# ABSTRACT

Soil nitrogen content is very important in plant growth. The right use of nitrogen fertilizer is important to maximize crop yields and achieve the desired quality. In general, farmers apply fertilizer rates based on soil testing before the planting process. There are two methods for measuring the availability of nitrogen in the soil such as conventional and non-conventional methods. The conventional method is a measurement carried out by taking soil samples and laboratory testing. This method requires a lot of time and costs. The non-conventional method is divided into two including contact sensors and non-contact sensors. Contact sensors are carried out with sensors that are plugged directly into the soil. This requires a long time and a lot of human resources. Non-contact sensors using SFCW radar can be an opportunity to measure nitrogen elements easily.

Stepped Frequency Continuous Wave (SFCW) is a type of radar that uses continuous electromagnetic waves with frequencies that change in steps. SFCW radars can determine the distance of an object or target from the phase shift of the signal reflected from the object or target. Variations in soil dielectric values can be measured by SFCW radar and provide clues about nitrogen availability. Radar data from average peak-to-peak values can be used as a reference to see the relationship between electromagnetic waves and soil nitrogen content. In large plantation soils, using SFCW radar can be an efficient method because it has a wide area and a few human resources in detecting nitrogen availability.

Data was collected on a laboratory scale. The frequency range used is 50Khz - 6Ghz. This research uses an interpolated look-up table to find the nearest value of the data that has been obtained. The result obtained from this thesis research is a third-degree polynomial curve shape that can represent the peak-to-peak value obtained from the SFCW radar with the nitrogen element obtained from the invasive sensor. The RMSE value of the third-degree polynomial is 0.0752. This study shows, that when the nitrogen element in the soil has a high value, the electromagnetic wave response in the form of peak-to-peak also has a high value.



***Keywords*: *SFCW Radar, Soil Nitrogen Content, ILUT***