DRUM IRRIGATION IN MAIZE ON A CHERNOZEM IN MĂNĂŞTUR, ARAD COUNTY, ROMANIA

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Abstract. *Drum irrigation is one of the most used irrigation methods in large crops, maize being among the largest water-consuming crops. The studied area is located in an arid climate, with a period of intensive drought, especially during the period in which maize needs an appreciable amount of water. The research methods used are the drum irrigation method, using Bauer Raninstar E51 XL drums. The density of the two maize plots is between 69,000 and 72,000 plants per hectare. In 2020, the amount of water used in maize was 30-35 l/m^2, of 3 cycles of watering, and the production ranged from 11.8 to 12.1 t/ha, compared to 4.8 t/ha in the no-irrigation maize on a neighbouring plot on the same type of soil. The soil on which research was conducted has high natural fertility, but in view of the climate changes in the last period, soil moisture does not cover the needs of water for plants. When applying this irrigation method, farmers must take into account a number of factors, including: the physical properties of the soil, the soil texture being essential in determining the water supply depending on the water storage capacity; the climate conditions specific to each year, respectively the vegetation period; plant consumption depending on the vegetation period; depth of groundwater; the forms under which water is found in the soil, etc. The results and productions obtained show that the drum irrigation method is obtained with minimal costs and can be used successfully and extended to other crops.*

Keywords*: soil, irrigation, drum irrigation, maize*

INTRODUCTION

Mănăştur, is a village that belongs, together with Mailat, to the Commune of Vinga, Arad County, Romania, between Vinga and Gelu, at about 30 km from Arad.

This locality is known by the fact that it is the only locality in the area where a castle is located, placed on the edge of the village. (BRÎNDEU L., 1980; DĂNILĂ I., 1981; GANGA M., VLADUT V., MANEA D., BIRIS S., BUNGESCU S., 2007; NAGHIU AL., 2008; NECULĂIASA V., DĂNILĂ I., 1995; RIPEANU A., 1982)

From an administrative point of view, the Commune of Vinga is part of Arad County and it is made up of three villages: Vinga, 23 km from Arad, Mailat, and Mănăştur.(DUMA COPCEA ANIȘOARA, MIHUȚ CASIANA, ARSENE O., 2017; DUMA COPCEA ANIȘOARA, ILEA R, POPA D., SÎRBU CORINA, 2018; SCRIPNIC V., BABICIU P., 1980; SILAȘ GH., GROȘANU I., 1981)

From a geographic point of view, Vinga is in the Banat Plain, which is the lowest relief level in Banat; it is located in the west, being close to the state borders with Serbia and Hungary. It is located in the south of Arad County, in the central part of the Vinga Plain, and it occupies an area of 12,801 ha, of which 11,695 ha is agricultural land. (TONEA CORNELIA, 2003; TOMA D., 1981)

MATERIAL AND METHODS

The soil on which studies were conducted was a cambic chernozem from Mănăştur, Arad County, Romania.

The irrigation system used was the drum irrigation system, the soaked method, using Bauer Raninstar E51 XL drums in maize, whose density was between 69,000 and 72,000 plants per ha. (AUNGURENCE N., 1994)

The amount of water used was 30-35 l/m^2, in 3 cycles of watering.

RESULTS AND DISCUSSIONS

Drum irrigation method is one of the most commonly used irrigation methods, practiced in a series of crops. Maize is a large consumer of water, which is why this method is one that gives very good results in the western area of the country, especially during June-August, when the amount of fallen precipitation was very low and unevenly distributed.

In maize, Bauer Raninstar E51 XL drums were used, maize was sown at a density ranging from 69,000 to 72,000 plants per ha (Figures 1 and 2).

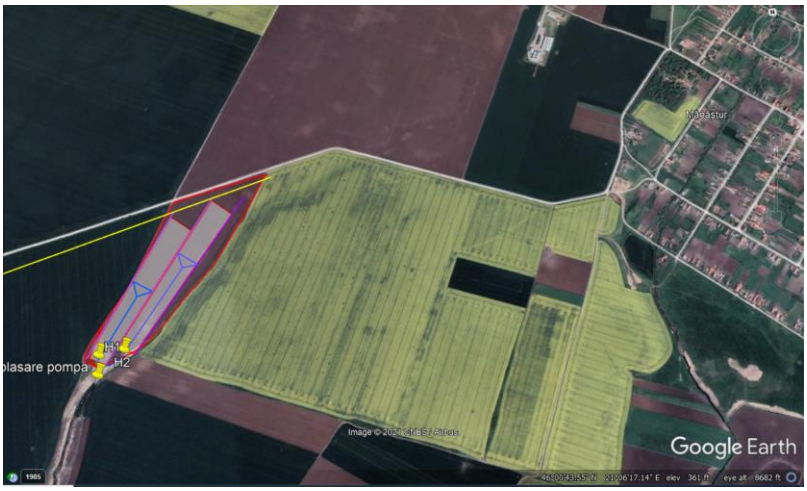

Fig. 1. Plots on which irrigated system studies were carried out

Fig. 2. Bauer Raninstar E51 XL drums
https://youtu.be/onbhzh3guwm (link to video Starting a drum irrigation system)

