

SUITABILITY OF AGRICULTURAL LAND FOR THE CULTIVATION OF CABBAGE IN THE AREA OF HERZEGOVINA-NERETVA COUNTY

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ABSTRACT

Purpose of this paper was to perform inventory of areas and features of agricultural land in the field of the Herzegovina-Neretva County based on existing data and to assess benefits of agricultural land for cultivation cabbage according to the characteristics of the soil, relief and climate. The evaluation of the land suitability was carried out in line with FAO method (FAO, 1976) according to the agro zone.

Based on conducted research, it was established that the studied area is very suitable for the production of cabbage. There are 23,249.3 ha (11.68%) suitable land for the production of cabbage and temporarily unsuitable 5,201.2 ha (2.61%) while permanently unsuitable land for intensive production of cabbage are on 170,451.8 ha (85.7%). The main limitations for intensive production of cabbage in the studied area are the slope, the depth of profile and rockiness.

According to official data on the state of the current production of cabbage in the studied area and data of suitable land and temporarily unsuitable land, the conclusion is that there are basic prerequisites in the form of land resources to expand the production of cabbage in this field.

Keywords: *agricultural land, climate, relief, suitability, cultivation of cabbage*

INTRODUCTION

The area of Herzegovina is a region in which vegetables are traditionally and successfully produced. Potatoes, cabbage and onions occupy largest production areas. In most cases, production is organized on smaller areas in relation to the real possibilities of production on available arable land. According to data from the Federal Bureau of Statistics, the total area where cabbage is grown in the Herzegovina-Neretva

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County (HNC) is 334 ha (39.06%) in 2010, 277 ha (32.34%) in 2011, and 244 ha (28.54%) in 2012. In the period from 2010 to 2012, the highest production of cabbage was found in the areas of the municipalities of Čapljina, Mostar and Konjic, while the lowest production was in the areas of the municipalities of Neum, Ravno and Stolac. The highest production of 5,400 t was recorded in the area of the municipality of Čapljina in 2011. The yield of cabbage was from 8.0 t/ha in the municipality of Neum to 48 t/ha in the municipality of Čapljina. The microclimate of the cultivation area is the biggest factor for the cabbage growing period. By combining production in climatically different regions of HNC, it is possible to continuously supply the market with cabbage throughout the year. Early spring, late autumn, winter and overwintering cabbage are grown in lower warmer areas, while mountainous and hilly areas are favorable for the summer and early autumn production.

In accordance with agro-ecological characteristics and specific biological properties of cabbage, the paper presents an evaluation of suitability of agricultural land for cultivation of this vegetable crop in the area of Herzegovina-Neretva County. When dealing with suitability of land, we essentially talk about grouping into specific zones with distinct characteristics for the method of use, which leads to the division of land into specific categories in terms of its suitability (Brinkman & Smith, 1973). As a subject of evaluation, land includes soil, physical space (relief), climate, hydrological conditions, geological substrate and vegetation, as well as past and present human activities with the option of including economic relations (FAO, 1976).

MATERIAL AND METHODS

Basic characteristics of soil in the area of the Herzegovina-Neretva County were determined from the soil map of FBiH at the scale 1:200 000. In addition to characteristics of soil, climate and relief, agro ecological conditions for the production of cabbage were analyzed as well.

Evaluation of suitability of soil for the cultivation of cabbage was carried out according to the criteria and standards set out in the framework of the FAO land evaluation method (FAO, 1976). Evaluation of suitability by agricultural zones was carried out based on characteristics of the only and/or dominant type of soil in the mapped unit, as well as ectomorphological characteristics. Limit values, types and degrees of limitations for cultivation of cabbage were established: climate, terrain slope, soil depth, rockiness, skeletal structure, soil pH, nutrient availability, drainage, humidity regime, verticity.

Map of the suitability of agricultural land for cultivation of cabbage in the area of HNC is developed on the basis of the suitability evaluation results.

