

US EPA ARCHIVE DOCUMENT



Solar Radiation a Predictor of *Solenopsis invicta* The Red Imported Fire Ant

Overview

Solenopsis invicta, the red imported fire ant (RIFA) is a pest in The United States. It first arrived in the United States through Mobile, Alabama sometime in the 1930's or late 40's from Brazil (Lockley 1996). RIFA are polymorphic with sizes ranging from 3-6mm

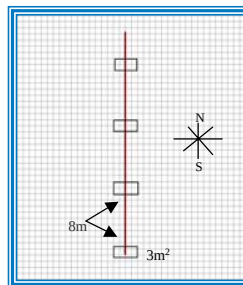
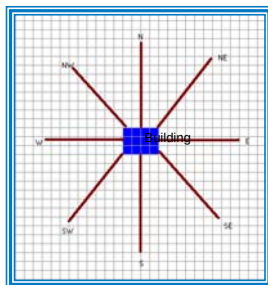


ants alter the delicate ecological balance in nature, competing with native ants as well as other insects. *S. invicta* responds rapidly and aggressively to any nest disturbance. They have a painful sting that is made up of venom, alkaloids and has insecticidal, bactericidal, and fungicidal properties (Hung 1977). Deaths have been documented as a result of stings (Lockley 1996). Fire ants cause at least \$300 million in Texas alone and up to billions of dollars in the U.S. in damage to crops, livestock, wildlife, as well as structures.

Approach

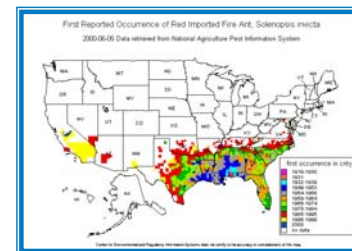
Solar radiation is only one parameter that is used to determine the location of *Solenopsis invicta*. Solar radiation data is determined by collecting shade angles of objects in eight directions. Solar radiation is calculated from the shade angles measured using a modified version of SOLPOS from the National Renewable Energy Laboratory (NREL). This program calculates the apparent solar position and intensity of the sun for any time and location on the Earth. (redc.nrel.gov).

The protocol is to locate buildings in urban areas where fire ant populations are established in Texas. A GPS reading is taken at each building location. Transects are made from each building in eight compass directions (North, Northeast, East, Southeast, South, Southwest, West, and Northwest) for a distance of up to two times the height of the buildings. Three meter square plots will be made along each of the transects, every eight meters with the first plot next to the building. The shade angle will be measured from the center of the three-meter plot in eight compass directions. The number of fire ant nests as well as the size of the mounds is measured within each plot. Shade angles for both soft (deciduous trees or any temporary shade) and hard shade (conifers, buildings, or permanent shade) are measured with a clinometer.

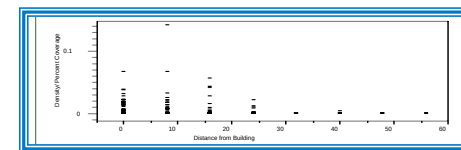


Results

Overall, data shows a significant trend of higher ant density at higher solar radiation. Analysis of data show minimum daily radiation is a good predictor in Lubbock, Texas. In Wichita Falls, TX ants show an avoidance of the sun during the summer solstice. In San Antonio, TX the RIFA do well in the sun while in Corpus Christi, TX little correlation between ants and radiation exists. Other parameters; soil pH, precipitation, and temperatures can further determine a more exact interpretation of the results. Ant density is highest nearer the buildings as indicated by the data collected in Lubbock & San Antonio, TX as shown below.



Spread of *Solenopsis invicta*



This graph shows the correlation between solar radiation and the density or number of *Solenopsis invicta* nests for Lubbock and San Antonio, Texas combined. The angles between the arrows indicate the correlations between the lines. The smaller the angle the higher the correlation. The density is strongly correlated with the winter solar radiation while the number of nests is more evident with summer radiation.

