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GIS based analysis of tomato and pepper growing regions in Bulgaria

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Abstract

Tomato and pepper production is priority branch of horticulture. In the last few years the agricultural lands with main vegetable crop were dynamic and unsustainable. Uncompetitive capacity of market system, unorganized and wrong land use has resulted in degradation scenario of horticultural output. In this study tomato and pepper areas under cultivation and yields in Bulgaria for the period 2008 to 2012 were analyzed and assessed. The results are presented by GIS tool in accordance with common classification of territorial units in Bulgaria. The GIS analysis has been applied in a wide variety of situations for defining and managing processes. On the base of assessment of statistical information, it was created a map of regions with dynamic combine graphs of the areas under cultivation and yields. Obtained from the analysis results, determined South Central Region as a major tomato and pepper production region. This GIS based analysis will be helpful for the farmers to make an appropriate decision for management practices. The results will be higher yields according to EU directives and production quality.

Key words: vegetable crop production, GIS based analysis

Introduction

Tomato and pepper production is priority brunch of horticulture in Bulgaria. (Cholakov, 2009). In the last few years the areas planted with these vegetables and the average yields were far from expected. The reasons for the negative trends are complex. The efforts of many researchers are focused on developing of new or optimizing existing production technologies in this sector, enriching and creating the assortment with new vegetable varieties and cultivars. (Shopova 2014, Dallev 2012, Ivanov, 2104, Dincheva,2012, Panayotov, 2009)

GIS is one of the most powerful technology for analyzing, managing and visualizing the information. The strength of GIS is to integrate different types of data into a common spatial platform. This information should present both opportunities and constraints for the decision maker (Ghafari et al, 2000). The powerful query, analysis and integration mechanism of GIS makes it an ideal scientific tool to analyze it for land use planning.

Database for zoning of grapevine cultivars in Bulgaria was created by GIS application. This GIS analysis are very useful for selection and localizing of new ones and maintenance of existing vineyards (Arnaudova,2011). The GIS database was created including factors influenced on nematode distribution of the soil. As a finale result, assessment maps of their distribution were created. (Bileva et al., 2011) Such kind of database for vegetable production are not developed in Bulgaria.

Data from different sectors can be integrated into a single analysis without the need for each sector duplicating data collection efforts

The aim of this study is to make GIS based analysis of tomato and pepper growing regions in Bulgaria. On the base of the assessment of information it will be determine the main vegetable growing region.

Materials and Methods

Graphic information

1. Administrative district map of the regions, Coordinate system WGS 84 UTM zone 35N

2. Level NUTS 2 of the European Nomenclature of Territorial Units divides the country in 6 statistical planning regions: North-

West, North -Central, North-East, South-East, South-West and South-Central.

Attribute information

For analyzing and assessment of tomato and pepper area under cultivation and average yields data were used from Agro-Statistical Reference book of the Ministry of Agriculture and Food for the period 2008 to 2012 years.

Analyzes

ARCGIS 10.0, Symbology by chart graph

Graphs were created based on information by years combining cultivated areas and yields.

Results

The proper regional distribution of the vegetable cultivars is an important element of development of modern horticulture in Bulgaria. The exact location of the plants is a specific complex of environmental factors according to eco-physiological zones and enhancing agricultural productions.

Dynamics of tomato cultivated areas and yields are presented on Figure1.

For the researched period tomatoes lands under cultivation are amended from 2924 ha in 2010 to 3860 ha in 2011 (average for investigated period 3335.2 ha)

During the whole period South-Central region is a leader. Over 50% of tomato production is concentrated there. Percentage of utilized agricultural lands are changed in years as follows 64.91% (2008), 51,54% (2009), 54,41% (2010), 56.20% (2011) and 59.48% (2012).

Analyses of the data arrange South-West and South-East regions as sequent. Compared to South-Central region tomato cultivated areas are twofold less.

