UNIVERSITY OF KRAGUJEVAC

FACULTY OF AGRONOMY ČAČAK

SYMBIOTECH

2nd INTERNATIONAL SYMPOSIUM ON BIOTECHNOLOGY

14–15 March 2024

Faculty of Agronomy in Čačak, University of Kragujevac, Serbia

- PROCEEDINGS -

2nd INTERNATIONAL SYMPOSIUM ON BIOTECHNOLOGY

XXIX Savetovanje o biotehnologiji sa međunarodnim učešćem

- PROCEEDINGS -

ORGANIZER AND PUBLISHER

University of Kragujevac, Serbia
Faculty of Agronomy in Čačak

Honorary Committee

Prof. Dr. Marina Pintar, Slovenia; Prof. Dr. Andrej Bončina, Slovenia; Prof. Dr. Branko Kramberger, Slovenia; Prof. Dr. Tomaž Langerholc, Slovenia; Prof. Dr. Ivica Kisić, Croatia; Dr. Kristina Kljak, Croatia; Prof. Dr. Krunoslav Zmaić, Croatia; Prof. Dr. Zvonko Antunović, Croatia; Prof. Dr. Muhamed Brka, B&H; Prof. Dr. Enisa Omanović-Mikličanin, B&H; Prof. Dr. Ivan Ostojić, B&H; Dr. Adrijana Filipović, B&H; Prof. Dr. Božidarka Marković, Montenegro; Prof. Dr. Sanja Radonjić, Montenegro; Prof. Dr. Vjekoslav Tanaskovik, North Macedonia; Prof. Dr. Ivana Janeska-Stamenkoska, North Macedonia; Prof. Dr. Zlatan Kovačević, B&H; Prof. Dr. Željko Vaško, B&H; Prof. Dr. Dragutin Đukić, Serbia; Prof. Dr. Nedeljko Tica, Serbia; Prof. Dr. Branko Ćupina, Serbia; Prof. Dr. Dušan Živković, Serbia; Prof. Dr. Vladan Bogdanović, Serbia; Dr. Darko Jevremović, Serbia; Dr. Marijana Pešaković, Serbia; Prof. Dr. Cosmin Salasan, Romania;

Technical editors

Prof. Dr Vladimir Kurćubić; Prof. Dr Pavle Mašković; Dr Marija Gavrilović; Dušan Marković, BSc

Print-run: 30

Printed by
MEDIGRAF - Čačak, Aleksandra Savića 42, 32000 Čačak

ISBN 978-86-87611-91-7

Year of publication: 2024

CONTENTS

Invited Speaker

Section: Field, Vegetable and Forage Crops

Section: Food Technology

DOI: 10.46793/SBT29.02ASS

SOIL SUITABILITY FOR AGRICULTURAL PRODUCTION IN THE AREA OF PROGAR (SURČIN MUNICIPALITY, BELGRADE)

Aleksandra Stanojković-Sebić[1], Darko Jaramaz[1], Zoran Dinić[1], Jelena Maksimović[1], Aleksandar Stanojković[2], Radmila Pivić[1]

Abstract: The aim of the paper was to conduct the research related to the examination of basic chemical parameters and texture class of agricultural soil, up to depth of 30 cm, in the area of Progar (Surčin Municipality) in order to improve them from the aspect of chemical reclamation and assessment of suitability for agricultural production. The results obtained indicate that the examined soils are mostly suitable for intensive field production, mainly wheat, maize and sunflower. Accordingly, general recommendations for fertilisers and liming materials application, are given for the mentioned plants.

Keywords: Progar, Surčin, chemical parameters, textural class, field production

Introduction

The Municipality of Surčin is located northwest of Belgrade (Republic of Serbia) and covers an area of 288 km^2. It is mostly characterized by agricultural-processing sector, where the share of agricultural soil in 2012 was about 72.6%. The quality of these soils is very different. The most fertile areas are in Surčin around the airport, while the lower classes are in the settlements of Boljevci, Bečmen, Progar and Petrovčić. The agricultural soil of the studied Progar area in 2012 was about 2426 ha. These soils mainly consist of arable soils intended for field production (Janošević et al., 2012). During the field survey it was observed that certain soils, intended for agricultural production, are marginal, in the sense of their limitations. Thus, the position of Surčin itself, which gravitates to the capital city, requires the need to try to enable each surface and turn it into a production area pursuant to appropriate application of agro-technical measures, mainly mineral fertilisers.

