The influence -of some appropriations of the different soil types on the tomato production in the case of the culture sowed directly in Braila County

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Abstract

The study has been made for establishing his influence of physical appropriations of some soil types (typical chernozem, saline chernozem, calcareous alluvial soil and saline alluvial soil) on the tomato production, in the case of the directly sowed cultures.

Following the research - it was established that the physical appropriations of the typical chernozem and saline chernozem are the most favourable because of the tomato production which was quantitative superior by comparison with the production obtained on the calcareous alluvial soil and saline alluvial soil.

Keywords: tomatoes, texture, clay, apparent density, structure.

Introduction

The tomatoes crop all over the world, being the most consumed vegetable in the world. Thus, tomato consumption varies; the tomatoes are consumed fresh, preserved or frozen.

In Romania, the tomato crop on 17 % from the vegetables surface, fill the second place after the cabbage. In our country, the production is 4 % from the total European tomato production.

In Braila County, which is situated in the most favourable zone for this culture, the tomato production is 20 % from the total vegetable production. The establishment of the tomato culture is made through the race in the case of the early cultures and through direct sowing for the summer-autumn cultures.

The advantages of the direct sowing for tomato cultures are: the reducing of the sowing expenses with 60 % towards the sowing through the race; high endurance of the plants at the hydro stress; the efficient capitalization of the production when the market requirement is large both for the consumption in fresh state and the conserving.

For the establishment of the tomato culture through direct sowing there are used late varieties; this type of culture is practiced in the south of the country, the production being used as prime material in the preserved industry.

Another particularity of the tomato cultures sowed directly is that this culture system is practiced only on the irrigate surfaces, the irrigation is assured through aspersion using subtly sputa asperser, with low pressure and reduced target, in order to avoid the crust formation. [6]

For the direct sowed culture, the land selection is decisive for the success of the culture. There are choose uniform lands with easy texture, structure and fertility, levelled, well drained, without crust and with lack of weed reserve.

The success of the tomato culture direct sowed depends on the preparation of the germinal litter, which must be well crushed and sufficient rammed for realizing the optimum depth in the sowing moment. [5]

The best soils for the tomato cultures direct sowed are the chernozem and the alluvial soils, the soils which allow a good preparation of the germinal litter and a high fertility [4].

The concomitant application of the water and nourishing substance through fertilization – directly on the roof zone – reduce the productivity variability because of the soil types. [3]

On the cold, compact, argillaceous soils we must apply in the same time with the plough land stall scum well decomposed, in dose of 40 – 50 t/ha for improving the permeability for air and water.

It has been ascertained that the tomato plants sowed on a compact soil after a time parch comparing with plants sowed on a loose soil – which grow normally.[2]

Materials and methods

The study is made on four types of soil: typical chernozem, saline chernozem, calcareous alluvial soil and saline alluvial soil using two varieties: Buzau 22 si Benfica VF, applying the same technologies elements, in the period of 2003-2005.

As all the cultures being sowed mechanized – the fourth repetitions were not randomized. For every type of soil, the experimental variants were made in multi-stage blocks with no randomization, the experimental surface was 480 m², total surface of the experience for the four soil types was 1920 m².

The biologic material used for the experience was forming the varieties: **Buzau 22 and Benfica VF.**

Buzau 22 sort, nearly tardy, with a vegetation period by 120-125 days, determined growing (80-90 cm), robust, recommended both for the fresh consume and or the industry.

The fruit is big (120-200 g), spherical, flattened, uniformly red, with delicately texture and equilibrate taste. The number of seminal cells is between 3- 4, the firmness is very good, with good resistance at bursting and medium resistance at keeping. The fruit is keeping the fermity on the field for 10-12 days. The soil presents tolerance at the specific diseases. The production potential is of 50-60 t/ha.

Benfica VF sort, nearly tardy, with a vegetation period by 110-120 days, determined growing (60-70 cm), the bushes are nearly straight , with 4-5 brushwood, recommended both for the fresh consume and or the industry. The fruit is big, the medium weight is between 150-200 g, roundly, uniformly red, and equilibrate taste. The number of seminal cells is between 3-4, the firmness is very good, with good resistance at the transport.