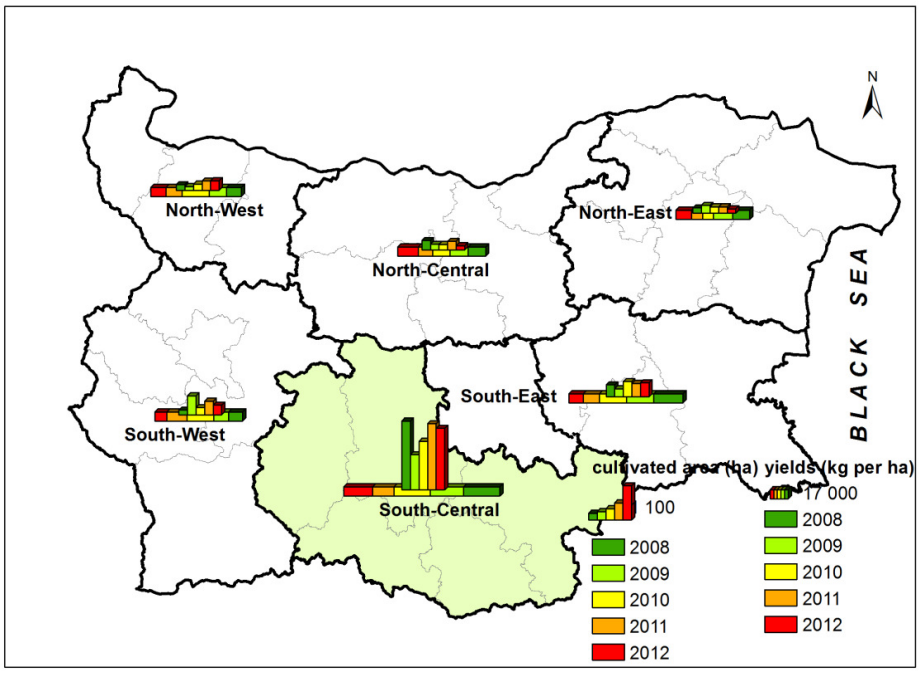

Figure 1. Dynamics of tomato cultivated area (ha) and average yields (kg/ha) for the period 2008-2012

The yields of tomato are variables. The highest rates achieved for the five year period are 28345 kg.ha^{-1} in 2008 and 28545 kg.ha^{-1} in 2010. The lowest are the average yields in 2011 -17576 kg.ha^{-1}. There is a slight raise of tomato production in 2012 - 21666 kg.ha^{-1}

Variations in average yields is due to unpleasant climatic conditions - drought, late spring and early

autumn frosts, attack by diseases and pests, low quality of agrotechnics. Distribution of the yields by statistical planning regions is unequal. The highest are in South-Central region, followed by South-East, South-West and North-Central. The realized production in South-Central region compared to the one in the whole country is higher as follow - 17.95% (2008), 28.11% (2009), 19.08% (2010), 11.38% (2011), 24.92% (2012).

The pattern in analyses for pepper is similar. For the researched period pepper areas under cultivation change from 3013 ha in 2012 to 5013 ha in 2009 (average for five-year period 4220 ha).

