Ortsklima mit relativ mässiger Erwärmung und Abkühlung der Luftmassen hohen Wassergehaltes. Dabei sind die Mikroklimate in den Wirkungen der Wassermasse, des kahlen Bodens, der verschiedenen Pflanzenassoziationen sowie der Niveau- und morphologischen Unterschiede charakteristisch.

Innerhalb dieser Mikroklimate sind auch die Luftfeuchtigkeitsverhältnisse mehr oder weniger unterschiedlich. Insofern wir den Tagesgang der Feuchtigkeit in nächtliche und tägliche Perioden teilen, müssen wir folgende Gliederung vornehmen:

1. *Bei Nacht:* in windstillem Wetter, bei gleichmässiger relativen Luftfeuchtigkeit von 95—100% entsteht:
   - a) *Tau,* dessen reichliche Bildung wir im Überschwemmungswald in jeder heiteren Nacht unserer Boebachtungsperiode bemerken konnten.
   - b) *Nebel,* in den Morgenstunden einer auf einen verregneten Tag folgenden heiteren windstillen Nacht zwischen den Dämmen.
   - c) *Dunst,* in der Luftschicht über dem Wasser konnte als Folge der Abkühlung in den Morgenstunden regelmässig beobachtet werden.
1. *Bei Tag:* mit wechselndem täglichen Gang, in welchem Fall:
   - a) *Bei heiterem, windstillem Wetter* die Wirkung des Wassers sich geltend macht, wobei die Werte der Luftfeuchtigkeit mit der Entfernung abnehmen.
   - b) *an einem bewölkten, windstillen Tag* nach einem verregneten Vortage die Luftschicht über der Vegetation und dem feuchten Boden des Überschwemmungsgebietes dunsterfüllter ist als über dem Wasserspiegel.
   - c) *zur Zeit von Luftbewegungen im Überschwemmungsgebiet* eine hochgradige Ausgleichung der Unterschiede erfolgt.

Tabelle 1.
Mittelwerte der Luftfeuchtigkeit bei heiterem Wetter am 16. Juni. von 4^h bis 19^h

	R. F. %	Dampfdruck mm	Temperatur C
Wasser (Station 7.)	78.	14.4	20.0
Ufer (Stat. 6.)	62.2	14.0	24.1
Wald (Stat. 3.)	58.8	13.7	24.1
Glasfläche (Stat. 2.)	54.1	12.9	25.3

Tabelle 2.
Mittelwerte der Luftfeuchtigkeit bei bewölktem Wetter am 18. Juni. von 4^h bis 19^h

	R. F. %	Dampfdruck mm	Temperatur C
Wasser (Station 7.)	79.0	14.1	19.5
Ufer (Stat. 6.)	72.3	14.4	21.0
Wald (Stat. 3.)	79.5	15.6	21.0
Glasfläche (Stat. 2.)	84.2	15.4	21.1

Tabelle 3.
Lufttemperaturminima und ihre Zeiten.

	am 16.		am 18.		am 19.	
	Uhr	C	Uhr	C	Uhr	C
Stat. 7 (überm W.)	4	15.0	3	14.2	1	13.2
Stat. 6 (ü. Ufer)	4	14.8	3	12.8	1	11.4
Stat. 3 (ü. Wald)	4	14.0	3	13.3	0	10.2
Stat. 2. (ü. Grasfl.)	4	14.2	3	13.3	2	11.2

CONTRIBUTIONS TO THE ECONOMIC GEOGRAPHY OF THE RED PEPPER „SZEGEDI".

(Soil geography of paprika)

I. PÉNZES

Geographical Institute of Szeged University

Introduction

In researches concerning agricultural geography special attention has to be paid to the evaluation of conditions of production in the domain of physical geography and of the effects of physical factors. Disclosure of dialectical connections and interpretation of the impact of these connections is an important and distinguished task of the physical geographer. In analyses of economic geography concerning specific branches of production, geological, geomorphological, climatical conditions, those of soil geography etc. are to be discussed in all details. Production of red pepper in Szeged and in the immediate environs of the town can be traced back to a remote past, thus offering a good opportunity to summarize experiences. Planned economy plays an ever increasing part also in the agriculture of the Szeged district, and rational agricultural production gains more and more ground. To become thoroughly acquainted with the physical geographical characteristics of the area in question is a preliminary condition of the practical realization of rational production. The present paper is intended to give an outline of some conditions of physical geography pertaining to the soil geography of paprika-growing.