This variety has tolerance at some diseases as *Verticillium* si *Fusarium*. The production potential is 60-70 t/ha.

The texture is determinate on the base of the proportion of the granulometric fractions (sand, dust, clay) which intercede in its composition – made by the treatment of the soil probe by the Kacinski method and the segregation of the granulometric fractions by sorting and dropping.

The method resides in the spreading of the granulometric fractions by treating the soil probe with hydrochloric acid 0,2 n, washing with 0.05 n, treating with solution of sodium hydroxide 1 n and the boiling.

The segregation of the particles is made by sorting (for the sand with the diameter over 0, 02 mm) and dropping (for dust and clay, with the diameter equal or smaller than 0, 2mm).

Apparently density (AD) was determined reporting the dry soil probe at the total volume of the soil probe.

The total porosity (TP) was determined by the formula:TP= (1-AD) x 100/D

The air porosity (AP): is determined with the formula: AP=TP-CC x AD

The soil structure is determined in the grand on the base of the morphological characterization of the soil profile. [1]

Results and discussion

The physical appropriations of the analyzed soil types were determined on the entire soil profile, but a major role in assurance the optima conditions for the plants growing presents the physical appropriations on the depth of 0-50 cm.

Table 1. The physical appropriation of the typical chernozem formed on the clayey loess in the field conditions

Specification/ Horizons	Ap	Am	AC
Depths (cm)	0-20	30-50	60-70
Brutish sand (2,0-0,2mm)%	0.05	0.05	0.04
Fine sand (0,2-0,02mm)%	44.44	42.08	45.75
Dust (0,02-0,002mm)%	25.49	31.29	27.23
Clay (under 0,002mm)% out of which:	30.02	26.58	26.98
Physical clay (under 0.01mm)%	37.93	43.56	39.27
Texture	LL	LL	LL

Apparently density(AD g/cm^3)	1.16	1.18	1.25
Total porosity (TP%)	56.3	55.2	52.8
Air porosity (AP%)	23.8	23.6	19.6

The horizons notation signification is the next one:

The A horizon, is the horizon from the surface of the soil which is characterized through accumulation of humus and total or partial leaching of salts. The horizon can be of more types:

Horizon Ap (A worked) which defines the ploughed layer from the surface of the soil and which because of cultivation, suffers modifications which differentiate it from the rest of the unworked horizon.

Horizon Am (A mollic) is characterized through accumulation of humus of the best quality, which it gives a dark colour and a very good structure, because of which it is aerated.

Horizon AC, is the horizon of transition towards the mother rock.

From **Table 1** results that in the granulometric fractions of the typical chernozem on the depth of 0-70 cm prevails the fine sand (42.08-45.75 %) that determines an argillaceous texture with positive appropriations over the soil landing for the direct sowed tomato culture, because the soil doesn't form the scab.

The values of the apparently density 1.16-1.18 g/cm³ shows a loose soil, which allow a good development of the deep roof system , the sowing being made at 2,5 cm in depth, the resistance of the soil being low, this involve a low energy consumption.

The value of 1.25 g/cm³ in the horizon AC shows an easily compact soil, mainly because of the low content of organic substance.

A good development of the granulometric structure ensures on the depth of 0-70 cm a total porosity of 55.2-56.3 %, from which the air porosity is 23.6-19.6 %, these values assure a favourable air and hydro regime for an optimum development.

Because of the structure profoundness the soil becomes wet this lead to the forming of a water reserve and in the drought periods there are no flaws in the soil.

The applied watering quotas are 400-500 m³/ha, there were applied 5 watering with an irrigation norm of 2200 m³/ha.

