Maize yield sensitivity to fall armyworm (*Spodoptera frugiperda*, J. E. Smith) and the adoption of IPM practices in Karnataka, India

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The increasing prevalence of the invasive fall armyworm (*Spodoptera frugiperda*) threatens global food security, as maize accounts for 36 per cent of the world's grain production. India, the fifth-largest maize producer, holds a strategic advantage in meeting global demand. The present study examined the sensitivity of maize yields to fall armyworm (FAW) infestations and the factors influencing the adoption of integrated pest management (IPM) practices in Karnataka, India, which is the leading maize-producing state. The Cobb-Douglas production function revealed a negative, although not statistically significant, but economically meaningful, effect of FAW infestation on maize productivity (407 kg/ha). In contrast, rainfall and technological progress had significant positive effects: each 1 mm increase in rainfall from the geometric mean raised productivity by 1.792 kg, while the trend variable had a coefficient of 51.887, highlighting the role of technological progress in boosting yields. The probit model identified key factors influencing IPM adoption, whereas the intensity of adoption was assessed using the negative binomial regression model. Maize productivity, farm size, off-farm income, education, training, and farming experience significantly influence both the adoption and intensity of IPM use. Promoting IPM in high-productivity areas, targeting experienced farmers, and implementing strategies to enhance maize yields should be key policy priorities. Additionally, strengthening farmers' knowledge through training would be crucial for improving IPM adoption and managing pest risks.

Keywords: Adoption, fall armyworm, IPM, Karnataka, maize, negative binomial regression.

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MAIZE (*Zea mays* L.) is a versatile and emerging crop with wide adaptability under different agroclimatic conditions. Because of its high level of genetic yield potential among all cereals, maize is known as the 'Queen of Cereals' globally. Maize is a vital crop for millions of people, providing food, fodder, feed, and industrial raw materials[1]. Globally, 1,147.7 million tonnes of maize are produced annually on 193.7 million hectares in 170 countries, with an average yield of 5.75 t/ha, contributing 36 per cent to global grain production[2].

In India, maize production has increased 23-fold over the past seven decades, surpassing 38 million tons in the years 2022–23 (ref. 3). This impressive growth is attributed to both the expansion of cultivation areas and significant enhancements in productivity. The domestic utilisation of maize highlights its multifaceted importance: approximately 63 per cent of the total production is dedicated to animal feed, while the remainder serves as industrial raw material (21%), food (8%), seeds and storage (3%), and other miscellaneous uses (5%) (ref. 4). These diverse applications underscore the pivotal role of maize in driving global agriculture, positioning it as a critical commodity on the international stage.

Empirical studies have shown that by 2025, India's domestic consumption of maize will reach approximately 50 million tons (Mt), with the feed sector alone demanding 32 Mt. India's maize exports have also surged in recent years, reflecting the country's growing prominence in the global agricultural trade arena[5]. There is an anticipated export potential of about 10 Mt, necessitating an overall production of approximately 60 Mt by 2025. Achieving this target necessitates an annual growth rate of 7–8 per cent in production[6]. As the scope of area expansion is limited, the emphasis must shift from merely expanding cultivation areas to significantly enhancing yields per hectare.

As global demand for maize continues to rise, India faces a critical challenge of significantly increasing maize