SYNTHETIC STUDY CONCERNING THE REQUIREMENTS OF VEGETABLES TO SOIL AND AGROCHEMICAL CONDITIONS FROM ROMANIA I. SOIL REQUIREMNENTS

STUDIU SINTETIC PRIVIND CERINȚELE PLANTELOR LEGUMICOLE FAȚĂ DE CONDIȚIILE PEDOLOGICE ŞI AGROCHIMICE DIN ROMÂNIA I. CERINȚE FAȚĂ DE CONDIȚIILE PEDOLOGICE

LĂCĂTUŞ V.
Research and Development Institute for Vegetable and Flower Growing
Vidra, Romania

Abstract. *This scientific paper shows the main vegetable requirements to different specific features of soils. There are also shown the evaluation criteria of soil fertility according to capacity and intensity factors for different vegetable growing systems, which are more or less intensive: in field, solar or warm greenhouse (solar greenhouse).*

Key words: vegetables, soil requirements, vegetable growing regions

Rezumat. *Lucrarea se referă la cerințele principalelor culturi legumicole față de diferite particularități ale solurilor. De asemenea sunt prezentate criteriile de apreciere a fertilității solurilor pe baza factorilor de capacitate şi de intensitate pentru diferite sisteme de cultivare a legumelor, mai mult sau mai puțin intensive: în câmp, solar sau seră caldă (seră solar).*

Cuvinte cheie:

INTRODUCTION

The vegetable growing in Romania has a well-known tradition, but the highest areas and yields were achieved in the ninth decade of the last century. One of the essential conditions for vegetable growing is soil quality, determined by the great number of its characteristics. Knowing the importance of soil for vegetable growing, this scientific paper is a synthesis of the experiments carried out at the Research and Development Institute for Vegetable Growing and Horticulture of Vidra and at research and development stations of Romania.

We showed the estimate criteria of soil fertility according to capacity and intensity factors for different vegetable growing systems, which are more or less intensive: in field, solar or warm greenhouse.

MATERIALS AND METHODS

As a biological material, we have used the most liked Romanian varieties, cultivated according to the technologies elaborated by ICDLF and vegetable growing stations.

Soil sampling, conditioning and analysis were done according to the methodology elaborated by ICPA Bucureşti, at which the watery extract method was added, which was introduced by the Agrochemistry Laboratory of ICDLF Vidra.

RESULTS AND DISCUSSIONS

In this scientific paper, we have shown a synthesis of the results obtained during more years, expressed directly as evaluation limits of the fertility of soils cultivated with vegetables, in open field or under protection. Our goal being that this scientific paper should be a guide for agrochemists, we have also used information from literature.

We are showing the main vegetable species requirements to soil, zoning of vegetable production according to soil and climatic conditions and to salt tolerance.

1. REQUIREMENTS OF THE MAIN VEGETABLE SPECIES TO SOIL

Sweet pepper: pH: 6.5 – 7; it requires well drained soils with a good water holding capacity; it has a mean tolerance to salinity; very susceptible to the lack of Mg;

Okra pods: pH: 6.5 – 7.5; loam-sandy, easy, warm soils;

Horse bean: less exigent; it requires soils with a good water holding capacity, heavy clay loam soils; it reacts well to potassium fertilization;

Cardoon: deep, wet, humus rich soils;

Cucumbers: pH: 5.5 – 7.5; relatively susceptible to salts; if salts are in excess, there is found a lack of P, Mg and Ca; very susceptible to the lack of Mo;

Onion: it requires dry, well drained soils; it does not like chalky soils; it is susceptible to the lack of Zn and Mo and very susceptible to the lack of Cu and Mg;

Spring onion: pH: 6.0 – 6.5; it requires soft soils, sandy-clay or clay-sandy soils;

Chicory: pH: 7.0 – 7.5; it requires a rich, deep and well drained soil; it is susceptible to the lack of Mn and Cu;

Cauliflower: pH: 6.5 – 7.5 (control of Plasmodiophoromycetes– *Plasmodiospora brassicae*); it requires well organic fertilized soils; it shows susceptibility to the lack of B, Mo, Ca and S;

Garden cress: it prefers less heavy soils with a very good water holding capacity;

Courgette: it requires soft, humic and well drained soils; it is a susceptible medium to the B excess and is susceptible to the lack of Mg and Mn and very susceptible to the lack of Fe and Mo; it has a high susceptibility to salinity;

Green bean: pH: 6.1 – 7.4; it has a great susceptibility to B and NaCl excess and to salinity; it is susceptible to the lack of Cu, Mo and Mn, very susceptible to the lack of Zn; it reacts well to the organic fertilization;

Sweet cicely: it is susceptible to the lack of Mn; it is grown on previously organic fertilized fields;