Table 2. The physical appropriation of the saline chernozem formed on the clayey loess in the field conditions

Specification/ Horizons	Ap	Am	ACsc
Depths (cm)	0-20	30-40	40-50
Brutish sand (2,0-0,2mm)%	1.32	1.07	0.96
Fine sand (0,2-0,02mm)%	43.68	40.0	41.05
Dust (0,02-0,002mm)%	27.18	27.66	29.16
Clay (under 0,002mm)% out of which:	27.82	31.27	28.83
Physical clay (under 0.01mm)%	40.87	43.04	39.85
Texture	LL	LL	LL
Apparently density(AD g/cm^3)	1.17	1.20	1.27
Total porosity (TP%)	55.4	53.1	51.6
Air porosity (AP%)	28.5	23.7	21.6

The horizon notation semnification is for the horizons Ap and Am the same as in the case of the typically chernozem and the semnification of the **horizon ACsc** is the next one: the transition horizon towards the mother rock is associated with a saline horizon (sc) of soluble salts accumulation in the shape of a flowering, in amounts from 0,1 – 1 % in the case of chlorides and 0,15 – 1,5 % in the case of sulphates.

From the results of **table 2** results that the saline chernozem texture on the depth of 0-50 cm is middle clayey, there are o lot of fine sand particles in proportion of 43.68 -40.0 %, the soil structure is glomerulary and

ensures values between 55.4-51.6 % of the total porosity from which 28.5-21.6 % is the air porosity values which assure a favourable regime.

The value of the apparently density of 1.17-0-1.20 g/cm³ between 0-40 cm shows a loose soil, which allows a uniform appearance of the tomato plants, over the depth o 30 cm has place a rising of apparent density values in consequnce of lowering the content of organic substance from soil.

At 40-50 cm depth there is a low chlorine saline process with a moderate effect over the diminution of the production.

Table 3. The physical appropriation of the calcareous alluvial soil formed on the clayey loess in the plane field conditions

Specification/ Horizons	Ap	Ao	AC
Depths (cm)	0-20	20-30	30-50
Brutish sand (2,0-0,2mm)%	0.19	0.16	0.06
Fine sand (0,2-0,02mm)%	24.56	21.03	14.83
Dust (0,02-0,002mm)%	32.37	34.80	40.54
Clay (under 0,002mm)% out of which:	42.88	44.01	44.57
Physical clay (under 0.01mm)%	65.54	71.64	73.54
Texture	LA	LA	LA
Apparently density(AD g/cm^3)	1.25	1.37	1.42
Total porosity (TP%)	47.5	45.6	44.7
Air porosity (AP%)	10.3	5.7	4.0

The horizon notation semnification is for the horizons Ap and AC the same as in the case of the typically chernozem and the ***Ao horizon (A ocric)*** is characterized through bright colour because of the low content of organic substance and it becomes massive and very hard in the dry period of the year

From **Table 3** results that in the granulometric structure of the calcareous alluvial soil on the depth of 0-50 cm prevails the mineral fraction the clay 42.88-44.01 % this determine the integration of the soil in the fine textural class, clay subclass, with negatives appropriations over the use of this type of soil in the direct sowed tomato culture because the soil forms the scab.

The apparently density values on the depth 0 – 30 cm between 1.25-1.37 g/cm³ shows a moderate settling even on the surface which determines that the sowing should be made in surface at the depth of 2.0 cm and the energy consume for the plough and for the preparation of the soil should be higher; although for the obtaining of some quality works there is necessary the accomplishment of several crossings and the time interval when the soil could be worked is short. The soil settling has as the effect the fact as the soil is hard to get warm and the coming up is being late.

On the depth of 30 - 50 cm the value of apparent density has values of 1.42 g/cm³, which shows a compact soil in depth.

The grain little structure, hardly developed assure values of the total porosity of 47.5-44.7 %, from which between 10.3-4.0 % is the air porosity. These values of the air porosity are low, that's why the air regime from the soil is not enough for the plants roots breath.

This thing supposes the application of a big number of works for the soil airy on the vegetation period (5 works of mechanic weeding).

Over the depth of 40 cm the soil is not structured, that's why is not able o form water reserves in the profoundness, consequently appears the puddles when the rich rainfall are coming or when there are used big norms of irrigation. On this type of soil there are no capitalized the poor rainfall because of the weak water structure which is lost through the evaporation on the surface of the soil and shortly after the moistening of the surface layer the plants become dry. The water norms were 400-500 m³ and there were applied 4 watering with a norm of 1700 m³ water/ha.