The author has tried to locate, with special reference to the requirements of the paprika plant, in the former inner red-pepper growing district of Szeged those areas, where the soils warrant red-pepper yields in different degrees. For this purpose five categories were established warranting approximately a yield of 40—50 q/cad. hold (1 cad. hold = 0,57 ha.) (excellent), 30—40 q/cad. hold (good), 20—30 q/cad. hold (medium) 15—20 q/cad. hold (satisfactory) or under 15 q/cad. hold (poor), provided that other physical and social factors also develop accordingly.

Location, extension, geological and geomorphical conditions of the inner red-pepper growing district in the environs of Szeged.

In 1934 the order in council No. 1890/1934. M. E. established in the environs of Szeged an inner and an outer red-pepper growing district.

The inner district included the town of Szeged and the communes of Kiskundorozsma, Gyála and Tápé in conformity with their administrative limits at that time. As a consequence of country planning after World War II. several new communities arose in the outskirts of the town of Szeged and of the commune of Kiskundorozsma. Thus the inner district at present includes the actual territory of the town of Szeged and the commune of Kiskundorozsma as well as the area of the communities formed in the former outskirts of the town of Szeged and of the commune of Kiskundorozsma, viz. Röszke, Domaszék, Zákányszék, Mórahalom, Csorva, Ásotthalom, Szatymaz, Balástya, Csengele, Forráskút, Üllés, Bordány, Zsombó, and the territories of the communes Gyála and Tápé. The whole area investigated comprises 1075,6 km^2 approximately.

The geological structure of the area was widely determined by the sinking still having been in course in the Levant period and subsequently causing a strong refilling. This is demonstrated by the boring-data showing that in Szeged the Pannonian strata were not reached even in a depth of 900 m. In the evolution of the contemporary surface important factors were dustfall in the Pleistocene, driftsand formed in the Holocene and alluvial deposits of the Tisza and Maros rivers.

In conformity with the threefold geological structure the inner red-pepper growing district of the environs of Szeged may be divided also geomorphically into 3 different horizons viz.:

1. an upper Early-Holocene horizon interrupted by depressions running from NW to SE and covered by Late-Holocene sand;

2. a somewhat lower area covered by Pleistoceneloessial soil and here and there by younger sand;

3. a low Early-Holocene horizon shaped by fluviatile erosion.

The upper terrain representing a considerable part of our area, forms ranges of sandhills consisting of calcareous sand. A great part of the sand terrain is black-earth sand, fully developed or in the making; a smaller part is driftsand, even today still without any characteristic feature. The mean depth of the ground water level is 2—3 m The depressions between the hill ranges are silty (caustic sludge) with alkali soils, at ime water-logged, with a comparatively rich humus content. The depth of ground water level is established at about 1 m on an average.

The other morphological horizon is located to the North and North-East of the settlements Szeged, Röszke, Szentmihálytelek, and includes the immediate surroundings of Kiskundorozsma and Fehértó; it is situated somewhat lower, and its dominant formation is infusorial loess. This area was at the end of the Pleistocene low lying, here and there interspersed with higher insular ridges. With the exception of the insular ridges the area was covered by water; dustfall and formation of loess occurred under these conditions. The infusorial loess is about 3—5 m thick, more argillaceous and compact than typical aeolian soil; its base is composed by loamy and silty deposits. The loamy base exercises a favourable influence on the water regime of the loessial stratum. The infusorial loess-ridge in the environs of Szeged belongs to the loessial area of the region beyond the Tisza carved up by the rivers Tisza and Maros. On the lower horizons arising as a consequence of the ablation of the Tisza or Maros river respectively, accumulation of a varied alluvium took place, showing here and there also alluvial clay. The lower lying plains of the area are alkali soils. The mean depth of ground water level is 3—5 m. Typical loess-spots of the area can be found at Óthalóm, Rácokkertje, on the east bank of the Matyér rill at Szentmihálytelek, further to the NW of Fehértó and E, of the commune Kiskundorozsma. The depth of the typical loess is 3—4 m., ist base consists of sand. Depth of ground water level is here too about 3—5 m.