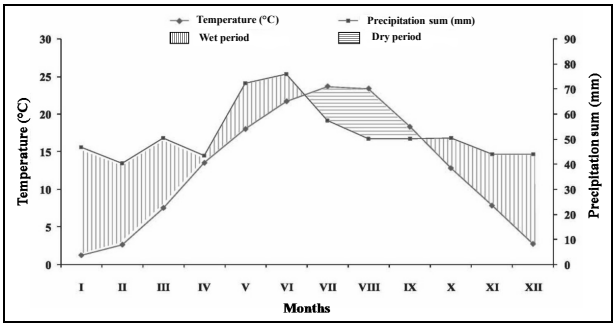
The aim of the paper was to conduct the research related to the examination of basic chemical parameters and texture class of agricultural soil in the area of Progar (Surčin Municipality) in order to improve them from the aspect of chemical reclamation and assessment of suitability for agricultural production.

[1]Institute of Soil Science, Teodora Drajzera 7, Belgrade, Serbia (astanojkovic@yahoo.com)
[2]Institute for Animal Husbandry, Autoput 16, 11080 Belgrade-Zemun, Serbia

Materials and methods

The trial was conducted in the area of Cadastral Municipality (CM) Progar, Surčin Municipality, Belgrade, Republic of Serbia (grid ref.: 44°42'N, 20°09'E).

Climate data for a series of 16 years of observation (period 2003-2018) were taken from the available meteorological yearbooks of the Republic Hydrometeorological Institute of the Republic of Serbia, and processed graphically. Data from the meteorological station Surčin (location: 44°49` N, 20°17` E, altitude 99 m above sea level), which covers with data the narrower and wider area of research, were used. The relation between wet and dry periods during 2003-2018 is presented using climate diagram according to Walter (Graph 1). The diagram was obtained on the basis of average mean monthly values of air temperature and average mean monthly precipitation heights in the ratio 3:1. Diagram shows that the dry period occurs from the end of June and lasts until the last decade of September. This precipitation regime does not positively affect either vegetable or fruit production, but are most favorable for crop production.



Graph 1. Climate diagram - ratio of dry and wet periods for 16 years of observation

Field work included taking composite soil samples with a probe at pre-determined locations in a disturbed state from a depth of 0-30 cm, then, packaging, transport and storage of samples, according to standard method (ISO 18400-105:2017). Soil samples (112 in total) were taken during July and August 2019 on 24 locations (cadastral parcels, CP) within CM Progar.

Based on the available satellite images and the pedological map of Institute of Soil Science, scale R=1:50.000, soil types (Eutric Cambisol and Fluvisol) and the observation places where sampling was performed, were located (Figure 1).

The soil samples preparation and analysis were performed using standard method (SRPS ISO 11464:2004). Soil acidity (pH in H_2O and in 1M KCl), $CaCO_3$ and total N content were analysed according to standard metods (SRPS ISO

10390:2007; SRPS ISO 10693:2005; SRPS ISO 13878:2005, 2005). Available P and K were analysed by AL-method, spectrophotometrically and flamephotometrically, respectively. Humus content was determined using Kotzman method (Džamić et al., 1996). Textural soil class was obtained using the International Union of Soil Science (IUSS) texture triangle (Murano et al., 2015), based on the share of clay, sand, and silt fractions in soil, respectively. The results are presented using Microsoft Office Excel 2007 statistical and mathematical program, where the following values were calculated: mean (AVR), STDEV and frequency. GIS software was used as a platform for geostatistical data analysis in spatial data processing.