Table 4. The physical appropriation of the saline alluvial soil formed on the clayey loess in the plane field conditions

Specification/ Horizons	Ap	Ao	AC
Depths (cm)	0-20	20-30	30-50
Brutish sand (2,0-0,2mm)%	0.04	0.04	0.03
Fine sand (0,2-0,02mm)%	22.69	22.52	22.23
Dust (0,02-0,002mm)%	33.85	35.32	32.96
Clay (under 0,002mm)% out of which:	43.42	42.12	44.78

Physical clay (under 0.01mm)%	75.96	76.07	79.52
Texture	LA	LA	LA
Apparently density(DA g/cm^3)	1.34	1.40	1.44
Total porosity (PT%)	49.8	46.5	44.8
Air porosity (PA%)	14.2	11.4	9.5

The horizons notation signification is the same as calcareous alluvial

From **table 4** results that the granulometric fraction which prevails in the composition of the saline alluvial soil on the depth of 0-50 cm is the clay 42.12-44.78 %, and that determine the integration of the soil in the fine textural class, clay subclass, with negatives appropriations over the use of this type of soil in the direct sowed tomato culture because the soil forms the scab.

The apparently density value of 1.34 -1.44 g/cm³ on the depth of 0- 50 cm shows a settling on the soil surface which determines negative effects on the coming up of the plants, on the depth of the root system and on the warming up of the soil.

The grain little structure, hardly developed – assure values of the total porosity of 49.8-44.8 %, from which between 11.4-9.5 % is the air porosity. These values of the air porosity are low, that's why the air regime from the soil is not enough for the plants roots breath.

The obtained production from the two species varies depending on the soil type where the plants are sowed (**table 5**).

Table 5 The influence of the soil type over the production of the directly sowed tomatoes in Braila County, in period 2003- 2005

Variant no.	Type of soil	Cultivar's	Average production		Differences t/ha	Signification
			t/ha	%		
1 (mt 1)	Tipical chernozem	Buzau 22	53.66	100.00	0.00	-
2 (mt 2)		Benfica VF	59.11	100.00	0.00	-
3	Saline chernozem	Buzau 22	50.09	93.34	-3.57	o
4		Benfica VF	55.39	93.70	-3.72	o
5	Calcareous alluvial soil	Buzau 22	30.64	57.10	-23.02	ooo
6		Benfica VF	32.68	55.28	-26.43	ooo
7	Saline alluvial soil	Buzau 22	26.33	49.06	-27.33	ooo
8		Benfica VF	27.31	46.20	-31.80	ooo

DL 5 % = 3.14 t/ha

DL 1 % = 4.52 t/ha

DL 0,1 % = 6.65 t/ha

From the dates presented in the table 5, results the following:

The soil type has big influence upon the production level, so for Buzau 22 sort the highest production level was on the typical chernozem - 53.66 t/ha. The sowing of that variety on other types of soil had as a consequence the diminution of he production level, with negatives differences upon the mt 1 (V1) with statistic cover..

On the saline chernozem soil the production reduce above the probe with – 3.57 t/ha – a significant negative difference.

The negative differences of -23.02 t/ha and of -27.33 t/ha above the probe the differences registered at the sowing of the same variety on the chalky alluvial soil (V5) and saline alluvial soil (V7) are very significant.

For Benfica VF sort, up to the probe (V2), the 4th variety (the culture on the saline chernozem) – the statistic interpretation evidence negative differences of the production of -3.72 t/ha and of -26.43 t/ha.

Conclusions

The Buzau 22 variety may be recommended for sowing on the typical chernozem because its use on the other types of soil has as a consequence the diminution of the production up to the probe- with moderates or very big differences in case on the 3rd variant and 5th and 7th.

In influence of the soil type over the production at Benfica VF variety is smaller in case of the V4 variant where it was register a semnificative negative difference of -3.72 t/ha; the similar cultures on the calcareous alluvial soil were finished with very big differences (-26.43 t/ha la V6 and -31.80 t/ha la V8) against control sample are very significant.

As a conclusion for the tomato culture directly sowed with Benfica VF variety is recommended only the typical chernozem.

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