Peas: pH: 6.0 – 7.5 (sandy-clay soil); it is grown on very fertile soils; it has a mean tolerance to salinity and does not like very heavy, poorly drained and sandy soils;

Carrot: it is susceptible to salinity and to the lack of microelements; it prefers soft soils;

Kohlrabi: pH: 6.6 – 6.8; it is an *exhausting* plant, susceptible to drought (both from soil and air); it does not like limy soils; it is susceptible to the lack of Fe and very susceptible to the lack of Mn, Mg and B;

Eggplant: it prefers soils with pH of 5.5 – 8.0; it is susceptible to the lack of Mg, Fe, B and Mo;

Parsley: it is an *exhausting* and a draught tolerant plant;

Yellow melon: pH: 6.0 – 7.5; it requires well drained and aired soils; it has a mean tolerance to salinity; very susceptible to the lack of Mg, Mn, Fe and Mo;

Leek: pH: 6.0 – 6.3; it prefers well aired, loose soils; it is susceptible to lime;

Rhubarb: pH: 6.1 – 6.5; it requires well drained and loose soils;

Radish: pH: 6.0; it prefers humiferous soils; it is very susceptible to the lack of B;

Garden lettuce: it is susceptible to salinity and to the lack of B;

Vegetable Oyster and Scorzonera: these are exhausting plants; they prefer deep, loose, humus and rich soils;

Beet: pH: 5.8 – 7.0; it is exigent to the organic matter and nitrogen:

Spinach: it is susceptible to the lack of Mn, to draught and to water excess;

Asparagus: pH: 6.5 – 7.5; it requires well drained soils with ground waters found at 0.8 m; it is tolerant to salinity and susceptible to the lack of B; it is not tolerant to acid soils;

Tomato: pH: 6.0 – 7.0; it has a mean susceptibility to salinity, but a great one to Cl fertilizers and to the lack of Zn, B, Fe and Mn; it is susceptible to the lack of Mo;

Celery: pH: 6.6 – 6.8; it requires well organic fertilized soils; it is susceptible to the lack of Mg and B; it is very susceptible to the $CaCO_3$ excess;

Garlic: pH: 6.8 – 5.5; it requires well drained soils; it is very susceptible to the lack of Cu and Mg and susceptible to the lack of Zn, Fe, B and Mo; sulphur is very important;

Cabbage: pH: 6.5 – 7.5; it requires clay, well organic fertilized soils; it is susceptible to the lack of Mg and S; it is tolerant to salinity and Cl, but not to Cu; it prefers sulphate;

Brussels sprouts: the best pH 6.8; tolerant to salinity and susceptible to the lack of B.

Romania has very favourable soil conditions for vegetable growing. In Romania, almost 80 vegetable species are cultivated. According to soil and

climate conditions, there are three favourableness zones for vegetable growing and development:

THE FIRST ZONE is characterized by mean temperatures of 10-11°C, rainfalls between 400 and 500 mm each year and relative humidity of air of 30-60 %. *Soil types:* steppe dark-coloured soil, brown Chernozem. These soils are found in the southern Romania and in the Western Plain.

THE SECOND ZONE is characterized by mean annual temperatures of 5-11°C, rainfalls between 550 and 650 mm, relative humidity of air of 65-70 %. *Soil types:* degraded Chernozem, forest dark soil, swamp, meadow soils and solidified sands. These soil types are typical of the Subcarpathian hills from the Moldova region in the north of Romania, in the region of Satu-Mare.

THE THIRD REGION is characterized by mean annual temperatures of 6-8°C, rainfalls of 600-650 mm, relative humidity of air of 65-70 %. *Soil types* vary from Chernozem in dark forest soils, weakly or mean podzols and alluvial soils. They are found in the Transylvanian Plateau.

Early, semi-late and late tomato crops, which represent almost 25% of the vegetable grown area, are placed in the first and the second zone. Here, there are found basins used for the specialization according to different crop types. We noticed the following basins: Arad, Sânicolaul Mare, Băileşti, Alexandria, Zimnicea, Vidra, Tecuci, etc.

Onion is grown especially in the south of Romania, on a part of the Western Plain, but also on great areas in Tulcea, Constanța, Brăila, Galați and Iași counties.

Sweet pepper and eggplant are grown especially in the first and the second zone, having almost the same requirements as tomato.

Cabbage has found favourable growing conditions in all the regions of Romania, being characterized by a special plasticity. However, early cabbage is grown especially in southern and western Romania.

Garden peas are grown especially around the can factories, but they found very good conditions in the second zone.

Garden beans require more from the environmental conditions viewpoint, but they are grown however in all the areas. They may be cultivated in the second crop, too, especially in southern Romania (producing two crops per year).

Cucumber, although a susceptible plant to heat, is grown both in southern Romania and in the Transylvanian Plateau and in northern Moldavia, due to an old tradition and to favourable micro-zone conditions (Dolj, Prahova and Galați).