The third geomorphical horizon is the low lying alluvium, bordering both banks of the Tisza in a different latitude. It includes the territory of the communes Tápé, Röszke, Gyála-rét, Újszeged and smaller spots in the Szeged area. The rill Matyér belongs also to this territory. Mean depth of the ground water level is about 3—4 m.

II.

General survey of the area from the point of view of soil geography.

In the process of soil formation the climate has a decisive importance, although matrix, terrain, organisms (fauna and flora) and time are to be considered as important factors too. *In the soil-forming process of the inner red-pepper growing district of the environs of Szeged the extremely varied terrain is an important differentiating factor.* The effect of the climate generally could not come into full display owing to the lively movement of materials; thus its soil-building effects asserted themselves only on the upper terrain.

The native rocks of soil formation are loess, infusorial loess, sand, and varied alluvial accumulation. As sand, loess and infusorial loess are located in the upper terrains of the investigated area, soil building process that started under the influence of the climate may be qualified as more continuous. On the deep low terrain motion of substances was very frequent (river accumulation and erosion) and in consequence the most important part of the soil building process, the formation of humus, didnot take place. Thus the soils of the flood area are to be considered more as skeleton soils developing actually in the direction of the black-earth variant. In the whole loess and infusorial loess area as well as in a substantial part of the sand, good black-earth soil variants arose, although uniformity is still lacking, owing to the unevenness (depressions) of the terrain. Variety is rather characteristic for these soils and is increased further by the flat spots with water-logging and by the alluvial clay areas. In the territory of the inner red-pepper growing district of the environs of Szeged black-earth (tchernoziom) soils, alluvial clay variants, alluvial skeleton soils, characterless driftsand soils and alkali soils have to be distinguished. In the sandy territories the soil of many parts forms a transition to the black-earth class. Developed black-earth can be found in the sandy area, generally in the vicinity of settlements.

III.

Soil requirements of red-pepper.

Rer-pepper came to the environs of Szeged from the Balkan Peninsula by the intermediary of the Southern Slavs and Turks. Experiences of several centuries and trials conducted for decades succeeded in an approximate determination of the requirements of red-pepper to the natural surroundings. According to these results the plant is particularly susceptible to temperature. The yield to be expected as to quality and quantity mainly depends upon temperatures, but it is also seriously affected by soil and water.

A great number of soil characteristics exert an influence on the plant to be produced. At present more than 50 characteristics playing a major or minor part in agricultural production are already known, on the basis of exact analytical data.

Based on the literary data at hand (1., 8., 9., 10., 11.) and on the experiences gained in practice, the most important requirements of red-pepper to the soil can be characterized as follows:

For the growing of red-pepper the *depth of surface soil,* that can be utilized by the roots of the plants is of vital importance. The roots of red-pepper are reaching as far as 25—40, some parts of lesser importance even as far as 70 cm in depth. Thus an area may be considered as *eminently* adapted for the production of red-pepper, when the depth of its surface soil exceeds 40 cm. An area, where the depth of surface soil equals 30—40 cm is *good,* an area with a surface soil depth of 25—30 cm and 20—25 cm *medium and satisfac*tory respectively. When the thickness of the surface soil is less than 20 cm, the area is to be qualified as poor.

Quality of the surface soil also exercises an influence on the yield. Therefore the *humus content* and colour of the soil is of equal importance in succesful production of red-pepper. The requirements of red-pepper to humus content are according to soil types as follows:

	loam	inundation soil	loamy clay — clay soil	sand
	%			
excellent	3,5	3,0	4,0	above 3,0
good	3,0—3,5	2,5—3,0	3,5—4,0	between 2,5—3,0
medium	2,5—3,0	2,0—2,5	3,0—3,5	2,0—2,5
satisfactory	2,0—2,5	1,5—2,0	2,5—3,0	1,5—2,0
poor	2,0	1,5	2,5	under 1,5

The *useful water storing capacity and heaviness* of the soil is also an extremely important production factor. The requirements of red pepper in this respect are as follows:

5 hours water raising in mm.

