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Soil Suitability Assesment for Plum *(Prunus domestica)* Production in the Municipality of Bužim

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Abstract

Amateurish and unprofessional handling of agricultural resources has lasting und unprecedented consequences for plant production, manifesting itself through the loss of soil quality, reduced crop yields, soil erosion, etc. The main focus of this research was to establish the characteristics of the agricultural soil within the municipality of Bužim, applying the FAO method AEZ (Agro-ecological Zoning), (FAO, 1978), and based on the achieved results, to assess the soil suitability for plum *(Prunus domestica)* cultivation. The assessment of the soil suitability has led to the conclusion that a significant part of land (classified S1 to N in quality), out of the total 13.026,27 ha of agricultural area belonging to the municipality of Bužim is well suited for fruit production. The following has been observed: areas with the best rated S1 class make up a total of 1.23% (159.52 ha), the S2 class takes up a total of 5.51% (717.24 ha), the S3 suitable class makes up a 2.29 % (298.24 ha) in total, and the largest area totaling 36.68 % (4.772.60 ha) is classified as N - meaning unsuitable soil. The main restraints imposed on intensive plum cultivation within the examined area are lack of nourishment, tilt, depth, rock-strewn soil and soil reaction.

Key words: Municipality of Bužim, soil suitability, plum

Introduction

The Municipality of Bužim, administratively and geographically speaking, is part of the Una-Sana Canton, the Federation of B&H, with the total area of 13,026.27 ha. It is the smallest municipality of the Una-Sana Canton with the population of 20.298 according to the 2013 census data. There are two soil orders in the municipality – automorphic/terrestrial and hydromorphic soils with eight types of soil: Regosols, Calcic Melanosols, Calcic Cambisols, Red Soil, Eutric Cambisol, Distric Cambisol, Luvisol and Fluvisol. The purpose of this research is to assess the suitability of soil in the Municipality of Bužim for plum cultivation, taking into account all the required data, and to analyze them according to the Agro-ecological zoning method, and to develop the soil suitability map.

The research resulted in two suitable soil classes, namely S2 (2.2%) and S3 (6.75%) and the N class of unsuitable soil with 36.67%. The findings show that the majority of land in terms of soil conditions is not suitable for plum production.

Material and Methods

The soil/land as the subject of suitability assessment encompasses a wide array of different suitability factors required for the assessment of the intended use of space (FAO, 1976 and Vidaček et al. (n.d.)). The applied model of Agro-ecological zoning (AEZ) is the methodology used for assessing the suitability of soil for agricultural production.

The AEZ system is used in order to determine the specific limitations for crop cultivation in certain climate, soil and terrain conditions. A detailed description of the AEZ method used in this research can be found in FAO Guidelines on Agro-ecological Zoning (FAO Soils Bulletin 73, Rome, 1996). The soil map at the 1:25000 scale of the Municipality of Bužim was used as the basis for the development of this research. The data on agrozone boundaries was obtained from The Federal Agro-Pedological Institute, and the data on climate were obtained from the Federal Hydrometeorological Institute. Reconciliation of specific requirements of crops, defined by Land Utilization Type LUT, with the parameters of soil texture, pH reaction, contents of organic carbon and soil depth, renders the degrees of soil suitability for cultivation of certain crops. The interaction of these parameters results in the final form for land utilization planning, Biancalani et al., 2004.

Classes:

S1 very suitable > 80% MDP

S2 preferable 60-80% MDP

S3 moderately suitable 20-60% MDP

N poor < 20% MDP

MPD - max. datable yield Land Levels

Tab. 1. The Degree of Suitability of Specific Parameters for Plum Cultivation *Ниво погодности одређених параметара за узгој шљиве* (Source: Biancalani et al., 2004)

Parameters	S1	S2	S3	N
pH	5.5–7.5	4.5–5.5	7.5–8.0	<4.5>8.0
Depth in cm	>150	100–150	50–100	<50
Texture	I, PGI, PrI, PrGI	GI, PI, PrI, PG	P	G
Total C	>30	20–30	20–10	<10

