



University of Zabol

Graduate School

Faculty of Agriculture

The Thesis Submitted for Ph.D Degree in the Agroecology

Title:

Investigation spatial and temporal dynamic of soil characteristics, weed populations and yield of wheat under different nitrogen fertilizer managements

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Abstract

In the conventional methods of producing agricultural products, fields are managed in a uniform manner, while uniform management is not only economically efficient but also can bring environmental problems due to the variety of spatial that exist. Geostatistical methods are highly effective in describing spatial changes and subsequently designing site specific management methods. It seems necessary to investigate the spatial variation of soil and weed characteristics and the effect they will have on the spatial distribution of yield. In this regard, the present study was conducted in order to investigate the spatio-temporal variation of soil properties, weed population and wheat yield, using geostatistical methods in a field located in Mobarakeh city in 2 crop years (2018-2019 and 2019-2020). The research was conducted in the form of randomized complete block design with 3 treatments and 3 replications. The investigated treatments included T1: 1/3 urea fertilizer as a base and the rest as a top but as a patch and based on the spatial distribution map of leaf chlorophyll content. T2: 1/3 urea fertilizer was applied as a base and the rest as foliar application based on the spatial distribution map of leaf chlorophyll content. T3: No application of urea fertilizer as a base and its application as a foliar spray based on the leaf chlorophyll map at the required points. Sampling of investigated traits in soil, weeds and wheat yield was done using fixed quadrats with dimensions of 0.25 square meters (50 x 50 cm). The results showed that the three dominant weeds of the field in most of the studied treatments did not have a uniform or random distribution, but had a patchy or cumulative distribution. The results of kriging showed that in almost all the maps, the patches of *Hordeum spontaneum* were often more inclined towards the edges of the field. While the *Chenopodium album* was more elongated along the planting rows. The *Alopecurus myosuroides*, which had a higher density, was distributed heterogeneously in almost all parts of the field. The grain yield of wheat was also patchy in the fields. So that the highest correlation (85.4%) was in the second treatment in the first year and the lowest correlation (50.1%) was related to the third treatment in the second year. The results indicated that the distribution patterns of the dominant weeds in the field corresponded to a large extent with the patterns of wheat yield variations. So that the spatial dependence between the two mentioned variables changed from 53.2 to 92.3 percent in the influence range of 2.2 to 16 meters depending on the weed species, type of treatment and year. The results showed that the spatial correlation for macro-elements from 4.2 to 58.1%, for EC and pH from 0 to 84.4% and for soil texture from 0 to 88.3% in the influence range from 3.9 to 51 m varied depending on the field and year. Grain yield showed a spatial correlation with macro-elements, pH, clay, silt, and sand inverse and EC inverse. The results showed that *Chenopodium album* had a strong spatial correlation with potassium content and soil sand percentage, while *Alopecurus myosuroides* was more dense in clay soils with lower pH. *Hordeum spontaneum* was also accumulated in areas with higher soil phosphorus content. In general, the results indicated that the change in weed distribution patterns can be affected by species characteristics, soil characteristics, and also management practices (such as fertilization). In general, it can be stated that the characteristics of the soil, as well as the population and biomass of weeds change from one place to another, and these changes ultimately lead to the arrangement of yield patchy on the field.

Keywords: site specific management, precision agriculture, geo-statistics, remote sensing