	loam soil inundation „ loamy clay „ clay „	sandy soil
	mm	
excellent	between 150—250	between 300—350
good	250—275 130—150	350—400
medium	275—285 110—130	400—450
satisfactory	285—290 90—110	450—480
poor	290—300 75—90	above 480

Red-pepper has high requirements also to the *structural condition of soils.* To reach certain crop qualities the following crumbling quality of the soil is desirable:

excellent	M	= eminently crumbly
	Mm	= eminently crumbly crumbly
	kHM	= heavily sandy prominently crumbly
good	m	= crumbly
	kH	= heavily sandy
	HM	= sandy prominently crumbly
	Hm	= sandy crumbly
medium	H	= sandy
satisfactory	tm	= compactly crumbly
	mt	= compact crumble structure
	Mm/por	= prominently crumbly crumbly dust
	M/por	= prominently crumbly dunst
poor	m/por	= crumbly dunst.

The requirements of red-pepper to the *chemical reaction of the soil* (pH) are shown in the following table:

excellent	pH	between	7,0—8,1
good	„	„	8,1—8,3 6,7—7,6
medium	„	„	8,3—8,5 6,5—6,7
satisfactory	„	„	8,5—8,7 6,3—6,5
poor	„	above under	8,7 6,3

Red-pepper requires also a great reserve of nutritive materials. The soil is most suitable for red-pepper growing, when it is rich in available nutritive materials. Nitrogen, phosphate and potassium reauirements of red-pepper are approximately as follows:

	Nitrogen (N)	Phosphate (P_2O_5)	Potassium oxide (K_2O)
	%		
excellent	above 0,250	0,250	0,200
good	between 0,200—0,250	0,200—0,250	0,150—0,200
medium	0,150—0,200	0,150—0,200	0,100—0,150
satisfactory	0,100—0,150	0,100—0,150	0,050—0,100
poor	under 0,100	0,100	0,050

Red-pepper can utilize *ground water* up to a depth of 120 cm. In the area of the inner red-pepper growing district of Szeged the depth to the ground water level is in most cases more considerable. Thus the plant generally depends upon precipitation to obtain the necessary quantity of water. Summarizing the results according to the findings of E. OBERMAYER: *red-pepper requires a medium heavy loam or inundation soil rich in humus and available ready nutritive materials, with a good water regime and easy cultivation, that is not liable to cracking and clod formation.* Not low-lying brown sandy soils rich in humus show also an excellent suitability for the growing of red-pepper when fertilized and irrigated abundantly.

Soil conditions of the Szeged district are extremely diversified. From the various soil types those variants warranting certain red-pepper crop qualities are the following:

An *excellent* red-pepper crop can be expected from an area with following characteristics:

1. Depth of surface soil humus stratum	above		40 cm
2. Humus content of			
loam	above		3,5 %
clay	above		4,0
inundation soil	above		3,0
sand soil	above		3,0
3. Useful water storing capacity and heaviness	between		150—250 mm
		in sand	300—350 mm
4. Crumbling quality			M, Mm, kHM
5. Chemical reaction (pH)			7,0—8,1
6. Nitrogen content	above		0,250 %
7. Phosphate content	above		0,250 %
8. Potassium dioxide content	above		0,200 %

A *good* red-pepper crop can be reasonably excepted from an area with following characteristics:

1. Depth of surface soil humus stratum			30—40 cm
2. Humus content of	loam		3,0—3,5 %
	clay		3,5—4,0
	inundation soil		2,5—3,0
	sand soil		2,5—3,0 %
3. Useful water storing capacity and heaviness			250—275 mm
			130—150 mm
		in sand	350—400
4. Crumbling quality			m, HM, kH, Hm
5. Chemical reaction (pH)			8,1—8,3
6. Nitrogen content			0,200—0,250 %
7. Phosphate content			0,200—0,250 %
8. Potassium dioxide content			0,150—0,200 %

A *medium* red-pepper crop can be reasonably expected from an area with following characteristics:

1. Depth of surface soil humus stratum			25—30 cm
2. Humus content of	loam		2,5—3,0 %
	clay		3,0—3,5 %
	inundation soil		2,0—2,5 %
	sand soil		2,0—2,5 %
3. Useful water storing capacity and heaviness			275—285 mm
			110—130 mm
		in sand	400—450 mm
4. Crumbling quality			H
5. Chemical reaction (pH)			8,3—8,5 %
			6,5—6,7 %
6. Nitrogen content			0,150—0,200 %
7. Phosphate content			0,150—0,200 %
8. Potassium dioxide content			0,100—0,150 %