RESULTS AND DISCUSSION

Climate

Two types of climate are typical for the area of the Herzegovina-Neretva County: mediterranean and continental with certain subtypes. The lower Mediterranean part of the municipalities of Neum, Stolac, Capljina, Ravno, Citluk and Mostar is characterized by mild and rainy winters with small amounts of snowfall, while summers are long, warm and hot with high daily temperatures. Hilly and mountainous parts of the municipalities of Jablanica, Konjic and Prozor/Rama are under the influence of harsh continental climate. Climate is much milder at lower altitudes, in areas along lake shores, and areas situated along rivers. In this area, precipitation is significant and ranges between 1,100 and 1,500 l/m².

Relief

The relief in the area of HNC can be characterized as a typical karst relief, with all fully developed types of karst formations: sinkholes (swallow holes), sinter pools, striations, grikes, chasms, springs, depressions, caves, karst fields (poljes), subterranean rivers, karst mounds, plateaus, ridges, canyons and others. The main visual and the most distinctive relief element of the entire HNC area is the Neretva River with its canyon and valley, which extends through and along the entire county from its far northeast to the far southwest where it enters the Republic of Croatia. Agricultural production is developed only in the valleys of the Neretva River and its tributaries, and to a degree on flat karst plates of lime dolomite rocks, and flysch and other tertiary sediments on which deep soils, suitable for agriculture, have developed.

By analyzing the altitude map, (Figure 1) it was established that altitude of the terrain varies in the range from under 200 m to over 1,200 m. Of the total area of HNC, which is 437,284.6 ha, the terrain with altitudes over 1,200 m covers the largest part with 25.03% (109,459.4 ha), while the terrain with altitudes from 1,000 to 1,200 m covers the smallest part with 6.86% (30,011.5 ha). The terrain with altitudes of up to 200 m extends over an area of 11.86% (51,859.5 ha).

By analyzing the terrain slope map (Figure 2), it was established that slopes 17-24% occupy the largest area of 25.03% (109,457.9 ha), while slopes 24-33% cover the smallest area with 4.57% (19,978.8 ha) in the area of HNC. There is 11% (48,060.60 ha) of flat and nearly flat terrain with gradient 0-2%. The presented maps show that the relief in the area of HNC is predominantly hilly and mountainous, which prevents and aggravates the conditions for agricultural production.

