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DROUGHT MANAGEMENT IN THE AGRICULTURE OF DOBROGEA PROVINCE

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Abstract. According to climate data Dobrogea is the warmest and the driest region of Romania. Due to climate, the productive potential of soils is poorly capitalized; productions depend mostly of the precipitations regime. The phenomenon is known for a long time, but the first steps to combat drought took just in the mid twentieth century when there was planted windbreak forest in the area Comorova and Ciocarlia - Cobadin. In the 50s of the twentieth century windbreak forest was planted on about 3,800 hectares that protected an agricultural area of over 75,000 ha. The latter these were cleared during 1962-1965, when work began planning for irrigation. In the period 1967-1989, were equipped more than 420 thousand hectares representing over 82 % of the arable land of the county of Constanta and close to 160 thousand ha - about 48 % of the arable land of the county Tulcea. Due to improper operation yields were much lower than those projected. After 1990, facilities were destroyed and abandoned, so that in the recent years have been irrigated between 10,000-20,000 ha, although meanwhile were performed numerous analyzes and studies of rehabilitation. The lack of a clear strategy in the field, lack of funding for rehabilitation and sometimes of the interest of farmers to irrigate - in years of abundant precipitation - lead to the conclusion of an uncertain future while irrigation in Dobrogea is the main factor that depends on achieving high and safe yields.

Key words: drought, irrigation, rehabilitation, systems

INTRODUCTION

The presence of drought and irrigation need in Dobrogea has been reported since the mid-twentieth century by the agronomist Ion Ionescu de la Brad, who in the work „*Agricultural trip in Dobrogea Plain*” makes the following remark: ... *generally all Dobrogea soils are light, dry, burning, the plants suffer more of water than nourishment* ... (1).

Yet more than a century ago in Dobrogea irrigation was practiced on only 13,500 ha, of which 8,600 ha in Constanta County and 4,900 ha in Tulcea County, almost exclusively with vegetables (3).

The first method to combat drought was in the 1939-1944 planting of windbreak forest on the Stud domain from Mangalia and in the area Ciocarlia from Constanta County. The results were encouraging, production in protected areas being more than double compared to unprotected land. The results obtained, especially the catastrophic drought of 1945-1947 years have prompted the government of that time to draw up a program of planting windbreaks forests nationwide, of which about 116 000 ha in Dobrogea (Fig. 1).

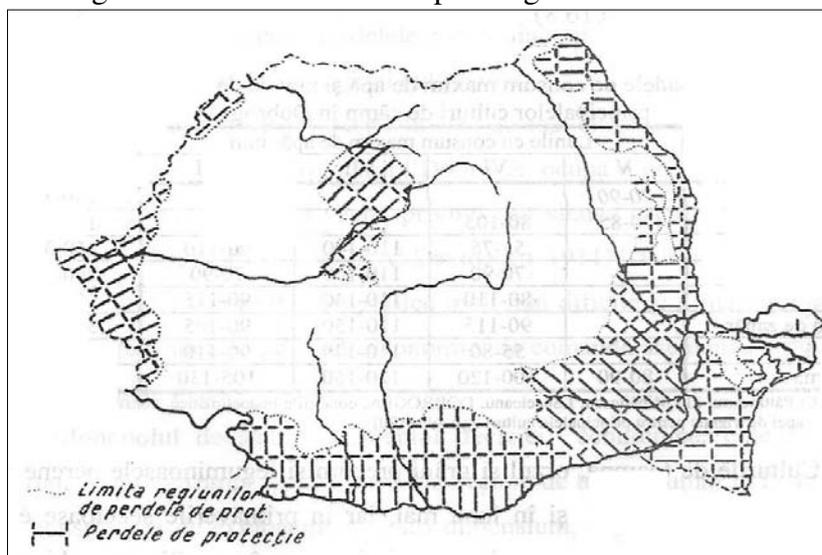


Fig.1. The territorial distribution and orientation of windbreak forests in Romania (after I.Z.Lupe and V.Jianu)

The program was not carried out, but in the period 1951-1954, were planted about 3,800 ha of windbreak forest in Constanta but were cleared after 10 years because they were diminishing the arable land, were delaying the spring works on the side protected, were hosts for insects and rodents, and especially puzzling the operation of another

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program to combat drought - irrigation. This program of extending irrigation over large areas was started in the second half of the 60s (twentieth century) and continued until the end of 1989, when the area equipped for irrigation in Dobrogea reached 581 500 ha, of which 422 300 ha in Constanta County and 159 200 ha in Tulcea County.