A *satisfactory* red-pepper crop can be reasonably expected from an area with following characteristics:

1. Depth of surface soil humus stratum			20—25 cm
2. Humus content of	loam		2,0—2,5 %
	clay		2,5—3,0 %
	inundation soil		1,5—2,0 %
	sand soil		1,5—2,0 %
3. Useful water storing capacity and heaviness			285—290 mm
			90—110 mm
4. Crumbling quality			mt, tm, Mm/por, M/por
5. Chemical reaction (pH)			8,5—8,7
			6,3—6,5
6. Nitrogen content			0,100—0,150 %
7. Phosphate content			0,100—0,150 %
8. Potassium oxide content			0,100—0,150 %

A *poor* red-pepper crop can be reasonably expected from an area with following characteristics:

1. Depth of surface soil humus stratum		under	20 cm
2. Humus content of	loam	under	2,0 %
	clay	under	2,5 %
	inundation soil	under	1,5 %
	sand soil	under	1,5 %
3. Useful water storing capacity and heaviness			290—300 mm
			75—90 mm
		in sand above	480 mm
4. Crumbling quality			m/por
5. Chemical reaction (pH)		under	8,7
		under	6,3
6. Nitrogen content		under	0,100 %
7. Phosphate content		under	0,100 %
8. Potassium dioxide content		under	0,100 %

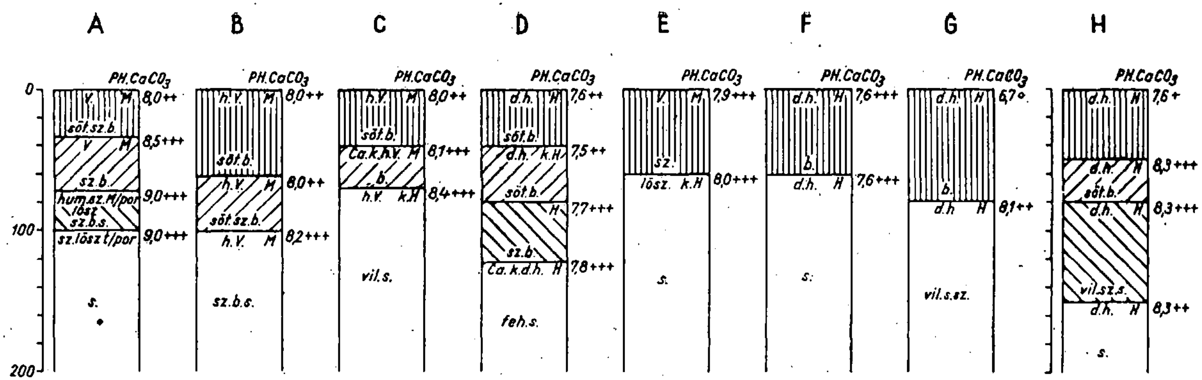
This classification does not and cannot signify rigid categories; on the contrary, there are always transitions. Certain qualities are more important in some soil types and less important in others. For instance in the case of sand, deepness of humus stratum and humus content are decisive, whereas with loam, clay and inundation soils the grade of heaviness is very important too. The content of nutritive materials the lower chemical reaction (pH) and soil structure are easier to improve. In reality the occurrence of a soil type where all characteristics would uniformly correspond to an established quality grade is very rare. Therefore it proved to be necessary to establish a certain gradition within the categories; so in the category »excellent« we introduced a subdivision for the qualities excellent A, excellent B and excellend C. The necessity of such subdivisions is connected with the fact that certain characteristics of an area may show a good, medium or even poorer value, nevertheless e. g. an excellent yield can be obtained with adequate intervention (e. g. better and more abundant fertilizers, more efficient soil preparation etc.). Of course this elasticity is only appropriate in the case of characteristics which offer due securities for the achievement of an excellent yield or of the yield of another category respectively. Within all grades the establishment of subclasses is specific, not general for all soil types; therefore the qualification of an area according to subclasses within the main categories can be established only in the course of synthetic valuation of soil characteristics. Areas separated on basis of this principle are shown in Figure No. 1.