Research was carried out over a period of two years, 2020 and 2021.

In 2020 and 2021, the average amount of water used varied between 30-35 l/m^2 in 3 innings, and the irrigated productions were between 11.8-12.1 t/ha, compared to 4.8 t/ha in the no-irrigation maize in a neighbouring plot on the same type of soil.

In 2020, it was irrigated between May and the end of August, and the average amount of water used was 33 l/m^2. This was supplied in three different stages:

Stage 1, 28.05.2020, 30 l/m^2;

Stage 2, 18.07.2020, 35 l/m^2;

Stage 3, 20.08.2020, 31 l/m^2.

The productions obtained in 2020 following irrigation were 12.1 t/ha at a density of 70,000 plants/ha.

In 2021, it was irrigated from June to the end of August, with an average amount of water of 35 l/m^2, assigned as follows:

Stage 1, 16.07.2020, 35 l/m^2;

Stage 2, 20.07.2020, 33 l/m^2;

Stage 3, 25.08.2020, 37 l/m^2.

In 2021, the productions were 11.8 t/ha at a density of 69,000 plants/ha.

Although the soil on which research was conducted has high natural fertility, the productions obtained varied from one year to another, they were clearly superior to the non-irrigated system, which shows that the productions obtained and their quality are undoubtedly higher, which makes us believe that the drum irrigation method is one that gives good results and deserves to be extended on as large areas as possible, as well as in other crops.

Incorrect irrigation and drainage associated with other inappropriate practices (short-lived monoculture or crop rotations, excessive soil aeration especially through numerous superficial works, non-observance of optimal periods of soil workability and trafficking, etc., soil work on slope lands from upstream to downstream, etc.), plus an inappropriate management and use of agricultural land and an irrational use of the forest fund cause the appearance and intensification of soil physical degradation through processes such as de-structuring, compaction, crustification, wind and water erosion, thus contributing to sensitising, fostering and accentuating pollution in different ways of the main components of the environment.

CONCLUSIONS

Research was carried out on a cambic chernozem in Mănăştur, Vinga, Arad County, Romania. The studied area was 5 ha and the researches were carried out in the years 2020 and 2021. The drum irrigation method was practiced with Bauer Raninstar E51 XL drums.

In the two years of research (2020 and 2021), the average amount of water used was 30-35 l/m^2, distributed in three stages.

The productions obtained were 12.1 t/ha in 2020 and 11.8 t/ha in 2021 compared to 4.8 t/ha obtained in non-irrigated maize.

When irrigating maize, farmers must take into account a number of issues:

- Physical properties of the soil;
- The forms under which water is found in the soil;
- Aspects of water circulation;
- Water consumption by the plant;
- The amount of water that the soil can store.

BIBLIOGRAPHY

AUNGURENCE N., 1994, Mașini agricole și horticole, Editura Mirton, Timișoara

BRÎNDEU L., 1980, Dinamica, Lito. IPTVT, Timișoara

DĂNILĂ I., 1981, Mașini agricole de recoltat, Lito. IPTVT, Timișoara

DUMA COPCEA ANIȘOARA, ILEA R, POPA D., SÎRBU CORINA, 2018, Mecanisation technology for the harvesting of grain maize with a self-propelled combine, Research Journal of Agricultural Science, 50 (1). https://rjas.ro/issue_detail/44

DUMA COPCEA ANIȘOARA, MIHUȚ CASIANA, ARSENE O., 2017, Optimising mechanised technology in what in the conditions of Bazoș, Timiș county, Romania, Research Journal of Agricultural Science, 49 (1). https://www.rjas.ro/paper_details/2440.