The improper exploitation of perimeters landscaped had no led to achieve parameters of productivity and economic efficiency projected, and after 1989, destruction, abandonment, market economy, have reduced the effective irrigated area to 10-12 thousand ha. In the recent years many studies and rehabilitation programs have been developed.

MATERIAL AND RESEARCH METHOD

There have been used as research material primarily statistical data on the evolution of surfaces equipped, costs and production results obtained on surfaces under irrigation. Along the way, numerous analyzes were performed on waters costs and its structure at water provider – the state. The agricultural units were analyzed irrigation costs, yield, and economic results. The method used is characteristic of economic research, data collection and selection, interpretation and conclusions release.

RESULTS AND DISCUSSIONS

1. Fighting drought with windbreak forest. In the introduction to this material was mentioned that the first measures to combat drought in Dobrogea were the windbreak forest planting - a kind of selvages with large width, of acacia – in the south of Constanta in Comorova and Vișoara-Cobadin area. The results obtained on the protected areas are shown in Table 1.

Table 1. The influence of windbreak forests on crops in some cultures in Dobrogea during 1943-1947 (after I.Z.Lupe)

Culture	Period	Production in protected area		Average of area kg/ha	Gain beside the average of area	
		average	maximum		Kg/ha	%
<i>Comorova (Constanța county)</i>						
Autumn wheat	1943-1944	1.840	2.070	750	1.090	145,3
Spring barley	1946	2.700	2.910	600	2.100	250,0
Oat	1943-1945	2.144	2.487	733	1.411	192,5
Maize	1943	3.350	5.540	1.500	1.850	123,0
<i>Ciocârlia (Constanța county)</i>						
Autumn wheat	1947 ^{*)}	600	-	33	567	1.718,0

*) 1947 was one of the catastrophic years in terms of drought

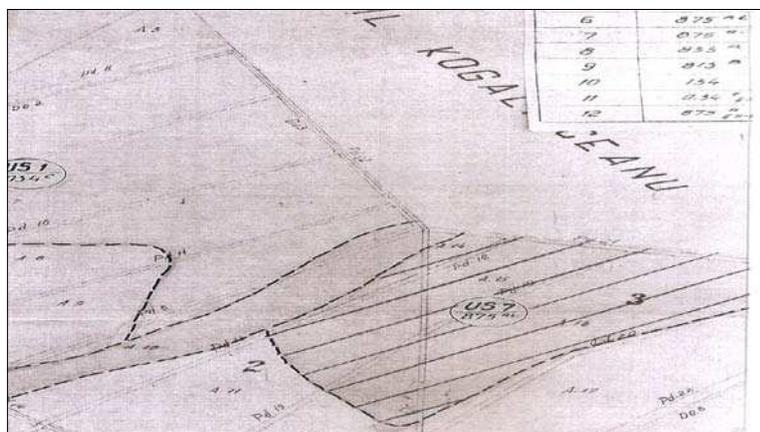


Fig.2. Location of windbreak forests on the territory of CAP Nisipari (Project of organizing territory of CAP Nisipari, Constanța County)

The beneficial effects of the 3,800 ha of windbreak forests planted during 1950 to 1954, have not been evaluated because after only 10-12 years after planting began their clearing. One of the criticisms made of this planting scheme of windbreak forest that would protect an over approximately 75,000 hectares of arable land in Constanta County was that the distance between two windbreak forests, on the contour line was only 200 m, which really would be hampered execution of

agrophytotechnical works (Fig. 2).

2. Combating drought through irrigation. The extent of works, arranged surfaces, construction and assembly, equipment, irrigation systems from Dobrogea were the largest investment objective in agriculture of the region. Evolution of irrigation facilities in the two counties - Constanta and Tulcea during 1960-1990 is presented in Table 2 and Figure 3.