Excellent A, B and C areas

Soils suitable for the production of excellent red-pepper have developed on all three morphological horizons. The soil of the individual plots is in many respects similar and it is nearly impossible to recognize the identical under so many similar plots. Soil types of the growing areas qualified as excellent are demonstrated by the profiles (A (16), B (16), C (19), D (18), E (18), F (18), G (19) and H (19).

Figure No. 1. Topography of varions types of soil yielding different crop results of red-pepper in the inner area of red-pepper culture.

A, B, C = I. excellent
A, B, C = II. good
A = III. medium
= IV. satisfactory
= V. poor
= VI. rivers and lakes
= VII. settling
= VIII. unfit for red-pepper culture
= IX. place of boring



Legends to the A, B, C, D, E, F, G and H profiles.

Physical soil sorts:

v = adobe clay
h = sand
dh = coarse sand

Colours:

b = brown
sz = grey
s = yellow
söt. = dark
vil. = bright
fek. = black

Morphological structure:

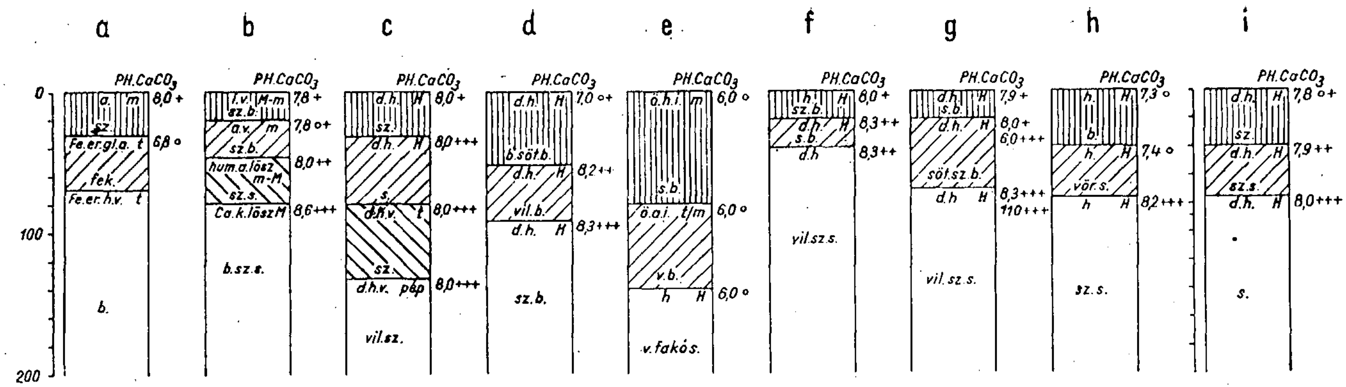
M = excellently crumble-like
kH = fixed sand
H = sandy
por = dust
t = compact

Other marks:

Ca. k. = lime concretion
hum. = humus

$CaCO_3$:

o = there is no
+ = slight fizz
++ = medium fizz
+++ = strong fizz



Legends to the a, b, c, d, e, f, g, h, and i profiles.

Physical soil sorts:

a = clay
v = adobe clay
i = mud
dh = coarse sand
h = sand
gl = gleyed
ö = flood

Colours:

b = brown
sz = grey
s = yellow
söt. = dark
vil. = bright
fek. = black

Morphological structure:

M = excellently crumble-like
m = crumble-like
t = compact
H = sandy
gép = pulpy

Other marks:

Fe. er. = iron veined
hum. = humus
Ca. k. = lime concretion

$CaCO_3$:

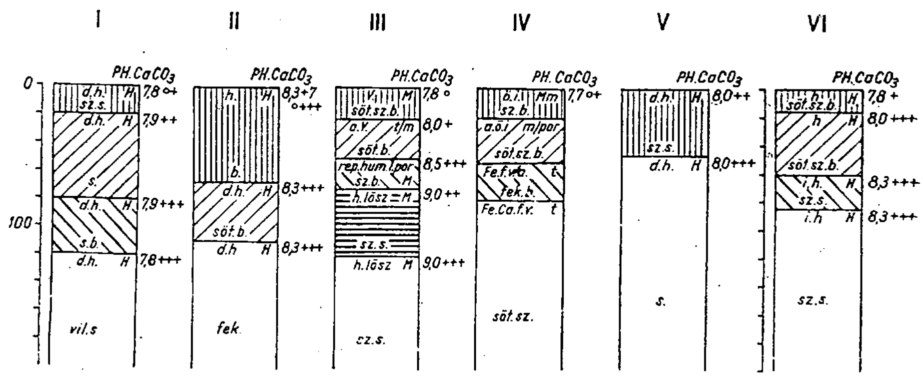
o = there is no
\+ = slight fizz
++ = medium fizz
+++ = strong fizz