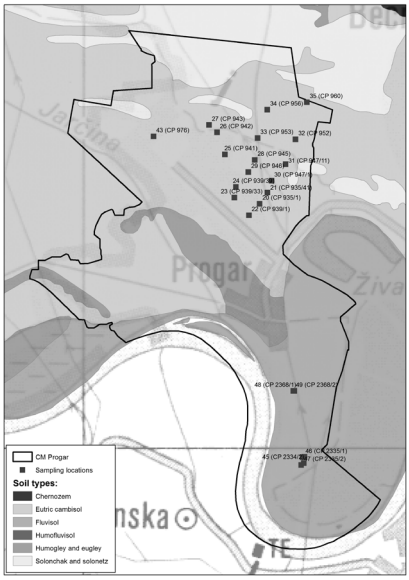


Figure 1. Pedological map and sampling locations of CM Progar study area (source: Institute of Soil Science, 2019)

Results and discussion

Table 1 displays the values of the basic chemical soil parameters in analysed soils of CM Progar.

The results showed that the tested Eutric Cambisol soils are characterized by the following features: strongly to slightly acid reaction (pH in 1M KCl), strongly to neutral reaction (pH in H_2O), with almost all samples without $CaCO_3$; very low to highly provided with available P, low to very highly provided with available K, insufficiently to well provided with total N, and low to highly provided with humus

(Džamić et al., 1996). The results of $CaCO_3$ contents are according to the obtained pH values, where low pH values indicate an adequate use of limestone. The low P content may be a consequence of many things, such as the presence of Ca in alkaline soils, but also of reduced P nutrition (Popović, 1989).

Table 1. Basic chemical properties of the studied area soil samples

CP	Basic chemical parameters of soil fertility (mean±stdev)						
	pH		P_2O_5 ($mg100g^{-1}$)	K_2O ($mg100g^{-1}$)	N (%)	Humus (%)	$CaCO_3$ (%)
	1M KCl	H_2O					
Soil type: Eutric Cambisol							
935/1	4.7±0.32	5.9±0.32	12.9±12.73	25.0±4.25	0.149±0.02	2.4±0.07	-
935/41	5.8±0.14	6.9±0.07	12.7±2.93	22.5±3.08	0.150±0.02	2.3±0.38	0.43±0.61
939/1	5.2±0.00	6.4±0.00	33.8±0.00	40.3±0.00	0.170±0.00	2.2±0.00	-
939/33	4.3±0.00	5.0±0.00	5.9±0.00	31.1±0.00	0.134±0.00	2.9±0.00	-
939/39	4.3±0.00	5.2±0.00	6.8±0.00	33.4±0.00	0.178±0.00	3.4±0.00	-
941	4.3±0.29	5.2±0.20	6.7±2.80	18.9±2.77	0.148±0.00	2.6±0.14	-
942	4.7±0.00	5.8±0.00	1.7±0.00	9.4±0.00	0.284±0.00	6.2±0.00	-
943	4.6±0.44	5.7±0.40	16.5±14.91	39.3±27.74	0.158±0.02	2.7±0.35	-
945	4.6±0.43	5.6±0.56	4.4±2.89	16.7±3.17	0.125±0.03	2.6±0.83	-
946	4.3±0.00	5.2±0.00	2.1±0.00	16.3±0.00	0.109±0.00	1.9±0.00	-
947/1	4.6±0.33	5.7±0.35	9.8±7.65	24.1±5.34	0.138±0.01	2.2±0.20	-
947/11	4.3±0.32	5.4±0.44	22.9±11.06	44.2±23.83	0.193±0.04	2.9±0.43	-
952	3.9±0.07	4.9±0.07	13.4±1.81	23.0±4.42	0.155±0.01	2.7±0.09	-
953	4.5±0.63	5.5±0.73	6.1±3.67	23.3±4.20	0.130±0.01	2.3±0.25	0.14±0.38
956	4.7±0.66	5.7±0.67	10.9±11.14	38.5±27.08	0.163±0.03	2.9±0.69	0.23±1.19
960	3.9±0.00	5.0±0.00	3.2±0.00	14.2±0.00	0.156±0.00	2.8±0.00	-
962	4.9±0.93	5.9±0.89	8.7±7.79	22.7±15.56	0.147±0.02	2.6±0.50	0.14±0.62
970	4.3±0.00	5.2±0.00	1.7±0.00	18.5±0.00	0.222±0.00	3.7±0.00	-
976	4.2±0.10	5.3±0.10	6.1±1.95	14.9±2.05	0.120±0.01	2.5±0.16	-
Range	3.9-5.8	5.0-6.9	1.7-33.8	9.4-44.2	0.109-0.284	1.9-6.2	-
Soil type: Fluvisol							
2334/2	6.7±0.00	7.6±0.00	16.3±0.00	15.8±0.00	0.200±0.00	2.3±0.00	7.78±0.00
2335/1	7.1±0.00	8.0±0.00	9.7±0.00	13.9±0.00	0.179±0.00	2.9±0.00	4.32±0.00
2335/2	7.0±0.00	8.2±0.00	5.7±0.00	15.7±0.00	0.196±0.00	2.6±0.00	8.64±0.00
2368/1	7.3±0.00	8.4±0.00	5.7±0.00	12.5±0.00	0.148±0.00	2.2±0.00	12.96±0.00
2368/2	7.4±0.00	8.5±0.00	4.4±0.00	16.9±0.00	0.153±0.00	2.1±0.00	14.96±0.00
Range	6.7-7.4	7.6-8.5	4.42-16.33	12.46-16.95	0.148-0.200	2.1-2.9	4.32-14.96

