

## Original Article

## Considerations Regarding Soil Tilling for the Spring Wheat Culture in the Jucu, Cluj County Soil Conditions

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Received 10 March 2013; received and revised form 29 March 2013; accepted 7 April 2013  
Available online 1 June 2013

### Abstract

Agriculture involves more than cultivating and breeding animals for food consumption. The main occupation of agriculturists is producing raw materials for food. For this purpose, they use traditional methods tested in time, which they have associated with the modern science and technology in order to offer high quality products at an affordable price. The studies made in order to elaborate the research project entitled "Research concerning the influence of the variety, sowing density and fertilization on the spring wheat production and quality in the Transylvanian plain conditions" were carried out in the experimental field of the USAMV Cluj-Napoca from Jucu, Cluj County. For the agricultural practice, the highest interest resides in the air and soil temperature and the precipitations. For the spring wheat plants, the optimum temperature for growth and development varies between 8 and 10°C until haulm elongation, between 14 - 18°C for the period of haulm elongation and 16 - 18°C for earing. The year 2010 was characterized by an annual average temperature of 11.22°C, the highest average being recorded in July (22.36°C), and the lowest in January (-2.16°C). The year 2010 summed an amount of precipitation of 695.9 mm. The lowest was recorded in April, 2.70 mm. For soil preparation in order to sow spring wheat we have chosen, in the minimal tillage system with preparation of the seedbed, the minimal tilling system with rotary harrows, which represents the most used option in the east and the south-east of Europe. The rotary harrow is a combined machine, operated from the tractor, for achieving a rotation movement of its active components, followed by the rollers, horizontally or vertically. Behind it the field is chopped, on a depth of 10 - 18 cm, levelled and placed. For the minimal tillage system, mechanical tillage of culture maintenance is carried out following the same agro-technical rules and requirements as with the conventional soil tilling system. In the agricultural practice, the specialists must know the soil and climate conditions of their area of activity, in order to choose the cultures or species which can better adapt to the climatic factors of the respective area. Although the temperatures and the precipitations in the field preparation period recorded values higher than the annual average, these facts didn't prevent us from preparing the seedbed in order to carry out spring wheat sowing on time and in the optimum conditions, in Jucu.

**Keywords:** soil, climate, spring wheat, production, quality.

### 1. Introduction

Even if before the year 1989 in the agriculture of Romania the production received more emphasis

and the quality of the products less, today producing low quality food is out of the question. The new situations which appeared inside the U.E. member countries related to labelling animal products wrong, the cow milk contamination, the vegetables contamination etc. are a delight for the

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press, in the serious detriment of both producers and consumers, "paralysing" their activity by lowering their sales, lowering the exports, and eventually affecting the national economy. We could even say that a new type of pollution has appeared, the "commercial pollution", which we will have to take into more account in the future.

Today agriculture implies much more than breeding animals for food consumption. The complexity of the occupation imposes multiple roles on the agriculturists, as for many of them agriculture is a way of life. Nowadays agriculturists are not only paid for producing food. In the past, the more agriculturists produced, the more subsidies they received.

In the future, the vast majority of help directed to farmers will be paid regardless of the quantities produced. According to P.A.C., in the frame of the new system, agriculturists will continue to receive direct payments with the purpose of maintaining income stability, but the connection with the production has been eliminated. Besides this, agriculturists must respect the standards of environment protection, of food safety and of plants and animals protection. Not respecting these standards will lead them to risk decreases in the direct payments they benefit from (this condition is known as "eco-conditionality") [11]. The main occupation of agriculturists is producing raw materials for alimentation. To this purpose they use traditional methods tested in time which they have associated with science and modern technology in order to offer high quality food at an affordable price.

Regarding the pollution which results from agricultural activities, we wish to mention that more and more competent people, but most of the time not competent ones, talk about agriculture as a great source of pollution for the environment. However, out of the anthropogenic activities, agriculture is one of the least pollutant ones.

In any case, the Romanian agriculture, with its medium quantities of fertilisers and pesticides used, is the least pollutant of the E.U. countries [7]. The conclusion which arises is that correctly and honestly carried out agriculture is not a source of pollution. On the contrary: the agricultural cultures to which technologies have been correctly applied can transform the agricultural environment into a landscape which is pleasant for the eye, it can be a source of income for those who do it, but it can also provide enhanced possibilities for air purification, for avoiding wind and rain erosion, for avoiding floods and enhancing soil fertility [7].