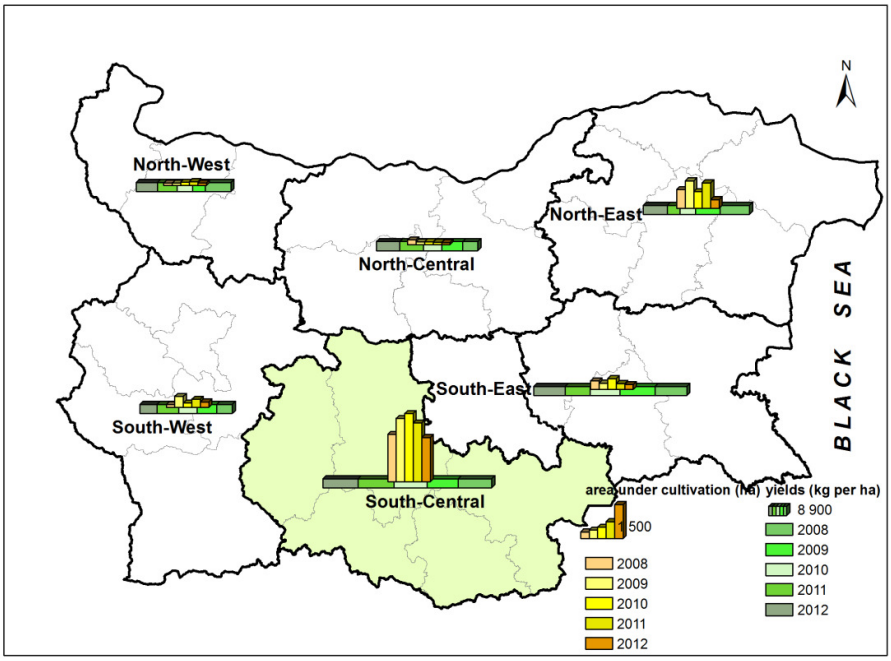

Figure 2. Dynamics of pepper cultivated area (ha) and average yields (kg/ha) for the period 2008-2012

By years and for the whole period, South - Central region is leader. The relative quota compared to utilized agricultural lands in the country during the years is 55.87% (2008), 55,85% (2009), 64,04 (2010), 56.28% (2011) и 65.08% (2012).

Analyses of the data arrange North-East, South- East and South-West regions as sequent. Despite area variation during the years, the average yield rates(14349 kg.ha^{-1}) are stable in all statistical planning regions.

According to the potential opportunities of the researched vegetable crop and soil-climatic conditions, the realized average production is low. This level of yield is balanced due to the incurred expenses for production and maintenance of their cost lower than the prices in the market.

Analyses present that areas under cultivation and yields of tomato and pepper are far from expected in the development plan of vegetable production. Main reasons are unstable market, lower and dynamic purchasing price, raising supplies costs - fertilizer, plant protection, seeds, insufficient subsidy, market competition.

The expectations are raising vegetable crop production mainly tomato and pepper. Increasing the production of products for processing and preservation reveals additional opportunities. Prime vegetable species are tomato,

pepper followed by cucumbers, green peas and green beans.(Cholakov 2009)

Results from the analysis determine South-Central region as fundamental. Over 50% of tomato and pepper cultivated areas are located there and are obtained the highest average yields. The rates are presented in figure 3

Conclusion

Tomato and pepper production is concentrated in South-Central region. Over 50 percent of area cultivated with both vegetable species are planted in this territorial unit. Produced average yields in the region exceeded the national average, 11.38-28.11% for tomato and 9.92-30.36% for pepper.

GIS technology is being increasingly employed by different users to create resource database and to arrive at appropriate strategies for sustainable development of agricultural resources. This GIS based analysis will be helpful for the farmers to make an appropriate decision for management practices. The results will be higher yields according to EU directives and production quality.

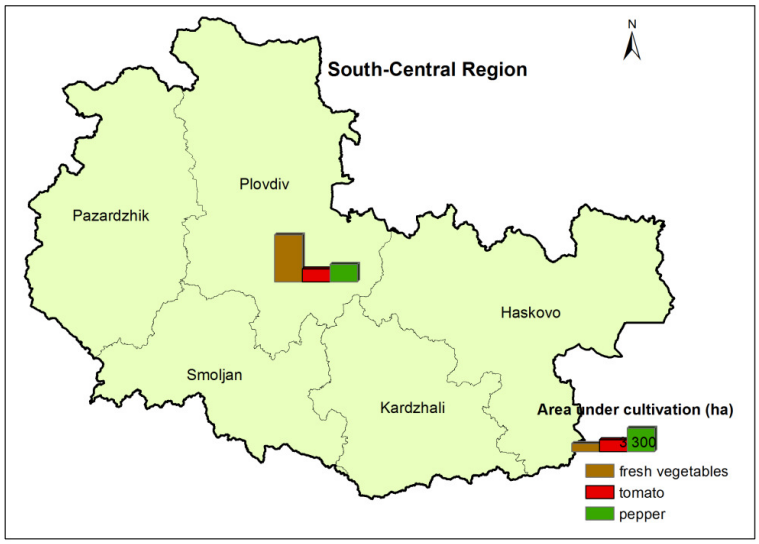

Figure 3. Dynamics of cultivated area (ha) for fresh vegetables, tomato and pepper for the period 2008-2012 in South-Central region

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