Good, good A, B and C areas

A good red-pepper crop can be obtained in a considerable part of the district. Soils formed on different native rocks are represented by profiles a (18), b (16), c (19), d (20), e (15), f (19), g (19), h (20) and i (18).

Medium and medium A areas

The following profiles may be considered as characteristic: I. (18), II. (19), III. (16), IV. (16), V. (18), and VI. (16).



Legends to the I, II, III, IV, V and VI profiles.

Physical soil sorts:

v = adobe clay
a = clay
ö = flood
i = mud
h = sand
dh = coarse sand

Colours:

b = brown
sz = grey
s = yellow
söt. = dark
vil. = bright
fek. = black

Morphological structure:

M = excellently crumble-like
m = crumble-like
t = compact
H = sandy
kH = fixed sand
rep. = crevassed

Other marks:

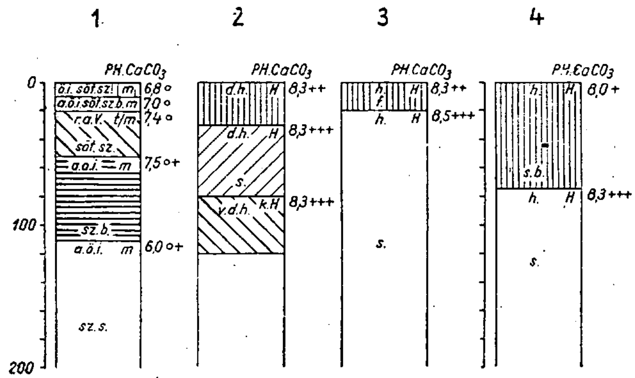
hum. = humus
Fe. f. = iron veined
Fe. Ca. f. = irony lime spots

$CaCO_3$:

o = there is no
+ = slight fizz
++ = medium fizz
+++ = strong fizz

Satisfactory areas

These areas developed on sandy or alluvial terrains and are less suitable for growing red-pepper. Soil conditions are characterized by the profiles marked 1. (16), 2. (19), 3. (22), 4. (25).



Legends to the 1, 2, 3 and 4 profiles

Physical soil sorts:

v = adobe clay
a = clay
ö = flood
i = mud
ra = meadow clay
dh = coarse sand
h = sand

Colours:

b = brown
sz = grey
s = yellow
söt. = dark
f. = black

Morphological structure:

m = crumble-like
t = compact
H = sandy
kH = fixed sand

$CaCO_3$:

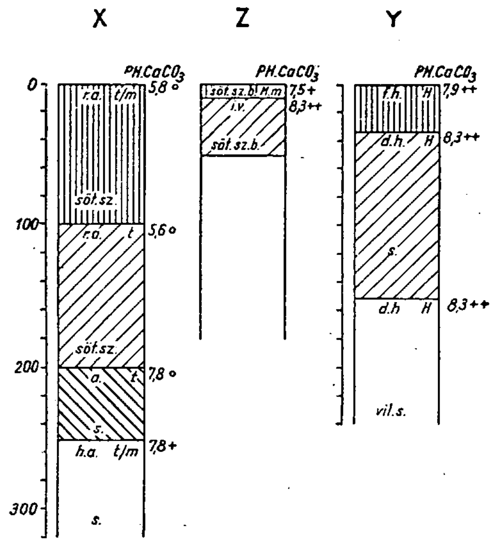
o = there is no
+ = slight fizz
++ = medium fizz
+++ = strong fizz

Poor areas

On such soils red-pepper ought to be grown in exceptional cases only. These are areas deficient in humus, in many cases scorched, sometimes with an alkali subsoil. The humus horizon varies between 10 and 20 cm. Soil conditions are illustrated ba the profiles X (15), Y (19), and Z (16).

