of affected vegetables. Subsequently, simulated customers sought information from the retailer regarding pesticide dosage, exhibiting distinct behaviors based on customer type. In the control group, customer, not reading the pesticide label, directly inquired about the quantity of pesticide required per acre of land. In the treatment group, customer first read the label's specified dosage per acre and then queried whether employing the labeled dosage (X grams per acre) was sufficient. Aside from this minimal difference, all other conditions were identical in both groups. Subsequent to the purchase, simulated customers expressed gratitude to the retailer and exited the store. Immediately after the transaction, customers were asked to complete a survey capturing details of the pesticide transaction. By comparing the pesticide recommendation strategies employed by retailers facing these two types of customers, it was possible to identify whether over-recommendation occurs.

Results	100 – 250 words
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Two primary findings emerge from the study:

Firstly, the ANOVA results concerning the recommendation strategy of the two retailer groups indicate that retailers facing with label-reading customers perform well in terms of both the percentage of over-recommending retailers and the overall degree of over-recommendation, displaying a lower proportion and a reduced extent of over-recommendation. Noteworthy is the substantial average degree of over-recommendation, surpassing the maximum label dosage by several multiples. These outcomes provide empirical support for the existence of over-recommendation behavior among retailers, signifying a substantial potential to reduce pesticide use through interventions targeting retailers.

Secondly, the initial regression results examining the influence of pesticide product packaging size on the extent of retailer over-recommendation unveil a U-shaped relationship. Retailers are prone to recommend more pesticides when the packaging size is either small or large. Subsequent analysis reveals that aligning the packaging size more closely with the labeled dosage mitigates retailers' inclination toward over-recommendation.

Discussion and Conclusion	100 – 250 words
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This study employs the audit experiment method to investigate whether retailers engage in excessive pesticide dosage recommendations, providing insights into the unexplored realm of retailer recommendation behavior. Additionally, the study proposes strategies to reduce

recommended pesticide dosages by focusing on optimizing the packaging size of pesticides, offering significant contributions to addressing the root causes of pesticide overuse.

Primarily, the overuse of pesticides is not solely attributed to farmers; pesticide retailers also bear responsibility. Whether retailers are intentionally or inadvertently over-recommending remains unclear, but it is evident that they engage in severe over-recommendation behavior, surpassing the maximum dosage indicated on labels by several multiples. Consequently, there is considerable potential and necessity to reduce recommended pesticide dosages from the supply side.

Encouragingly, our findings suggest that excess dosages recommended by retailers can be mitigated by optimizing pesticide packaging size. The study reveals that both excessively large and small pesticide packaging increases the likelihood of retailers over-recommending pesticides. A plausible explanation is that mismatches between net content and label dosage afford retailers greater room for over-recommendation. Large pesticide packages incur higher storage costs, potentially diminishing efficiency and complicating farmers' purchases. Consequently, retailers may increase recommended dosages to facilitate successful product sales. Conversely, small-pack pesticides diminish label information visibility, exacerbating information asymmetry between retailers and farmers, prompting retailers to over-recommend for profit. Thus, optimal packaging size should align with the standard dosage specified on pesticide product labels.