The results of the tested Fluvisol soils showed that they are characterized by the following features: neutral to alkaline reaction (pH in 1M KCl), slightly to medium alkaline reaction (pH in H_2O), medium to highly carbonated, very low

to medium provided with available P, low to medium provided with available K, and medium provided with total N and humus (Džamić et al., 1996).

According to the share of clay, sand, and silt fractions in both soils, 94% of the examined samples belongs to the textural class of light clays, 2% belongs to heavy clay, while 1% each belongs to clay loam, silty loam, silty clay loam and silty clay.

Based on the terrain reconnaissance and the results obtained in this research from the depth of 30 cm, it was established that the CM Progar agricultural areas are suitable for intensive agricultural production, namely the cultivation of wheat, maize and sunflowers. Therefore, general recommendations for fertilisers and liming materials application, including the type, dosage and time of application, pH value, the state of calcium in the soil, as well as other soil fertility parameters (Popović, 1989), are given for the mentioned field plants.

The general recommendation for the lime material introduction, in the amount of 4-6 t $CaCO_3$ ha^{-1} (in basic tillage) refers to the following parcels: 935/1, 941, 947/1, 952, 953, 962, 943, 947/11, 939/33, 939/39, 956, 942, 945, 960, 976, 946, 970.

The general recommendations for mineral fertilisation of wheat (in the fall during the basic tillage; the fertilizers amounts for plant nutrition depend on the available N in February-March) are as follows: 500 kg ha^{-1} NPK 16:16:16 (parcels: 935/1, 935/41, 941, 947/1, 952, 953, 962, 2334/2); 300 kg ha^{-1} NPK 10:30:20 (parcels: 939/1, 943, 947/11); 300 kg ha^{-1} NPK 10:30:20 + 100 kg ha^{-1} MAP (parcels: 939/33, 939/39, 956); 600 kg ha^{-1} NPK 10:30:20 (parcel 942); 400 kg ha^{-1} NPK 16:16:16 + 100 kg ha^{-1} MAP (parcels: 945, 960, 976, 2335/1, 2335/2, 2368/1, 2368/2); 500 kg ha^{-1} NPK 16:16:16 + 100 kg ha^{-1} MAP (parcels: 946, 970).

The general recommendations for mineral fertilisation of maize (before sowing) are as follows: 400 kg ha^{-1} NPK 10:30:20 + 300 kg ha^{-1} KAN (parcels: 935/1, 935/41, 939/33, 941, 945, 947/1, 952, 953, 956, 960, 962, 976, 2334/2, 2335/1, 2335/2, 2368/1, 2368/2); 500 kg ha^{-1} NPK 16:16:16 + 200 kg ha^{-1} KAN (parcels: 939/1, 943, 947/11); 350 kg ha^{-1} NPK 10:30:20 + 250 kg ha^{-1} KAN (parcel: 939/39); 600 kg ha^{-1} NPK 16:16:16 + 100 kg ha^{-1} MAP (parcel: 942); 500 kg ha^{-1} NPK 10:30:20 + 200 kg ha^{-1} KAN (parcel: 946); 500 kg ha^{-1} NPK 10:30:20 (parcel: 970).