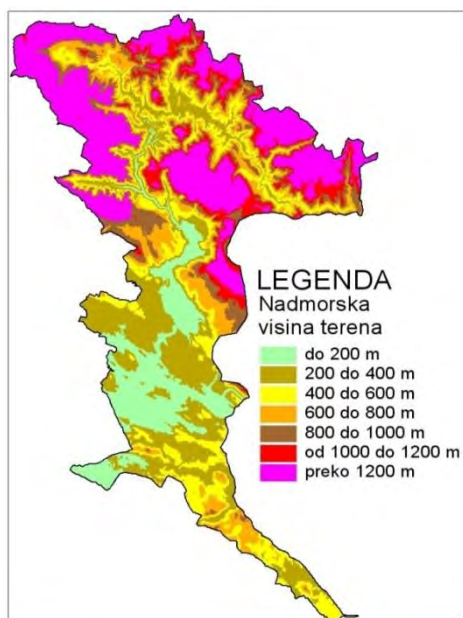


Figure 1. Terrain altitude map of the HNC

Source: Ćorić *et al.*, 2013

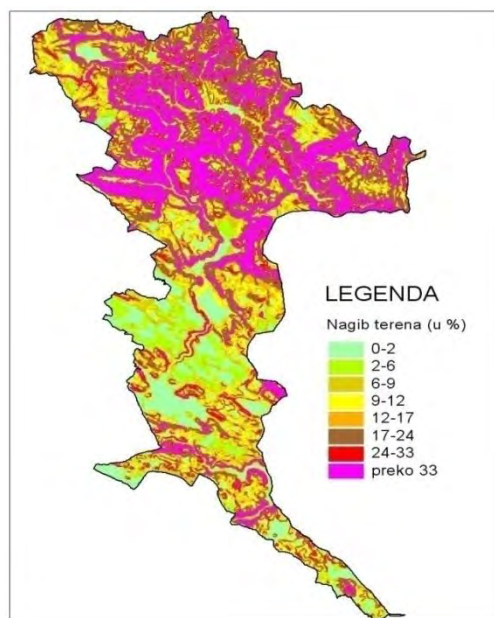


Figure 2. Terrain slope map of the HNC area

Soil

Based on the soil map of F BiH at the scale 1: 200,000 the spatial distribution of soil types in the area of HNC is shown by agricultural zones (Figure 3). The area of HNC is characterized by 15 types of soil, out of which 11 are automorphic soils (sierozem, colluvium, calcomelanosol, rendzina, ranker, vertisol, calcocambisol, terra rossa, eutric cambisol, luvisol, distric cambisol) that are beyond the reach of flood water and groundwater, and 4 types of soil (alluvial, humofluvisol, marshy gleyic and low peat) are hydromorphic soils characterized by excessive wetting by rainwater or extraneous waters of different origins (capillary, flood, underground and seepage water). The most widespread soils are black soil on limestone and dolomite (calcomelanosol), and brown soil on limestone and dolomite, or calcocambisol. They are followed by rendzina, terra rossa, acid brown soil and colluvial soils (Ćorić *et al.*, 2013).

The area of HNC has very little high-quality arable land for field production, and expansion of cities and settlements is mainly associated with lowland areas where relatively good soils are found, and so arable land has constantly been decreasing.

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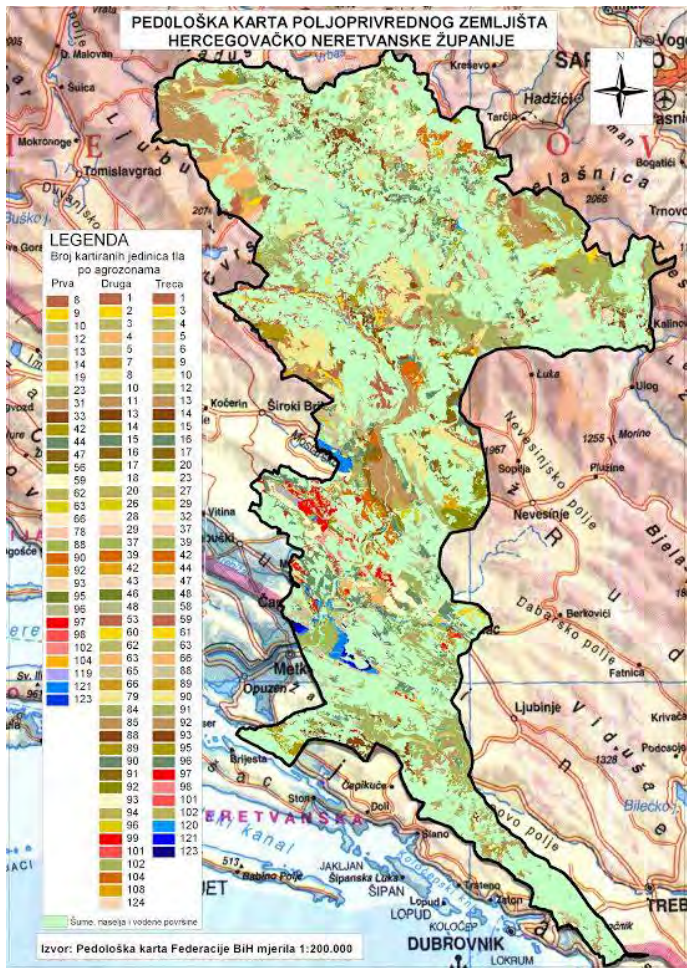


Figure 3. Soil map of agricultural land in the Herzegovina-Neretva County
Source: Federal Institute for Agropedology, Sarajevo

Agro ecological conditions for the cultivation of cabbage

Selection of species and varieties of vegetables and technology of their cultivation need to be adapted to climatic factors and the characteristics of available soil.

