



An index method to evaluate growers' pesticide use for identifying on-farm innovations and effective alternative pest management strategies: a case study of winegrape in Madera County, California*

Wen-juan LI¹, Zhi-hao QIN^{†‡1,2}, Ming-hua ZHANG³, Joe BROWDE⁴

⁽¹⁾Institute of Agro-Resources and Regional Planning, Chinese Academy of Agricultural Sciences, Beijing 100081, China)

⁽²⁾International Institute for Earth System Sciences, Nanjing University, Nanjing 210093, China)

⁽³⁾Department of Land, Air and Water Resources, University of California, Davis, CA 95616, USA)

⁽⁴⁾California Association of Winegrape Growers, Sacramento, CA 95825, USA)

[†]E-mail: zhihaoqin@163.com

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Abstract: Winegrape is an important perennial crop in California, USA. Each year California winegrape farming consumes about 20 million kilograms of pesticides that have been a pollutant source to the fresh water systems of the state. The variation of pesticide use among winegrape growers has been significant. It has been observed that some growers have developed effective ways to reduce pesticide use, yet control pests efficiently to ensure harvest. Identification of the growers with low and high pesticide use is very helpful to extension programs that aim on reducing pesticide environmental risk. In this study, an index approach is proposed to quantitatively measure pesticide use intensity at grower level. An integrated pesticide use index is developed by taking pesticide quantity and toxicity into account. An additive formula and a multiplying formula were used to calculate the pesticide use index, i.e., PUI and PUIM. It was found that both PUI and PUIM were capable of identifying the low and high pesticide users while PUI was slightly more conservative than PUIM. All pesticides used in California winegrape farming were taken into account for calculating the indices. Madera County, one of the largest winegrape producers in California, was taken as an example to test the proposed approach. In year 2000, among the total 208 winegrape growers, 28 with $PUI \leq 10$ and 34 with $10 < PUI \leq 20$ were identified as low pesticide users who were characterized with both low quantity and low toxicity of pesticide use. Most of the growers had small-sized vineyards, i.e., one field and small planted areas. Furthermore, they had very low pesticide use intensity, used only 1–2 types of pesticides (mainly fungicides), applied few pesticides (1–3 only), and emphasized the use of low toxicity compounds. Meanwhile, 19 growers with $PUI > 60$, identified as high pesticide users, had large-sized vineyards, i.e., more fields and large planted areas. They used all types of pesticides and many compounds, which indicated that their pest controls heavily depended on pesticides rather than on-farm management. Through the case study, the proposed approach proved to be useful for analyzing the growers' pesticide use intensities and interpreting their pesticide use behaviors, which led to a new start point for further investigation of searching ways to reduce pesticide environmental risk.

Key words: Pesticide use index, Toxicity, Compound, Pesticide environmental risk, California

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[†] Corresponding author

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1 Introduction

California's 2.6 billion-dollar output of winegrape farming needs pesticide application to ensure harvest. Each year about 20 million kilograms of