The general recommendations for mineral fertilisation of sunflower (before sowing) are as follows: 600 kg ha^{-1} NPK 16:16:16 + 100 kg ha^{-1} KAN + 100 kg ha^{-1} of potassium salt (parcels: 935/1, 935/41, 941, 947/1, 952, 953, 962, 2334/2); 400 kg ha^{-1} NPK 6:12:24 + 200 kg ha^{-1} KAN + 100 kg ha^{-1} MAP (parcels: 939/1, 943, 947/11); 600 kg ha^{-1} NPK 16:16:16 + 100 kg ha^{-1} KAN (parcels: 939/33, 945, 956, 960, 976, 2335/1, 2335/2, 2368/1, 2368/2); 500 kg ha^{-1} NPK 16:16:16 + 150 kg ha^{-1} KAN (parcel: 939/39); 800 kg ha^{-1} NPK 16:16:16 (parcel: 942); 700 kg ha^{-1} NPK 16:16:16 + 100 kg ha^{-1} MAP (parcels: 946, 970).

Conclusion

The results of soil chemical parameters and textural class indicate that the examined soils of Progar, Surčin Municipality, up to depth of 30 cm, are mostly suitable for intensive field production, mainly wheat, maize and sunflower. Accordingly, general recommendations for fertilisers and liming materials application, such as type, dosage and time of application, pH value, the state of Ca in the soil, and other soil fertility parameters, are given for the mentioned plants. It is necessary to regularly monitor the changes in the basic chemical parameters of the tested soils fertility in order to give appropriate recommendations based on the obtained results.

Acknowledgement

This work is financially supported by the Serbian Ministry of Science, Technological Development and Innovation (Contract 451-03-66/2024-03/200011) and the Serbian Ministry of Agriculture, Forestry and Water Management (Contract 401-00-00596/1/2019-14 -03-9/2021-14/200011).

References

Janošević V. et al. (2012). Available: http://surcin.rs/wp-content/uploads/2018/12/Strategija-odrzivog-razvoja-GO-Surcin.pdf.

ISO 18400-105:2017. (2017). Soil quality - Sampling - Part 105: Packaging, transport, storage and preservation of samples.

SRPS ISO 11464:2004. (2004). Pretreatment of samples for physico-chemical analysis.

SRPS ISO 10390:2007. (2007). Kvalitet zemljišta - Određivanje pH-vrednosti.

SRPS ISO 10693:2005. (2005). Kvalitet zemljišta - Određivanje sadržaja karbonata - Volumetrijska metoda.

SRPS ISO 13878:2005. (2005). Kvalitet zemljišta - Određivanje sadržaja ukupnog azota suvim sagorevanjem ("elementarna analiza").

Džamić R., Stevanović D., Jakovljević M. (1996). Praktikum iz agrohemije. Univerzitet u Beogradu, Poljoprivredni fakultet.

Murano H., Takata Y., Isoi T. (2015). Origin of the soil texture classification system used in Japan. Soil Science and Plant Nutrition. 61(4): 688-697.

Popović Ž. (1989). Agrohemija. Univerzitet u Beogradu, Poljoprivredni fakultet, Naučna knjiga, Beograd.

CIP - Каталогизација у публикацији Народна библиотека Србије, Београд

63(082)
606:63(082)

INTERNATIONAL Symposium on Biotechnology (2 ; 2024 ; Čačak)
Proceedings / 2nd International Symposium on Biotechnology, 14–15 March 2024 ; [organizer] University of Kragujevac, Faculty of Agronomy [in] Čačak. - Kragujevac : University, Faculty of Agronomy in Čačak, 2024 (Čačak : Medigraf). - 595 str. : ilustr. ; 24 cm

"XXIX Savetovanje o biotehnologiji sa međunarodnim učešćem" --> kolofon. - Tiraž 30. - Bibliografija uz svaki rad.

ISBN 978-86-87611-91-7

a) Пољопривреда -- Зборници b) Биотехнологија -- Зборници

COBISS.SR-ID 139941641

DOI: 10.46793/SBT29