To realize the size of these works we mention that in 1990, out of over 3,100 hectares equipped the whole country, almost 19.0% were in Dobrogea and only 13.6% in Constanta county, where 74.8 % of agricultural land and 82.5% of arable land were equipped for irrigation (only in Calarasi and Braila the share of equipped areas was higher but in completely different orographic conditions). The first arrangements were made in the late 50's.

Table 2. Evolution of the arrangements for irrigation in Dobrogea in the period 1960-1990

Specification	1960	1965	1970	1975	1980	1985	1990
Agricultural surface- thousand ha -							
Constanța county	8,6	9,1	62,7	199,4	339,5	393,7	422,3
Tulcea county	4,9	5,9	14,0	77,2	112,5	142,5	159,2
<i>Dobrogea</i>	<i>13,5</i>	<i>15,0</i>	<i>76,7</i>	<i>276,6</i>	<i>452,0</i>	<i>536,2</i>	<i>581,5</i>
Arable land - thousand ha -							
Constanța county	8,6	7,3	58,0	187,7	326,3	377,1	395,6
Tulcea county	4,9	5,8	11,6	75,6	108,0	137,3	153,8
<i>Dobrogea</i>	<i>13,5</i>	<i>13,1</i>	<i>69,6</i>	<i>263,3</i>	<i>434,3</i>	<i>514,3</i>	<i>549,4</i>

Source: Statistical Yearbooks of Romania. Data: DIF-RAIF

In Constanta County the first irrigation system with an area of 3,600 ha was built in area of municipalities Mircea Voda-Satul Nou and in Tulcea County was built about 1,200 hectares around the village Sarinasuf.

Arranging for irrigation of large areas of land in Dobrogea, was started later in 1968-1969, when construction of the, great complex of irrigation Carasu was built with an area of about 200,000 ha, which remains today one of the largest in country.

Since 1969, the first hydro technical system *Mihail Kogălniceanu* is put into operation in Constanta county, with an area of 24 075 ha equipped and the next year the system *Nicolae Bălcescu* also in Constanta County with 26,389 ha, so that at the end of 1970, the equipped agricultural

area reached at 62 700 ha in Constanta County and 14.0 thousand ha in Tulcea County.

The priority was granted to this area is justified by exceptional climatic conditions of Dobrogea as well as the economic development level of agricultural units which promised the operation of large surfaces equipped in conditions of efficiency. Only Carasu Complex from Constanta County, for example, whose technical-economic study (TES) date from 1967 represented an investment of over three billion lei, in those times prices. In commissioning this giant complex it represented, among others: 50 million cubic meters of excavated earth; 1050 km of supply and distribution channels; 420 km of reinforced concrete gutters; 2870 km of concrete or cement pipeline buried; 80 km of metal pipes; 87 pumping stations of various sizes, totalling an installed

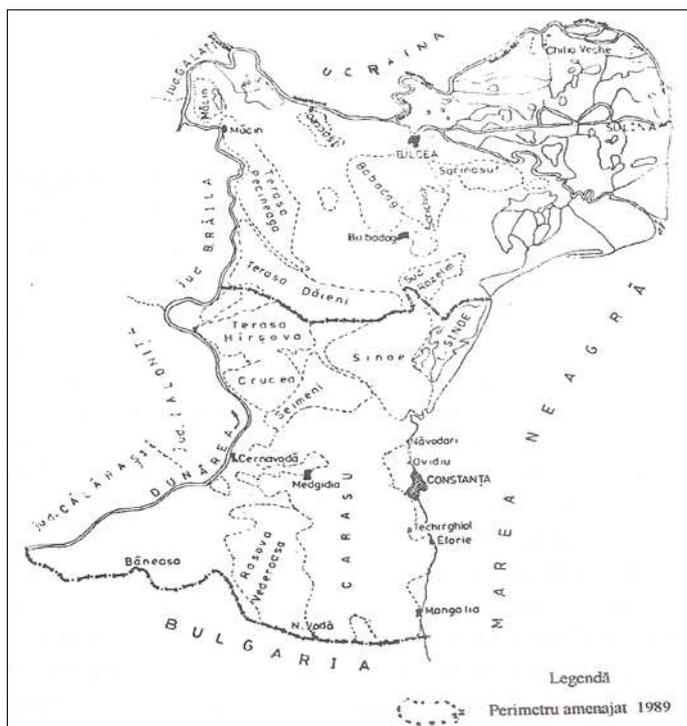


Fig.3. Arrangements for irrigation in Dobrogea, 1989 (after SNIF)

capacity of 120 megawatts; more than 200 hydro technical works, bridges, dams, hydro technical nodes etc.