## 2. Material and Method

In order to elaborate the research project entitled "Research concerning the influence of the soil, sowing density and fertilization on the spring wheat production and quality in the Transylvanian plain conditions" studies were carried out in the experimental field of the USAMV Cluj-Napoca from Jucu, Cluj County.

**The research field from Jucu** is situated in the middle flow meadow of the Somesul Mic river which separates the Somesan Plateau and the Transylvanian Plain, with a geographical localisation of 46°45' north latitude and 23°45' east longitude. The average altitude is between 280 and 360 m. The soil and climate conditions of a specific area are highlighted by the environmental factors.

The environmental factors have been divided by specialists in climate factors and soil factors, to which the following belong: solar radiation, air and soil temperature, air humidity, nebulosity, atmospheric precipitation, atmospheric pressure and wind.

They do not act independently, but in close connection to each other. They are also called vegetation factors, and they are directly involved in the plant growth and development process and they eventually influence positively or negatively the production and the quality of the cultivated plants. For the agricultural practice, the air and soil temperature and the precipitations interest us the most.

For the soil preparation in order to sow the spring wheat we have chosen, in the minimal tillage system of the seedbed preparation, the minimal tilling system with the rotary harrow, which is the most commonly used alternative in the east and south-east of Europe (figs. 1 and 2).



**Figure 1.** Preparing the field – tractor aggregate



**Figure 2.** Rotary harrow

Owing to the before mentioned, the agriculture specialists need to have knowledge of the soil and climate conditions in the area they carry out their activity in, in order to select the cultures or species which can best adapt to the climatic factors in the respective region. In the last years work has been done on elaborating models for a general system, climate-soil-plant-technology, microclimate systems, hydric regime, photoperiodism, photosynthesis, etc. [10].

For the wheat plants, the optimal temperature for growth and development varies between 8 and 10<sup>0</sup> C until haulm elongation, between 14 - 18<sup>0</sup> C for the period of haulm elongation and 16-18<sup>0</sup>C for earing [2]. The year 2010 was characterized by an annual average temperature of 11.22<sup>0</sup>C (table 1). The highest average was recorded in July (22.36<sup>0</sup>C) and the lowest in January (-2.16<sup>0</sup>C).

The high temperature, according to Chang A.C., Gallie, D.R., [5], determines the loss of ARNm stability, as changes similar to those caused by the hydric stress take place, which leads to the accumulation of free radicals, which determines a growth in the biodegradation process of the cells and wheat plants. The optimal humidity for the normal development of the spring wheat is 70-80%, and the minimal temperatures it can withstand frost is -6, -7<sup>0</sup>C [4]. During the entire vegetation period, the spring wheat requires a sum of temperature degrees of about 1500<sup>0</sup>C, depending on the variety and the climatic conditions [9].

The year 2010 summed an amount of precipitation of 695.9 mm. The lowest was recorded in April, 2.70 mm.

The multiannual average was 169.6 mm higher than the annual average. In the optimum period for preparing the field, respectively the month of March, it records an average monthly difference of +14 mm as compared to the multiannual average. From the data presented in

the table it follows that 2010 was a rainy year. The clay chernozem in the experimental field belongs to the class of molisol, with large edaphic volume, different by texture as follows: medium texture (medium clay) on the 0-40 cm section, fine texture (clayey-silty) on the 40-140 cm depth and clayey in more depth.

From the point of view of its physical characteristics, it could be characterised as a good soil for wheat culture. In table 3 the multiannual average values, calculated along time periods during the years, are illustrated. It can be noticed that in the winter months the temperature values have increased with +0.4 C, while the precipitation tendency is growing, which shows us the +14.6 mm value in the last 55 years. However, the long periods of excessive draught interrupted by periods of short violent rain with storm aspects have become common. Certainly in the Earth's history such changes have taken place before, which proves that planet Earth is alive, a system looking for new balances. What is specific to the current changes is the human activity contribution to global warming and implicitly to the breaking of natural balances.

The climate changes also affect the physiological processes and the metabolism of the spring wheat plants, as the higher temperatures in agro-ecosystems favour certain diseases, some pests' attacks etc., which will finally lead to an imbalance on Terra. Thus, climate warming has caused in the west of Canada the invasion of some insects (for example the Spruce cone worm), which causes here more damage than all the insects together.

