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DETERMINATION OF TOXIC RESIDUE LEVELS OF FUNGICIDES APPLIED AGAINST CHICKPEA DISEASES DURING THE VEGETATION PERIOD

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Abstract: *This study evaluates the efficacy of various fungicides against powdery mildew and ascochyta blight in chickpeas, specifically focusing on testing different application rates of three specific formulations: Juke 33% EC (active ingredient Propiconazole 250 g/l + Cyproconazole 80 g/l), Folicur Plus 35% EC (Tebuconazole 125 g/l + Triadimefon 100 g/l), and Titul Miks 40% C.E.C. (Propiconazole 200 g/l + Tebuconazole 200 g/l). Post-harvest chemical analysis was conducted to determine the concentration of toxic residues remaining within the chickpea seeds across the different experimental variants.*

Keywords: *Chickpea, pulse crops, irrigated land, rainfed areas, biological efficacy, fungicide, application rate, powdery mildew, ascochyta blight, farm enterprise, active ingredient, crop yield.*

INTRODUCTION

Among pulse crops, chickpeas are distinguished by their high protein content, making them essential for human nutrition. Chickpea seeds typically contain 19–33% protein, 4–7% lipids, and 0.2–4.0% vitamins and essential amino acids. However, various diseases encountered during the vegetation period negatively impact plant density and overall yield parameters. In particular, several strains of fungi responsible for ascochyta blight and fusarium root rot pose significant challenges in major chickpea-producing nations. Failure to implement timely management strategies—based on a thorough understanding of disease types, disease prevalence, economic thresholds, and the bio-ecological characteristics of the pathogenic fungi—can result in yield losses ranging from 30% to 35%. Therefore, timely intervention not only preserves the harvest but also ensures the production of export-quality crops, contributing significantly to food security and providing the population with protein-rich food resources.

LITERATURE REVIEW

Chickpea (Cicer arietinum L.) occupies a unique position among pulse crops due to its high protein concentration and the quality of its nutritional lipids. In contemporary global livestock sectors, particularly within developed nations, chickpeas serve as a critical fodder source among legumes. Furthermore, the crop is an essential raw material in the food industry, widely utilized to manufacture diverse products with high nutritional profiles [1; pp. 7524-7532]. Given its specific thermophilic requirements, this crop has been traditionally cultivated across Central Asia, a region characterized by a sharp continental climate. In recent years, however, advanced cultivation technologies for producing chickpeas on irrigated lands have been extensively implemented into agricultural practice [2; p. 22].

Chickpea ranks among the leading crops in terms of global production volume. It is extensively utilized both as a primary food staple and as a high-value forage component. Chemical composition analyses across various cultivars indicate that chickpea grains contain 20–30% protein and 5–8% lipids, with an average of 120 g of digestible protein identified per 1 kg of dry matter [3; pp. 85-90]. Furthermore, the nutritional profile of chickpea seeds includes approximately 25.8% protein, 8.19% fat, 60% starch and sugars, and about 3% crude fiber (cellulose). This complex biochemical makeup facilitates its broad application across the diverse sectors of the food industry [4; pp. 989-992].

MATERIALS AND METHODS.

The preparation and identification of experimental samples were conducted according to the methodology established by S.N. Bykovskiy. The processed standards and samples were analyzed using High-Performance Liquid Chromatography (UHPLC) and Gas Chromatography (GC) systems. Quantitative analysis revealed that the active ingredients—namely Tebuconazole, Propiconazole, and Triadimefon—were not detected in residual forms within the tested samples (Figures 1–6).

STUDY LOCATIONS.

The research was conducted between 2022 and 2024 across the Tashkent, Samarkand, and Navoi regions of Uzbekistan.

RESEARCH RESULTS.

To combat powdery mildew and ascochyta blight during the chickpea vegetation period, the following formulations and application rates were tested: Juke 33% EC (0.2–0.25–0.3 l/ha), Folicur Plus 35% EC (0.3–0.35–0.4 l/ha), Titul Miks 40% C.E.C. (0.1–0.15–0.2 l/ha) and Torso 22.5% EC (0.3 l/ha) — used as the experimental control.

While pesticides play a crucial role in protecting agricultural crops from harmful organisms, their utilization poses significant risks to environmental stability and human health.

Consequently, this study was undertaken to quantify the toxic residue levels of the applied fungicides within the harvested produce grown on both irrigated and rainfed chickpea fields.

Samples were collected from the mature chickpea harvest across the various fungicide-treated variants and homogenized using a laboratory grinder. Subsequently, 10.0 mg of the resulting chickpea powder was precisely weighed using an analytical balance and transferred into specialized Eppendorf tubes. To these samples, 1.5 mL of acetonitrile (a polar solvent) was added for extraction.