It is understood that such work represented not only a huge financial effort but also significant material and labor consumption. The Carasu complex built between 1969-1974, at a rhythm of arrangement of about 40,000 ha of land annually succeeded, in Constanta County during 1975-1977, the Sinoe system - 49.466 ha equipped; in 1976-1977 Topalu system - 12.052 ha equipped; in the period 1978 -1982 Rasova- Vederosa systems - 64.086 ha equipped; Terrace Hirsova - 31.037 ha equipped; Seimeni - 23.402 ha equipped. În Tulcea County, due to specific conditions, the arrangements were made on hydro systems with smaller areas. The largest hydro systems are: the complex Babadag - 25.446 ha; Daieni-Ostrov-Peceneaga - 23.837 ha; Peceneaga-Turcoaia-Macin - 19.924 ha; Beibugeac-Sarinasuf - 15.736 ha; South -Razelm - 13.498 ha.

What has characterized the irrigation development in Dobrogea was the speed with which the work took place. In just 10 years (1970-1980) was arranged in two counties an area of 342 943 ha representing 52.9% of their agricultural area or 26.7% of the total area of the country arranged in this period.

Constructive solutions respectively the type of arrangements have been found at that time in line with the technologies used in other countries, although then some of them (setting concrete troughs suspended; using thermal aggregates of pumping for large surfaces) have been found to be expensive and difficult to operate. Also had much insisted that about 1/3 of areas arranged to be irrigated by drainage, on furrows, that requires levelling the land, expensive and not recommended by soil scientists and agronomists. As a type of arrangement at the end of the 80's, the buried pipeline system was almost $\frac{3}{4}$ of Constanta county equipped area and about $\frac{2}{3}$ in Tulcea County. Sprinkler irrigation method based on pressurisation stations (PS) is the most widespread and the rain wings with manual move (RWMM) were almost exclusively in the cooperative sector of agriculture.

Dobrogea irrigation facilities were made with a particular investment effort. In Carasu irrigation complex from Constanta County, for example, for an average investment of 15,786 lei / ha, depending on the type of facility, the specific investment (on ha) ranged as follows: 20 078 lei / ha for the type sprinkler fitting with buried pipes and pressurization stations (PS), 17 055 lei / ha for irrigation with distribution network with open channels but mobile pumping units (MPU) or 15 236 lei / ha for distribution of water to plants, on furrows. Depending on the share of each type of fitting on the nine administrative systems of Carasu complex, the specific investment ranged between 13.793 lei / ha for Cumpăna system and 21 921 lei / ha for Basarabi system (A.Lup, 1997).

Meanwhile, the investment per unit of area (ha) increased much, both due to more difficult conditions (land less suitable for arrangements) and to rising prices of construction materials or equipment (cement, asbestos, pumps, irrigation equipment), workmanship.

Here, for example, is the specific investment in four hydraulic systems in Constanta for projects executed in two phases: projects in 1975 and extensions in 1989 (A.Lup, 1997).

- System Sinoe: project 1975, 15.687 lei/ha; extensions 1984: 53.950 lei/ha
- System Topalu: „ „ 16.942 „ „ „ 50.180 „
- System Hârşova: „ „ 16.942 „ „ „ 50.180 „
- System Topalu: „ „ 16.942 „ „ „ 50.180 „

The designers had a problem; the economic feasibility of projects should - according to the investment law³ of the time - allow recovery of the investment from the additional net income in 10-12 years.