A climate warming of only 3<sup>0</sup>C could produce 7200 billion of Spruce cone worms [10]. Bright, [3] shows that the water in the west of Canada could become about 2<sup>0</sup>C warmer until 2070, which would eliminate some winter species from the river fauna.

For the soil preparation in order to sow the spring wheat we have chosen, in the minimal tillage system with seedbed preparation, the minimal tilling system with the rotary harrow.

The rotary harrow is a combined machine, operated from the tractor, for achieving a rotation movement of its active components, followed by the rollers, horizontally or vertically.

Behind it the field is chopped, on a depth of 10 - 18 cm, levelled and placed.

For the minimal tillage system, mechanical tillage of culture maintenance is carried out following the same agro-technical rules and requirements as with the conventional soil tilling system.

**Table 1.** The thermal regime (°C), in the year 2010, in the Jucu conditions, Cluj county

Year	Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average IV- X	Annual average
2010	Decade I	1.65	- 1.81	1.27	9.90	17.47	19.82	20.41	23.36	14.87	11.96	10.12	5.91		
	II	- 0.57	2.32	2.85	11.02	14.70	22.74	24.87	23.87	15.57	9.04	10.93	- 1.73		
	III	- 7.56	6.10	11.70	13.17	18.46	20.12	21.81	19.79	13.54	8.70	8.38	- 0.88		
	Monthly average	2.16	2.20	5.27	11.36	16.88	20.89	22.36	22.34	14.66	9.90	9.80	1.10	16.91	11.22
	Multiannual average	-	-	3.20	9.10	14.30	17.50	19.30	18.30	14.30	9.10	3.30	- 1.60	14.56	8.30
	Difference	4.50	2.30										2.70	2.35	2.92

Source: U.S.A.M.V. Cluj-Napoca Weather Station, in Jucu village

**Table 2.** The rainfall regime (mm), in the year 2010, in the Jucu conditions, Cluj county

Year	Specification	Month												Sum IV- X	Annual sum
		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.		
2010	Monthly sum	27.30	31.80	41.00	2.70	86.20	181.50	120.40	49.60	70.30	27.30	10.60	47.20	538.00	695.90
	Multiannual averages	27.00	27.20	27.00	51.00	74.50	99.00	91.40	77.50	50.00	43.00	28.00	17.10	486.40	612.70
	Difference	+0.30	+4.60	+14.00	-48.3	+11.70	+82.50	+29.00	+27.90	+20.30	-15.7	-17.4	+30.10	+51.60	+83.20

Source: U.S.A.M.V. Cluj-Napoca Weather Station, in Jucu village

**Table 3.** Multiannual averages and sums

Month	Years No.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperatures														
Air Temperature (° C)	55	-3.5	-0.9	4.1	9.8	14.7	17.7	19.6	19.2	14.9	9.6	3.7	-1.5	9.0
Air Temperature (° C)	50	-3.7	-1.0	4.0	9.8	14.8	17.8	19.5	19.4	14.9	9.6	3.7	-1.5	8.9
Air Temperature (° C)	45	-3.7	-0.9	4.1	9.7	14.7	17.7	19.4	18.9	14.8	9.6	3.7	-1.6	8.9
Air Temperature (° C)	40	-4.1	-1.1	3.9	9.4	14.5	17.4	18.5	18.5	15.0	9.5	3.4	-1.3	8.6
Precipitations														
Precipitations (mm)	55	21.3	18.7	23.1	44.7	67.7	84.5	76.7	55.9	40.3	32.0	28.7	26.9	520.6
Precipitations (mm)	50	21.3	18.2	22.6	46.1	67.4	80.6	74.7	57.0	40.0	30.1	29.1	26.4	513.6
Precipitations (mm)	45	20.9	18.0	21.9	46.0	69.4	80.9	71.1	52.3	39.1	30.3	29.1	27.0	506.0
Precipitations (mm)	40	23.7	20.8	24.2	48.2	71.3	75.7	70.8	55.5	34.5	29.3	28.3	26.9	509.2

After harvesting the pre-emerging plant, respectively the potatoes in our case, the preparation of the seedbed is done in spring, before sowing, by superficial tillage with the combinatory or the rotary harrow followed by the rollers, perpendicularly or on the diagonal of the sowing direction. In this situation we used the Kverneland MG-M 101 rotary harrow, followed by the Packer rollers. By preparing the seedbed, weed removal is intended, also soil levelling, chopping and loosening on the sowing depth for the precipitation water to penetrate and for the seed distribution on the tamped area, for water access through capillarity from the soil for seed germination. On the surface, the soil must have

small balls to avoid forming a crust and soil compaction, to retain precipitations and reduce wind erosion. The seedbed preparation is done the day before sowing.

