Monitoring of pesticide residues and risk assessment for consumer safety in rice samples from Andhra Pradesh, India

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A systematic study monitored the pesticide residues in commercially important food grains, specifically rice produced, consumed and exported from India. Residues of 18 commonly used pesticides (acephate, buprofezin, carbendazim, hexaconazole, isoprothiolane, lambda cyhalothrin, profenofos, propiconazole, tebuconazole, azoxystrobin, bifenthrin, flubendiamide, imidacloprid, tricyclazole, indoxacarb, monocrotophos, quinalphos, thiamethoxam) were determined in 135 samples collected from farmer fields and 15 samples from markets from Guntur and Palnadu districts of Andhra Pradesh, India. The residues were extracted using the modified quick, easy, cheap, effective, rugged and safe method and quantified by gas chromatography–mass spectrometry/mass spectrometry and liquid chromatography-tandem–mass spectrometry/mass spectrometry. Propiconazole, tricyclazole and tebuconazole were the most frequently detected pesticides. The farm-gate rice (de-husked brown) samples from zero budget natural farmers and polished rice samples from markets of both districts were free from pesticide residues. No pesticides were detected in 71.11% and 74.44% of all the farm-gate rice samples collected from farmers of Palnadu and Guntur districts respectively.

Keywords: Food safety, pesticides, residues, rice cultivation, risk assessment.

Likewise, production also flared up from 23.5 MT in 1949–1950 to 124 MT during 2020–2021 (ref. 3). However, in Andhra Pradesh, there has been a modest increase in the area under cultivation of rice, i.e. from 2.21 Mha in 1950–1951 to 2.3 Mha in 2020–2021. However, the production and productivity of rice have surged from 2.19 MT and 995 kg ha^{-1} during 1950–1951 to 7.88 MT and 4437 kg ha^{-1} in 2020–2021 respectively[3,4]. Due to the advanced crop management techniques followed in Andhra Pradesh by rice farmers, the productivity of rice in the state is significantly higher than that of the national average. Consequently, the state is popularly known as the Rice Bowl of India. In Andhra Pradesh, Guntur district has a significant area of 0.26 Mha under cultivation of rice, with a production of 1.25 MT for 2020–2021 (ref. 5).

However, concurrent with intensive agriculture, there was an aggravation of biotic constraints, viz. insect pests, diseases and weeds. More than 100 species of insects were recorded as pests of rice, of which a dozen are significant in India[6]. Behera and Singh[7] reported that weeds can reduce paddy yield by 28–48% and a study conducted by Savary *et al.*[8] in 2019 reported a global loss in the range of 25–41% due to pathogens and pests in rice.

The Green Revolution paved the way for the use of chemicals to increase production in agriculture in general and rice in particular, creating a tremendous impact on rice