Although extending over a wide range, cabbage is grown most successfully in cool and humid areas. The most favorable temperatures for growth and development of cabbage plants are 15-20°C, while its growth stops at temperatures 25°C and 0°C. Cabbage can tolerate short-term cold spells of even up to -12°C without significant damage, but if such low temperatures occur suddenly and affect plants at the stage

completely formed heads, they can completely destroy them. The optimum relative humidity of air for the cultivation of cabbage is 85-90%. Because of its need for high air humidity, the best yields are achieved by growing cabbage in river valleys and along major watercourses (Matotan, 2004). Alluvial, medium-heavy, deep soils rich in humus are the most suitable for cultivation of cabbage. Lighter soils that warm up sooner are more favorable for spring production, while heavier soils are more favorable for autumn production (Lešić *et al.*, 2002). The most favorable are mildly acid to neutral soils with pH of 6.0-6.5. On acid soils cabbage can be grown only with abundant application of manure. The root neck disease often occurs on such soils (Parađiković, 2002). Production of cabbage and other vegetable crops require selection of level to mildly sloped areas. For the production of vegetables in hilly areas, it is desirable to use southern or southwestern positions and avoid surfaces shaded by natural barriers for extended periods (Matotan, 2004).

Evaluation of suitability of agricultural land in the area of HNC for the cultivation of cabbage

The evaluation of suitability of land in the Herzegovina-Neretva County for the cultivation of cabbage was carried out on the basis of the presented data on characteristics of soil, climate, relief and specific requirements of cabbage.

According to the FAO methodology, evaluation of soils classifies individual mapped land units into suitability orders, classes and subclasses. The inventory of areas of all orders and classes of soil suitability for the cultivation of cabbage, obtained by evaluating the suitability of the only and/or dominant soil type in mapped units and the area of mapped soil units within the agricultural land, is shown in Table 1, and their spatial distribution is shown in Figure 4.

Table 1. Inventory of areas of suitability classes for cultivation of cabbage (ha)

| Suitability class | Area (%) | % |
|--------------------------|-------------------|---------------|
| P-1 | 821.70 | 0.41 |
| P-2 | 7,667.40 | 3.85 |
| P-3 | 14,760.20 | 7.42 |
| N-1 | 5,201.20 | 2.61 |
| N-2 | 170,451.80 | 85.70 |
| TOTAL | 198,902.30 | 100,00 |

Source: Marić, 2014

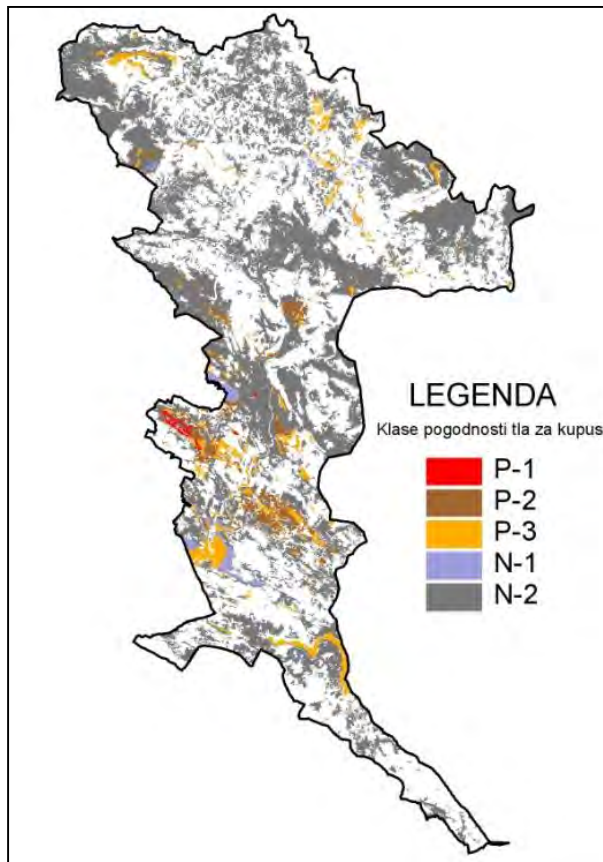


Figure 4. Suitability of agricultural land in the Herzegovina-Neretva County for cultivation of cabbage

