

# **Pesticide Residues in Vegetables: A Case Study of Lemons Market in Pakistan**

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## **Abstract**

In developing countries, markets are inefficient in term of information exchanges between producers and consumers, which are one of the prerequisites for prices to act as signal for proper resource allocation in an economy. In case of vegetables, information on quality traits are often difficult for consumers to obtain prior to purchase, resulting in market failures for food safety. The market for vegetables contaminated with pesticides residues in Pakistan appears to be one of these markets. This study attempts to investigate determinants of pesticide residues and estimate information efficiency in the vegetable market by establishing a relationship between pesticide residues (quality trait) and prices paid by the consumers within a representative sample of 360 farmers in Pakistani Punjab, the main vegetable growing province. Chromatography technique is employed to quantify pesticide residues—a quality trait that is generally unobservable by the consumers—in four common vegetables i.e., okra, spinach, cauliflower and brinjal. Majority of the vegetable samples surpasses the maximum residues limits, hence, they are lemons. Econometric analysis shows that magnitudes of pesticide residues in vegetables vary with pesticide quantity and spray interval, freshwater irrigation and farmers education, vegetable experience and district dummy. To test information efficiency, a lemon model is estimated. We observed that vegetable prices are negatively but insignificantly correlated with pesticides residues, implying that vegetable market is a lemon market in Pakistan. Proper implementation of food safety standards and product labeling could help to provide safe vegetables to consumers.

**Key words:** Vegetables, information asymmetry, lemons market, gas chromatography, pesticide residues, food safety, Pakistan