Atrazine and its Relation to Percolation of Water as Influenced by Three Rates and Four Methods of Irrigation Water Application. Troiano, J., C. Garretson, C. Krauter, and J. Brownell. EH 90-07. 1990.

Abstract

Leaching of atrazine and bromide or chloride was related to the amount of deep percolating water produced from irrigations. Atrazine is an herbicide and bromide and chloride are inorganic tracers that are used as surrogates for the measure of water movement in soil. Deep percolating water and subsequent solute movement were compared between four methods of water application: sprinkler, basin, furrow, and drip. In each method, three amounts of water were applied to bare soil which were calculated as 0.75, 1.25, and 1.75 fractions of reference evapotranspiration measurements (ETo). Water applications were based on ETo because the amount of infiltrated water from a treatment could be related to climatic conditions. ETo values were obtained from the California Irrigation Management Information System (CIMIS) weather station located at Fresno, California.

Very little atrazine, bromide or chloride was recovered in soil sampled directly beneath drip emitters, precluding any comparison to the other irrigation methods. In sprinkler, basin, and furrow treatments, increases in the amount of water applied caused an incremental increase in the downward movement of the inorganic tracers, as observed by their soil distribution down to a depth of 3 meters. A corresponding increase in the downward movement of atrazine was also measured in those irrigation methods; a first-order linear relationship was measured between the amount of water added and the location of the center of mass of atrazine residue in the 3-meter soil column. The center of mass was about 0.6 meters deeper with every 0.5 increment in the level of ETo. Although the slope for this relationship was similar between methods, the magnitude of leaching differed between irrigation methods. Location of the center of mass was approximately 0.4 meters deeper in basin than in sprinkler irrigation and about 0.6 meters deeper in furrow than in basin irrigation. Owing to the experimental design, the treatment differences may have been caused by location of the irrigation study sites. However, measurements of soil infiltration rate and soil texture were similar between locations. A more probable explanation for treatment effects was the difference in method of water application. Sprinkler treatments had the shallowest center of mass because irrigations were made frequently with smaller amounts of water added per event compared to basin and furrow irrigations. Thus, more water was subject to loss by evaporation in sprinkler irrigation resulting in less infiltrated water. The deepest center of mass was measured in the furrow irrigation method because water was applied to only 1/2 the soil surface area compared to basin treatments. Consequently, in this sandy soil, furrow irrigation would have caused greater downward flux of water than in basin irrigation. Overall, the measure of ETo as related to the amount of infiltrated and, subsequently, deep percolated water may be a useful criterion for adopting modified uses that limit pesticide movement. However, any recommendation must also take into account differences in irrigation frequency and amount of water applied per irrigation event, which in turn may be influenced by the choice of irrigation method. Since Leaching was related to the amount of water available for deep percolation, irrigations should be limited based on the amount of water lost per event to deep percolation.