Results and Discussion

The climate of the research area

Since there is no weather station in the municipality of Bužim and thus no official measuring data, the climate characteristics for the municipality of Bužim were described using the data of the nearest meteorological station in Bihać situated at 246 m altitude. The presented data were based on the observation periods of 1961-1990 and 1999-2009, respectively. According to Šarićet al. (2010), the length of vegetation period for the area of the Una-Sana Canton is 264 days for cryophilic plants (+5ºC), and 204 days for thermophilicplants (+10ºC).

Observing the data of mean monthly temperatures reveals that the values of mean temperatures are higher in the observation period 1999-2009 in all months except September, where minor drop of 0.3 ^{o}C in mean monthly air temperature was observed. As a result of rise in the sum of monthly temperatures, the mean annual temperature also rose. In the first period from 1961-1990, the mean annual air temperature was 10.6^{o}C, while in the second period from 1999-2009 the mean annual air temperature was 11.7 ^{o}C, which means that it increased by 1.1 ^{o}C.

Table 2. The mean monthly and annual air temperatures for the area of Bihać, in the periods 1961-1990 and 1999-2009 in °C
Средње мјесечне и годишње температуре ваздуха за Бихаћ, у вишегодишњим периодима 1961-1990 и 1999-2009 у °C (Source: Federal Hydrometeorological Institute)

Period	Months												Year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1961 -'90	0.3	2.3	6.1	10.7	15.1	18.3	20.1	19.3	15.9	11.3	6.3	1.7	10.6
1999 -'09	1.4	3.1	7.3	11.5	16.7	20.0	21.5	20.9	15.6	12.4	7.5	2.9	11.7

According to some estimates, warming in the moderate longitudes and latitudes of the northern hemisphere will increase, exceeding the global average, and range between 0.8 and 1.0 ^{o}C, for every 10 years (Komljenović et al., 2014; Žurovec, et al., 2015).

Table 3. Mean monthly and annual precipitation for the area of Bihać in the periods from 1961-1990 and from 1999-2009 in mm
Средње мјесечне и годишње падавине за Бихаћ у периодима 1961-1990 и 1999-2009 у mm (Source: Federal Hydrometeorological Institute)

Period	Months												Year
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1961 -'90	86	91	99	115	116	109	106	109	108	110	146	114	1.309
1999 -'09	103	96	106	120	112	83	87	97	139	116	132	149	1.342

More than one third of annual precipitation falls in the autumn. What is characteristic for the period of 1961-1990 is that in the summer period the atmospheric fallout is higher than in winter. The comparison of the total annual precipitation for the period 1961-1990, which was 1309 mm, with the precipitation for the period of 1999-2009, which was 1 342 mm, shows that the precipitation increased by 33 mm. Generally speaking, this increase can be seen as a good sign for agricultural production, however the rainfall distribution is not favorable, since the precipitation is lowest in the summer when water demands are the highest.

Soil types

There are two soil orders in the Municipality of Bužim: automorphic/terrestrial and hydromorphic soils. Situated out of reach of the flooding or underground waters and characterized by water percolation through solum, automorphic soils are the dominant ones (Ičanović, 2016).

Tab. 4. Soil types in the Municipality of Bužim
Типови земљишта на подручју општине Бужим

Soil Type	Area (ha)	Percentage (%)
Regosol	128.01	0.99
Kalkomelanosol	331.60	2.54
Calcocambisol	2,272.20	17.45
Eutric cambisol	1,867.45	14.33
Distric cambisol	5,266.51	40.42
Rossa	709.16	5.44
Luvisol	1,550.98	11.91
Fluvisol	900.31	6.92
Total	13,026.27	100.00

Due to denser net, the quality of data presented and the comprehensiveness of the research probes and profiles, eight soil types were observed in the research area and the soil map was developed at the scale of 1:25 000.

