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FERTILIZERS RECOMMENDATION SYSTEM FOR DISEASES PREDICTION

TEAM ID:

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ABSTRACT:

Spatial variability management of soil chemical attributes is one of the approaches to be employed in the face of the constant challenge of increasing agricultural yield to meet world demand. In this sense, precision agriculture has as one of its tools the application of inputs at varying rates, which seeks to determine the ideal amount of fertilizer at each point of the crop, contrary to the conventional recommendation approach based on average values. In this context, this work studied the fertilizer recommendation methods used in site-specific nutrient management and the calculation methodologies for N, P, and K recommendations. For this purpose, a systematic literature study (SLS), consisting of systematic literature mapping, snowballing, and systematic literature review was performed. The analyzed studies were grouped into five domains (precision agriculture, soil fertility, site-specific nutrient application, fertilizer recommendation methods, and recommendation software for site-specific nutrient application). As a result, the SLS identified 12 methods for recommending N, nine for recommending P, and six for recommending K, in addition to five computer programs for precision agriculture that perform fertilizer recommendations at varying rates.

LITERATURE REVIEW:

Detection and recognition of plant diseases using machine learning are very efficient in providing symptoms of identifying diseases at its earliest. Plant pathologists can analyze the digital images using digital image processing for diagnosis of plant diseases. Application of computer vision and image processing strategies simply assist farmers in all of the regions of agriculture. Generally, the plant diseases are caused by the abnormal physiological functionalities of plants. Therefore, the characteristic symptoms are generated based on the differentiation between normal physiological functionalities and abnormal physiological functionalities of the plants. Mostly, the plant leaf diseases are caused by Pathogens which are positioned on the stems of the plants.

These different symptoms and diseases of leaves are predicted by different methods in image processing. These different methods include different fundamental processes like segmentation, feature extraction and classification and so on. Mostly, the prediction and diagnosis of leaf diseases are depending on the segmentation such as segmenting the healthy tissues from diseased tissues of leaves.

AUTHOR: Schnug et al. 1998

DESCRIPTION: The use of nutrients in agriculture must be in line with sustainable agriculture to guarantee current and future human needs for food or other agricultural goods while preserving environmental quality and natural resources. However, agricultural fields have been considered homogeneous for a long time, allowing agricultural activities to represent areas with agricultural inputs on a fixed scale without considering their variability. In addition, soils are not static and homogeneous in space and time, and the standard approach of uniform input application always results in an excessive or insufficient supply at each location in the area, causing unnecessary environmental burdens.

AUTHOR: Frogbrook et al. 2006

DESCRIPTION: Thus, evaluated crop yield's spatial and temporal variability relative to nutrient conditions (K, Mg, and P) and soil pH. They observed that the relationship between crop yield and measured soil properties was generally weak. However, they found that information on the scale of variation of soil chemical properties could be derived from yield maps, which can also be used to guide the sample density of soil properties. The authors also found that the stability observed in the variation structure (semivariogram) of soil pH and nutrients is important for PA and that this information can be used for at least the next two to three years after its identification.

AUTHOR: Lambert et al. 2007

DESCRIPTION: The mentioned some impasses for soil fertility management due to the heterogeneous transport of some nutrients, such as P. This element is irregularly transported in the soil from one year to another, mainly because of the topographic and chemical characteristics of the soil. The authors explained that a uniform application of this fertilizer would not be recommended due to this heterogeneous behavior, as the same area may present an immediate availability after the fertilizer application, or the availability may be difficult or even impossible due to characteristics such as pH, clay content, and organic matter. Therefore, applying a uniform rate can cause an excess of the nutrient in some parts and nutritional deficiency in others, reducing the crop yield.

AUTHOR: Shanahan et al. 2008

DESCRIPTION: The management strategies for N are still inefficient, and nitrogen fertilizers applied in production systems have only 33% utilization. Considering that the cost per ton of nitrogen fertilizer at the time of this survey was $ 850.00 and assuming that 67% are considered losses, it represented an annual loss of $ 28 billion in agricultural activities.

AUTHOR: Molin et al. 2010

DESCRIPTION: The performance of fertilizer application at variable rates, in which the PA techniques are practical and promising for long-term evaluation in coffee. Although the research was carried out only on coffee, the authors extrapolated the conclusions to other perennial crops. Applications of P and K resulted in an increase of 34% in crop yield, with savings of 23% in phosphate fertilizers and 13% in potassium fertilizers compared to the fixed fertilization rate.

AUTHOR: Nogara Neto et al. 2011

DESCRIPTION: The found differentiated yield for the maize crop in plots of the same agricultural area and proposed that these results reaffirm the need to adopt site-specific management, as recommended by the PA methodology.

AUTHOR: Stępień et al., 2013

DESCRIPTION: The authors highlighted the possibility of subdividing the area into smaller sub-areas, called management zones, each of them with homogeneous characteristics and, therefore, internally expressing similarity regarding the limiting factors of production. The use of management zones for site-specific fertilizer application requires measuring the spatial variability of nutrients, usually performed by soil sampling.

AUTHOR: Shukla et al., 2017

DESCRIPTION: Understanding and measuring spatial variability regarding the amount of nutrients available in the soil is crucial to defining site-specific fertilizer management strategies to increase production efficiency and sustainability of agricultural production. Therefore, management with the use of nutrients at a varying rate becomes a viable alternative to reduce the heterogeneity of soil attributes.