Legumes meet favourable conditions in all the regions of Romania, but the best results were obtained in the Western Plain and in the centre of Transylvania. Because of their requirements, these crops extended around the big cities from southern Romania, showing good economic results.

2. SALT TOLERANCE

Vegetables have a different susceptibility to salts, beginning with onion, carrot, sweet pepper and lettuce that are very susceptible and finishing with beet and spinach that are the most resistant (tab. 1).

Table 1

Limits of soil salinity that result in the affection or the diminution by 50 % of the vegetable production (mineral residue, g/100g dry soil)

Crop	Limit that affects the production, according to the texture			Limit at which the production decreases by 50 %, according to the texture		
	Thin	Mean	Rough	Thin	Mean	Rough
Beans, cucumber	0.23	0.20	0.15	0.35	0.30	0.25
Carrot	0.19	0.17	0.13	0.38	0.25	0.20
Sweet pepper, lettuce	0.20	0.18	0.15	0.43	0.30	0.23
Onion	0.17	0.15	0.13	0.40	0.30	0.22
Potato	0.23	0.20	0.16	0.45	0.35	0.25
Cabbage	0.23	0.20	0.15	0.55	0.40	0.26
Courgette	0.25	0.20	0.17	0.60	0.45	0.30
Tomato	0.25	0.20	0.17	0.60	0.45	0.30
Spinach	0.30	0.25	0.20	0.60	0.45	0.30

For the soils from solariums, which content in organic matter (OM) is up to 6.5 %, according to the analysis and interpretation methods from Romania (OM – determined as calcination loss), the tolerable contents that should not be exceeded by soluble salts, sodium chloride and the electric conductibility (EC) are estimated by the following relation: (Ghidia and Lăcătuş, 1983):

Soluble salts, % ≤ (2* OM + 15)*0.01 (1)

NaCl, mg l at 100 g dry soil ≤ (2* OM + 15) (2)

EC, mS at 25°C ≤ (2* OM + 15)*0.027 (3)

The relation (2* OM + 15) is assessed as being equivalent to the water field capacity from soil, when it does not exceed a content of 6.5 % OM. Because this organic matter rate is affected by a positive error, due to the fact that at calcination, soil minerals lose water, the above-used relations reach the limit values of the respective indices, which are increased. But, the presence of mineral colloids from soil diminishes the negative effect of high salt concentration on plants, thus compensating the error when dosing the content of organic matter by calcination.

In soils from greenhouses and solariums, with a content of organic matter higher than 6.5 %, the correlation between this and water field capacity is described by the relation: **cca, % ≈ 2.7* OM + 10,7** (4)

In this case, relations 1,2 and 3 are modified according to the relation 4.

REFERENCES

1. **Borlan Z., Hera Cr., 1973** – *Metode de apreciere a stării de fertilitate a solului în vederea folosirii raționale a îngrăşămintelor*. Ed. CERES. 190-198, 242-247, 350-357.
2. **Davidescu D., Velicica Davidescu, 1972** – *Evaluation of fertility by plant and soil analysis*. Ed. Acad., Bucureşti, Romania. ABACUS PRESS, Tunbridge Wells, Kent, England. 437-484.
3. **Davidescu D., Velicica Davidescu, 1992** – *Agrochimie horticolă*. Ed. Acad., Bucureşti, Romania. 177-186, 347-364.
4. **Dumitrescu M., Scurtu I., Stoian L., Glăman Gh., Costache M., Dițu D., Roman T., Lăcătuş V., Rădoi V., Vlad C., Zăgrean V., 1998** – *Producerea legumelor*. Ed. GEEA. 65-101.
5. **Geissler Th., Kindt V., Lanckov J., Lekve O., Windisch B., 1976** – *Gemuseproduktion unter Glas und Plasten*. VEB Deutscher Landwirtschaftsverlag, Berlin. 25, 70, 90, 123, 141, 189, 200, 232.
6. **Hera Cr., 2004** – *Solul-garanție a dezvoltării durabile şi siguranței alimentare* în „Lumea rurală-astăzi şi mâine" . Rev. Academica.
7. **Lăcătuş V. şi colab., 2002** – *Tehnici şi tehnologii în legumicultură*. Concepții moderne în cercetarea horticolă Românească. 113-142.
8. **Stoian L., 1998** – *Cercetări privind testarea stării de fertilitate a solurilor destinate culturilor de legume*. Teză de doctorat.
9. **Voican V., Scurtu I., Costache M., Lăcătuş V., Stoian L., Roman T., Dumitrescu M., 2002 –** *Cultura legumelor în câmp*. Ed. PHOENIX. 283-302.
10. **Voican V., Lăcătuş V., 2004** – *Cultura protejată a legumelor în sere şi solarii*. Ed. CERES. 47-57, 98-100, 118-123.