

Eliciting the Least-Risky Pesticide Production Plans for Greenhouse-Tomato Varieties: A Risk Programming Application to Saudi Growers

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ABSTRACT

More than 40% of the standing tomato-greenhouse projects located in the Saudi central region are being shut down. High productivity of the tomato greenhouse stands alone versus high investment, production, and maintenance costs. Pesticide is known to be used excessively despite its high unit price, causing high variations in the gross margin of the monetary unit spent on this input. Moreover, farmers seem to stick to some tomato varieties for unknown economic reasons. Four production plans based on the use of pesticides and fertilizers are identified. This paper presents three different scenarios regarding the maximization of the gross margin for the Saudi Riyals spent on pesticides per unit of land for tomato-greenhouse projects, taking into consideration tomato varieties grown and pesticide plan implemented. Both linear and MOTAD programming are implemented and the results are contrasted with those of the current status. The results showed that two tomato varieties: Rashida and Ramada are almost always considered risky, while field variety Mermand appeared to be partially risky. The pesticide production plan, utilizing Sandofan and Ridomil as fungicides, and Lannate as an insecticide, in addition to utilizing compound fertilizers, is characterized of being always inefficient. Growers should be directed to adopt the third (fourth) production plan, depending on, if they were risk neutral (aversar) respectively.

Key words: Pesticide production plans; Greenhouse-tomato varieties; MOTAD programming.

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1. INTRODUCTION

Tomatoes are considered to be the most important greenhouse vegetable grown in Saudi Arabia, where 14% of total tomato production comes from greenhouses. The study area of Riyadh and Kharj of the Saudi Central region represents 51% of total production of greenhouse tomatoes in the Kingdom. A greenhouse, in general, could be looked upon as an integrated agricultural system. The integrity rises from its numerous agricultural, engineering, and environmental sides. This leads to the need for a qualified management staff that could handle its anticipated complexity. The above has been proven to be essential in order to achieve returns, which could surpass the greenhouse's high investment costs which go parallel with the materials of which the greenhouse is made of, level of technology used, and the production capacity of the house. These investment costs could go as high as SR250/m² (one US \$ equals 3.75 Saudi Riyal). In addition, high production and maintenance costs are also another character of greenhouse projects.

High productivity is often the known and anticipated main advantage from investing in tomato greenhouse projects. A seven-fold productivity of the greenhouse to that in traditional agriculture is considered to be normal. Yet, the price of this advantage is embodied in numerous types of risks associated with this business. These types of risks are known to be inherent in the method of cultivation itself, soil type, quality of irrigation water used, pesticides applied, and the environment peculiar to greenhouses. Knowledge of these technical, in addition to the necessary economic sides, is considered to be of utmost importance to make good management decisions.

The study area is characterized of possessing real harsh climate. Zero degrees in Winter and above 50 degrees Celsius in Summer is considered