After seedbed preparation I made seeding using drill experimental WINTERSTEIGER. Basically, this system is achieved by two passes (tillage plus seeding) [6]. It is advisable most of the time to till the soil only with the rotary harrow followed by rollers.

The ploughing tillage can be given up after soybean, beetroot, potatoes and corn silage, as after harvesting them the field usually remains clean of plant debris, levelled, it is obtained with a higher soil tillage speed and 10-14 l/ha of diesel is

saved [1]. After sunflower and corn large quantities of plant debris remain, which make the field preparation only by rotary harrow tillage harder.

#### 4. Conclusions

In the agricultural practice, the specialists must have knowledge of the soil and climate conditions in their area of activity, in order to choose the cultures and species which can better adapt to the climatic factors in the area.

Although the temperatures and precipitations in the field preparation period had higher recorded values in the year 2010 than the multiannual average, these things have not hindered us in the preparation of the seedbed in order to carry out the sowing of the spring wheat on time and in optimum conditions in Jucu, Cluj county.

Regardless of the tilling system carried out, the soil must be maintained in a state of maximum fertility, with an orderly structure, with decomposing matter in the superficial layer, by which to ensure humus accumulation in the immediately inferior layer and mineral elements for plant nutrition. Also, soil tillage must be as superficial as possible, so as not to destroy natural capillarity, not to diminish the pedofauna activity and to keep the natural profile of the soil by not overthrowing the furrows.

Soil degradation has multiple causes. Some of them can be found in the agricultural practice and in the anthropic activity, manifested by the erosion, salinization, compaction, contamination, swamping of the soils. Statistics show that on the globe, the agricultural fields` degradation, due to erosion and not applying the good agricultural practices, represents a serious problem, and that until the year 2020 about 47 million hectares will be taken out of the agricultural circuit. It has been estimated that Romania will lose more than 1 million hectares of tillable land, with claims that

about 40% of the soil fertility has already been lost. Therefore these facts are more than a warning signal for all of us.

#### References

- [1] Bîlteanu GH., V. Barnaure, 1989, *Fitotehnie*, vol. I, Ed. Ceres, București, 20-116
- [2] Bîlteanu GH., Al. Salontai, C. Vasilica, V. Barnaure, I. Borcean, I., 1991, *Fitotehnie*, Ed. Didactică și Pedagogică, București
- [3] Bright C., 1997, *Pe urmele ecologiei schimbării climatului în problemele globale ale omenirii*, Ed. Tehnică, București
- [4] Cernea S., 1995, *Fitotehnie*, curs, Ed. Genesis, Cluj-Napoca
- [5] Chang A. C., D. R. Gallie, 1997, In, *Plant Physiol.*, 113, 1253-1263
- [6] Guș P., T. Rusu, 2005, *Dezvoltarea durabilă a agriculturii*, Ed. Risoprint, Cluj-Napoca
- [7] Haș I., 2013, *Agricultura și protecția mediului, Agricultura Transilvană – cultura plantelor de câmp*, Buletin informativ nr. 18 Februarie, pag. 9
- [8] Ignea M., 2013, *Caracterizarea anului 2012 la Turda din punct de vedere climatic, Agricultura Transilvană – cultura plantelor de câmp*, Buletin informativ nr.18 Februarie, pag.14
- [9] Muntean L.S., S. Cernea, G. Morar, M. M. Duda, D. I. Vârban, S. Muntean, 2011, *Fitotehnie*, Ed. a II-a. Ed. Risoprint, Cluj-Napoca
- [10] Rusu T., 2005, *Agrotehnica*, Ed. Risoprint Cluj-Napoca
- [11] Zăpârțan M., 2004, *Biometeorologie vegetală*, Ed. Dacia, Cluj-Napoca
- [12] \*\*\*, [www.apia.org.com](http://www.apia.org.com)