Source: Ćorić et al., 2013

Analysis of the data (Table 1) shows that the Herzegovina-Neretva County area has the least soils of the P-1 suitability class for the cultivation of cabbage, which are without any significant limitations or with limitations that will not significantly affect the productivity and profits in production. They occupy only 821.7 ha, which accounts for 0.41% of the total area of agricultural land in HNC. The class of moderately suitable soils of the P-2 suitability class for cultivation of cabbage, which represents soils with limitations that moderately affect the productivity and profits in production of cabbage, occupies 7,667.4 ha or 3.85%. Soils of the class P-3, suitable to a limited degree, which are the soils with limitations that significantly compromise the productivity and profits in cultivation of cabbage, cover the area of 14,760.2 ha, or 7.42%. So, the total area of soils suitable for the cultivation of cabbage is 23,249.3 ha or 11.68% relative to the total studied area of agricultural zones in HNC. Temporarily unsuitable soils of the class N-

1, which can be upgraded to a certain class of suitability for cabbage by using adequate improvement measures, occupy 5,201.2 ha or 2.61%. Permanently unsuitable soils of the class N-2, which represent soils with limitations (stony, rocky, very steep and shallow soils) that rule out the possibility of growing cabbage, are by far the most abundant, occupying the area of 170,451.8 ha or 85.7%.

CONCLUSIONS

Based on the evaluation of suitability of agricultural land for the cultivation of cabbage, we can conclude that the area of Herzegovina-Neretva County has 23,249.3 ha (11.68%) of land suitable for the production of cabbage and 5,201.2 ha (2.61%) of temporarily unsuitable land. Areas permanently unsuitable for the production of cabbage, of the class N-2, occupy the area of 170,451.8 ha, or 85.7% of agricultural land in the area of HNC. The main limitations for intensive production of cabbage are terrain slope, rockiness and stoniness.

Cabbage is one of the most economically important species of vegetables, so it is necessary to carry out land improvement measures in order to increase areas and create higher-quality conditions for growth and development, which will ultimately result in high and quality yields. The presented evaluation of agricultural land will certainly promote its purpose-oriented use and help intensify the production of cabbage in the area of the county.

REFERENCES

- Brinkman, R., Smyth, A.J. 1973. Land Evaluation for Rural Purposes. Summary of an Expert Consultation, Wageningen, The Netherlands, 6-12 October 1972, International Institute for Land Reclamation and Improvement, Wageningen, The Netherlands, No 17:116.
- Ćoric, R. et al. 2013. Project: Multipurpose valuation of land in the Federation of Bosnia and Herzegovina, Federal Ministry of Agriculture, Water Management and Forestry, Sarajevo.
- FAO. 1976. A framework for land evaluation. FAO Soils Bulletin No. 32, FAO, Rome and ILRI, Wageningen. Publ. No 22.
- Federal Bureau of Statistics. 2011. Crop production of the Federation of Bosnia and Herzegovina 2010, Sarajevo 2011, No150: 8-23.
- Federal Bureau of Statistics. 2012. Crop production of the Federation of Bosnia and Herzegovina 2011, Sarajevo 2012, No166. 8-23.
- Federal Bureau of Statistics. 2013. Crop production of the Federation of Bosnia and Herzegovina 2012, Sarajevo 2013, No 180: 8-23.
- Lešić, R., Borošić, J., Buturac, I., Čustić, M., Poljak, M., Romić, D. 2002. Vegetable production: Cabbage. Zrinski, Čakovec, 171-185.

- Marić, A. 2014. Suitability of agricultural land for the cultivation of vegetables in the area of Herzegovina-Neretva County. Graduation thesis, Faculty of Agronomy and Food Technology University of Mostar, 2014.
- Matotan, Z. 2004. Contemporary technology of vegetable production, Globus, 2004 Zagreb, 65-96.
- Meteorological data - Federal Hydrometeorological Institute.
- Parađiković, N. 2002. Basics of Vegetables Production, Katavad.o.o., 2002 Osijek.
- Soil Map of the Federation of BiH by agricultural zones, at the scale 1:200.000, Federal Institute for Agropedology, Sarajevo.