To ensure the formation of a true solution and complete separation, the mixture was subjected to centrifugation for 10 minutes. Following centrifugation, the supernatant (liquid phase) was carefully separated from the precipitate (solid residue).

This extract was further diluted until a concentration of 0.01 mg/mL was achieved. All standards and experimental samples were prepared following this identical standardized procedure.

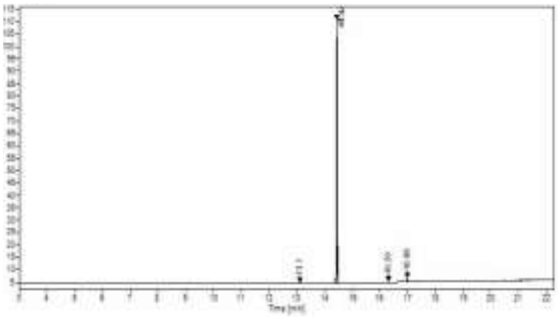

Figure-1. Tebuconazole Standard.

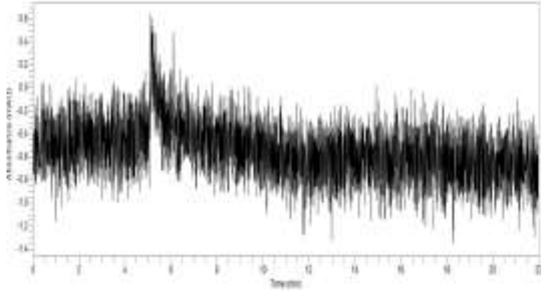

Figure-2. Tebuconazole Content in Chickpea yield.

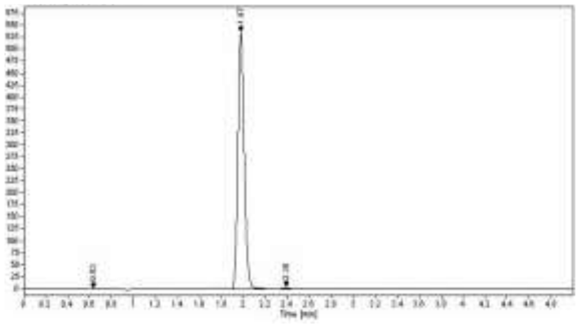

Figure-3. Triadimefon Standard.

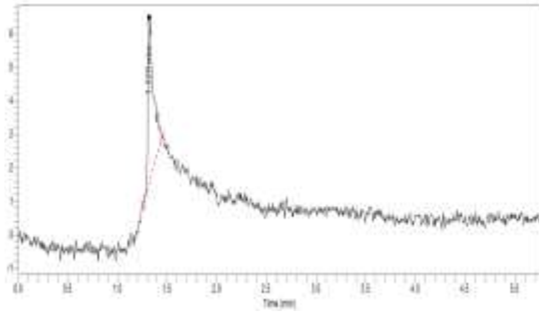

Figure-4. Triadimefon Content in Chickpea yield.

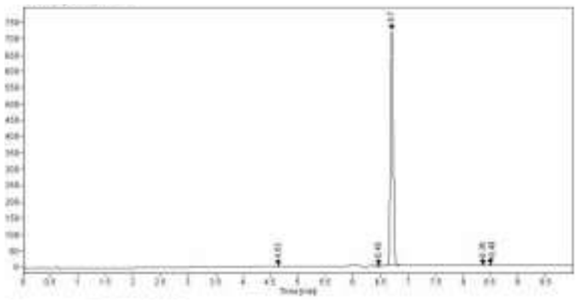

Figure-5. Propiconazole Standard.

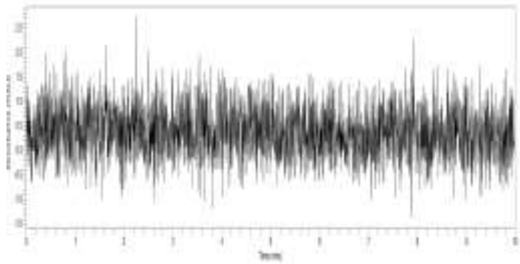

Figure-6. Propiconazole Content in Chickpea yield.

CONCLUSIONS. The study concluded that the application of various fungicides against powdery mildew and ascochyta blight during the chickpea vegetation period did not result in detectable chemical residues in the final grain. Specifically, when Juke 33% EC (Propiconazole 250 g/l + Cyproconazole 80 g/l), Folicur Plus 35% EC (Tebuconazole 125 g/l + Triadimefon 100 g/l), and Titul Miks 40% C.E.C. (Propiconazole 200 g/l + Tebuconazole 200 g/l) were applied at their respective rates at least 30 days prior to harvest, the toxic residue levels in the harvested grains were found to be non-existent. These results confirm that following the established pre-harvest intervals ensures the production of ecologically safe chickpea yields.

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