The discrict includes many plots with an alkali soil or temporary water logging. In the course of evaluation these plots were left out of consideration.

Within the territory of the inner red-pepper growing discrict red-pepper is grown on 3500 cad. holds approximately. A considerable part of the growing areas, about 2500—2600 cad. holds, coincides with the excellent A, excellent B, excellent C, good, good A, good B and good C areas shown in Figure No. 1, a minor, unsignificant belonging only to the lower categories.



Legends to the X, Y, and Z profiles.

Physical soil sorts:

ra = meadow clay
a = clay
h = sand
i. = mud
v = adobe clay
fh = fine sand
dh = coarse sand

Colours:

b = brown
sz = grey
s = yellow
söt. = dark
vil. = bright

Morphological structure:

M = excellently crumble-like
m = crumble-like
t = compact
H = sandy

$CaCO_3$:

o = there is no
+ = slight fizz
++ = medium fizz
+++ = strong fizz

BIBLIOGRAPHY

1. *Obermayer Ernő:* A magyar fűszerpaprika termesztése. Fejezet I. V. Jakuskin Növénytermelés *II. kötet.* Budapest, 1951.
2. *Obermayer Ernő:* Időszerű kísérleti célkitűzések és munkák a fűszerpaprika nagyobb termelékenysége és jobb minősége érdekében. Szeged. Kézirat.
3. *Obermayer Ernő—Horváth Ferenc—Szanyi István:* A magyar fűszerpaprika helyes termesztése és ipari feldolgozása. Budapest, 1938.
4. *Szűcs Mihály:* Szeged mezőgazdasága, Szeged, 1914.
5. A Szegedi Városi Tanács által 1954. január 7-én rendezett paprikaankét jegyzőkönyve. 1954. Kézirat. Szeged.
6. Szegedi Paprikafeldolgozó vállalat irattári anyaga.

7. A Magyar Hidrológiai Társaság Szegedi Csoportja paprikaöntözési munkabizottságának zárójelentése és jegyzőkönyvei. Szeged, 1954. Kézirat.
8. *Kreybig Lajos:* Trágyázástan. Budapest, 1955.
9. Magyar fűszerpaprika (termesztés, feldolgozás, értékesítés). Budapest, 1954.
10. *Fekete Zoltán:* Talajtan. Budapest, 1952.
11. *Dr. Görög László:* Magyarország mezőgazdasági földrajza. Budapest,1954.
12. *Korpás Emil—Pálmai Mátyás:* Szeged környékének talajföldrajzi vázlata. Földrajzi Értesítő, 1955. IV. évf. 1. füzet.
13. *Bujk Gábor:* Adatok a Kalocsa-vidéki paprikatalajok megismeréséhez. Kísérletügyi Közl. 1937.
14. *Horváth Ferenc—Bujk Gábor:* A paprikanövény tápanyagfelvétele és tápanyagkihasználása. Kísérletügyi Közl. 1934.
15. *Babarczy József:* 5564/2. sz. 1:25 000-es Szeged D átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb..
16. *Imre József:* 5464/4. sz. 1:24 000-es Szeged É. átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb.
17. *Babarczy József:* 5464/2. sz. 1:25 000-es Hódmezővásárhely átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb.
18. *Bácskay István:* 5564/1. sz. 1:25 000-es Horgos átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb.
19. *Szádeczky Kardoss Géza:* 5464/3. sz. 1:25 000-es Kiskundorozsma átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb.
20. *Lendvai József:* 5464/1. sz. 1:25 000-es Kistelek átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb.
21. *Sarkadi János:* 5363/3. sz. 1:25 000-es Pusztaszer átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb.
22. *Szádeczky Kardoss Béla:* 5563/2. sz. 1:25 000-es Kelebia átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb.
23. *Vígh Albert:* 5463/4. sz. 1:25 000-es Pusztamérges átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb.
24. *Gyenes József:* 5463/2. sz. 1:25 000-es Kiskunmajsa átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb.
25. *Sarkadi János:* 5363/3. sz. 1:25 000-es Jászszentlászló átnézeti talajtérkép, talajfelvételi jegyzőkönyv stb.