Plum (*Prunus domestica*)

There are three classes of soil suitability in the Municipality of Bužim for plum production, namely: S2, S3 and N. The S2 class merely covers 2.29% of the overall area.The first location of the S2 suitability class is the area of local community of Čava, including the places such as Razbojne, Babinac, Dizdarevići and one small part towards Popovići and Baštra.

This is a relatively small complex at the outskirts of the Municipality of Bužim towards Bosanska Krupa. The second and territorially wider area with S2 suitability class is situated in the local community of Zaradostovo in the settlement of Piskovac. This area spans from the left side of the road from the Elementary School towards Bućevci up to Cinska Glavica.

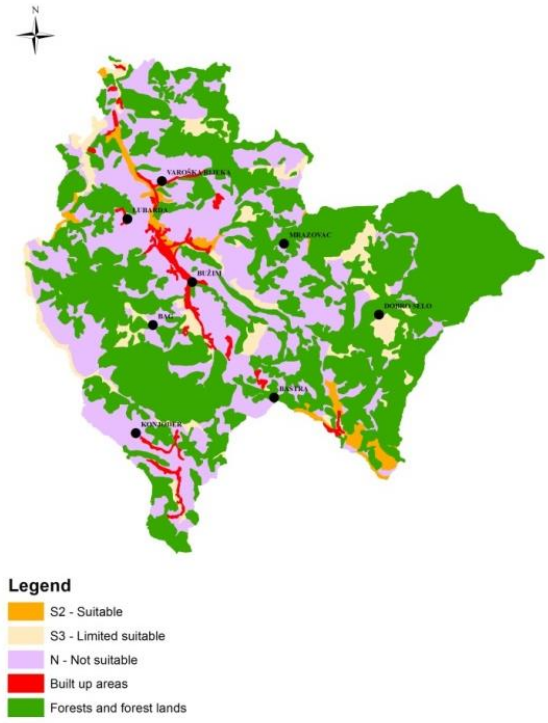

Fig. 1. Suitability for plum cultivation in the municipality of Bužim
Погодност за узгој шљиве на подручју општине Бужим

This class is also found in the local community of Varoška Rijeka, from the local road towards Kudelići up to Aleševići. The third area with the S2 suitability class for plum cultivation is situated in the settlement of Pašin Brod towards Abdići and one smaller elongated complex, somewhat undulated area, along the Čaglica rivulet.

The S3 suitability class for plum cultivation encompasses somewhat wider area of Bužim with 6.75% out of the overall surface area and is present in the overall area in greater or smaller complexes. This class is represented along the very border with the neighboring municipality of Cazin, from the settlement of Pivnice towards Jusufovići, and ends in the Jusići settlement. The S3 class is found in the Abdići settlement downwards towards Čaglica. The wider area of Bajraktarević Polje, Hakolić and the part towards the Republic of Croatia also has the S3 suitability class. Most of the area is classified as N with 36.67% or 4,771.98 ha out of the total Municipality area.

The reason for such great area being classified as unfavorable lies primarily in the depth of physiological profile of soil, since the largest area of N suitability class concerned the soil depth. This type of soil is usually found in elevated regions and terraces, where land is more prone to erosion and other forms of damage. The soil classified as unfavorable can be found in all local communities of the Municipality, depending on the micro-locality. Elevations are often classified as unfavorable and lower parts of parcels, where sediments deposit, are often classified as S3 or S2 suitability class depending on the quantity of the settled material.We can conclude that the N class of soil suitability is mostly the continuation or extension of S3 or S2 classes towards higher altitudes and is always connected to these two classes.

Built-up area comprises 1.77% of the overall area, and forests and forest land comprise 52.53% of the overall area of the Municipality.