GANGA M., VLADUT V., MANEA D., BIRIS S., BUNGESCU S., 2007, „Using static and dynamic method for the testing of the cabins and protection devices of the agricultural and forestry tractors on the wheels“, Journal of Science Society of Power Machines, Tractors and Maintenance", Traktori I Pogonske Masine (Tractors and Power Machines), Nr. 2, Godina 12, November 2007, UDK 631.372, Biblid: 0354-9496(2007)12:2, UDK:631.1:620.95:519.862(043.3), Novi Sad, Serbia, ISSN 0354-9496, polj.uns.ac.rs/srpski/casopisi.htm, pag. 79 – 90, Novi Sad, Serbia;

MATEOC-SIRB N., T. MATEOC, ANISOARA DUMA- COPCEA, S.GH. SÂRB, G. ŞUSTER, 2013, Analysis of agricultural development of region West, Lucrări Ştiinţifice – vol. 56 (1), seria Agronomie, Iași

MIHUȚ Casiana, A. OKROS, Anișoara DUMA-COPCEA, L.D. NIȚĂ L.D., V.D. MIRCOV, Valeria CIOLAC, Antoanela COZMA, M. STROIA, 2021 - Supply in nitrogen, phosphorus and potassium of a preluvosol from Giulvăz, Tmis county, romania, under the influence of organic fertilisation. The international symposium "Trends in european agriculture development", vol. 53, nr. 1 Timișoara România

MIHUȚ CASIANA, RADULOV ISIDORA, 2012, Științele Solului [Soil Science]. Ed. Eurobit, Timișoara.

MIRCOV V.D, C. MOISE, CODRUTA CHIS, 2015 - Risk aspects in the warm season 2014- climatological and synoptic characterisation during summer 2014 in western region of Romania. Research Journal of Agriculture Science, vol. 47, pg. 89-95, Timisoara

MIRCOV V.D., NICHITA IULIANA ANCA, CIOLAC VALERIA, OKROS A., MIHUT CASIANA, COZMA ANTOANELA, DUDAS M., 2019, Extreme Meteorological Phenomenons Recorded In South West Of Romania In The Winter Of 2018/2019 – Record Snow Depth Registered In Timisoara. Proceedings of the InternationaL Conference on Life Sciences. Proceedings Edition July 2019. ISBN 978-88-85813-243.

NAGHIU AL., 2008, Baza energetică pentru agricultură, Ed. Risoprint, Cluj-Napoca

NECULĂIASA V., DĂNILĂ I., 1995, Procese de lucru și mașini de recoltat, Editura A92, Iași

NIȚĂ L, D ȚĂRĂU, GH ROGOBETE, GH DAVID, D DICU, SIMONA NIȚĂ, 2018, Using pedologic information in defining the quality and sustainable use of land in Western Romania, Jurnal Research Journal of Agricultural Science, Volumul 50, Numărul 1.

NITA LUCIAN, ADIA GROZAV, GHEORGHE ROGOBETE, 2019, Natural and Anthropic Soil Acidification in the West of Romania, Jurnal revista de Chimie Volumul 70 Numărul 6 Pagini 2237-2240 Editor Chiminform Data Sa.

OKROS ADALBERT, PIRSAN PAUL, BORCEAN ADRIAN, MIHUT CASIANA, NITA SIMONA, MIRCOV VLAD DRAGROSLAV, HAMDAMOV SHAHZOD, GOZIBEKOV ABDUMANON, 2019, Intensive Agriculture Management In The North-West Area Of The Banat Region Under The Influence Of Different Bio-Pedo-Climatic Conditions. Proceedings of the InternationaL Conference on Life Sciences. Proceedings Edition July 2019. ISBN 978-88-85813-24-3.

RIPEANU A., 1982, Mecanica tehnică, Ed. Didactică și Pedagogică, București

SAIDA FEIER DAVID, NICOLETA MATEOC –SÎRB, TEODOR MATEOC, CRISTINA BACĂU, ANIȘOARA DUMA COPCEA, CASIANA MIHUȚ, 2020, Agriculture and sustainable soil use in Timiș County, Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development Vol. 20. ISSN 2284-7995 ttp://managementjournal.usamv.ro/pdf/vol.20_1/Art25.pdf

ȘANDRU A., CRISTEA I., 1983, Exploatarea utilajelor agricole, Ed. Did. și Pedagogică, București

SCRIPNIC V., BABICIU P., 1980, Mașini agricole, Editura Ceres, Bucureşti

SILAȘ GH., GROȘANU I., 1981, Mecanica, Editura Didactică și Pedagogică, Bucureşti
TOMA D., 1981, Tractoare și mașini agricole, Ed. Didactică și Pedagogică, București
TONEA CORNELIA, 2003, Mașini agricole și horticole, Editura Agroprint, Timișoara
***www.agriculture.com