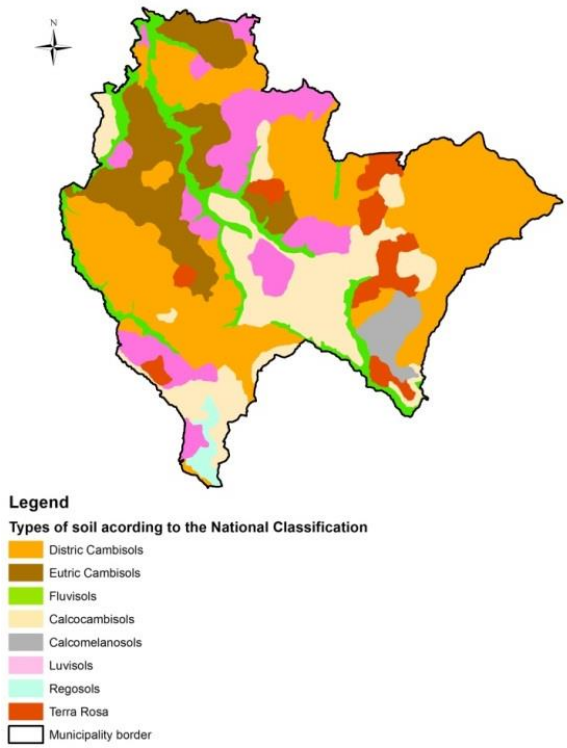

Fig. 2. Soil Map for Plum Production in the area of the Municipality of Bužim

Педолошка карта за студију погодности узгоја шљиве на подручју општине Бужим

Conclusion

Within the Municipality of Bužim there are eight soil types: Regosol, Calcic Melanosol, Calcic Cambisol, Eutric Cambisol, Distric Cambisol, Red Soil, Luvisol and Fluvisol. In terms of the overall soil suitability, three soil classes were observed for plum cultivation: S2, S3 and N class-unfavorable soil.

The S2 class covers very small area with merely 2.29% out of the overall area. Administratively speaking, these include Čava, Razbojne, Babinac, Dizdarevići, Zaradostovo, Bućevci, Varoška Rijeka, from the local road towards Kudelići, up to Aleševići and Pašin Brod towards Abdići.

The S3 class of soil suitability for plum cultivation covers 6.75% of the area of Municipality. It is situated along the border with the neighboring Municipality of Cazin, wider area encompassing the following settlements: Bajraktarević Polje, Porić, Tratina, Mušić, Dobro Selo, Prokop, Skenderevići, Vajagići, Kneževići and Mrazovac.

Most of the area is classified as N class with 36.67% out of the overall area of the Municipality or 4,771.98 ha.

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Процјена погодности земљишта за узгој шљиве (*Prunus domestica*) у општини Бужим

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Сажетак

Нестручно господарење земљишним ресурсима има дугорочне и несагледиве посљедице за пољопривредну производњу, које се огледају кроз губитак квалитетних земљишта, смањење приноса гајених култура, ерозији земљишта и сл. Основни задатак истраживања је утврдити карактеристике пољопривредних тала/земљишта општине Бужим, према FAO методи AEZ (агро-еколошко зонирање), (FAO, 1976), и на основу добијених резултата извршити процјену погодности земљишта за узгој шљиве. Поред наведених основних карактеристика тла утврђене су и карактеристике климе и рељефа истраживаног подручја. На основу резултата процјене погодности утврђено је да у укупним површинама пољопривредног земљишта општине Бужим (13.026,27 ha) значајан удио заузимају земљишне површине погодне за воћарску производњу означене од S1 do N класе погодности земљишта. Тако се подручја са најбоље оцјењеном класом S1 распроистиру на свега 1,23 % или 159,52 ha, S2 класа заузима 5,51 % (717,24 ha), C3 класа погодности заузима 2,29 % (298,24 ha), а највеће површине су под N класом непогодног земљишта са 36,68 % (4.772,60 ha). Основна ограничења земљишта за интензивну производњу шљиве на истраживаном подручју су недостатак хранива, нагиб, дубина, стјеновитост и pH реакција тла.

Кључне ријечи: општина Бужим, погодност земљишта, шљива.

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