The problem was solving by projecting bigger and bigger yields per unit area (ha) (accepted by policy makers and supported by research in the field). For example, in the last years of the totalitarian regime, hydro technical projects were based on economic returns of 6,000 kg / ha wheat 10,000 kg / ha maize, 3000 kg / ha sunflower or soy in any agro-climatic zones.

³ Law no.9/1980, of investments.

Regarding the cost of providing water, they varied widely depending on the functional and structural characteristics of each arrangement in part (pumping heights, type of equipment, transport distance) between 900-1500 lei / ha in recent years of the control economy. Mentioned that state subsidized the irrigation water costs over this period with 70-75%, and water was provided to the recipients at fixed rates of 18 lei/1.000 m³ and a fixed fee on an equipped hectare between 138 lei / ha for field crops and 210 lei / ha for vegetables.

In the agricultural units a hectare irrigation costs grew from about 800 lei / ha in 1971-1975, to over 1,600 lei / ha in the period 1986-1989.

Regarding the economic aspects should be mentioned that water supplier - State - never recovered the full cost of water, and in turn, no production units have recovered additional expenses with irrigation (with some exceptions in some years, for some crops) due to lower yields per unit of area on land under irrigation.

Table 3. Evolution of average yields (kg / ha) of main crops in the system Carasu from Constanta County during 1966-1986

Crop	Sector	1966-1970	1973-1975	1981-1983	1984-1986	1984-1986 1966-1970 %
Wheat	I.A.S.	2 530	4 235	3 966	3 545	140,1
	C.A.P.	2 650	3 310	3 786	3 170	119,6
Maize	I.A.S.	3 916	4 631	4 294	4 975	126,9
	C.A.P.	3 818	1 866	4 831	4 785	125,3
Sun flower	I.A.S.	1 899	2 249	2 162	2 300	121,1
	C.A.P.	1 964	2 088	1 905	1 962	99,9
Soybean	I.A.S.	1 156	1 477	1 173	1 213	104,9
	C.A.P.	-	1 208	804	729	60,3

Source: A.Lup: *Agricultural Dobrogea from legend to...globalization*.

3. The present and the perspective of irrigation in Dobrogea. Unsatisfactory results obtained in poor operation of irrigation systems in Dobrogea in the planned economy period were due equally to their structural characteristics and faulty operation. The units with low pumping efficiency, higher pumping heights, especially impermeability of supply and distribution channels resulted in low yields and high water losses.

In this situation since 1990, rehabilitation studies were initiated, Carasu complex has been the subject of such a study conducted by a Romanian-French team for a period of three years. Lack of financial resources did not allow the implementation of this study and others conducted in the next 20 years.

An element of novelty appeared in 1999, when by the Ordinance no.147/1999 was regulated the establishing of the Association of Irrigation Water Users - WUA. According to this law have been established dozens of WUAs, both in Constanta County (44 WUAs covering an area of almost 100 hectares) and in Tulcea County. Establishment of WUAs and then Organisations of Irrigation Water Users OIWU not led as expected to increase irrigated areas.

In 2009, the Romanian Parliament appointed a commission of inquiry to investigate the situation in Romania of land improvements and propose solutions to improve the situation. With this occasion Dobrogea ANIF Branch presented a statement of hydro facilities and their status (Table 4).

Table 4. Situation of the hydro patrimony in Dobrogea in 2009

County	Total equipped surface ha	Of public utility ha	Of non public utility ha	In preservation ha	Decommissioned ha
Constanța	422452	106842	167387	117387	198223
Tulcea	160110	55469	93933	93933	10628
<i>Total branch ANIF</i>	582562	162391	211320	211320	208851

On this occasion it was proposed the rehabilitation for 2010, of an area of 43 366 ha, in Constanta county, with a volume of 40 million expense, returning 922.4 € / ha.

A final evaluation of a viability of irrigation systems in Dobrogea was presented by the consulting firm “*Fidman Merk at S.R.L.*” to the Presidential Commission for public policies on agricultural development in Romania. According to this assessment in Dobrogea were found viable in economic systems or parts of the old hydraulic systems totalling 74 216 ha, of which 54 727 ha in Constanta County and 19 489 ha in Tulcea.

Regarding rehabilitation and finally the irrigation of these areas it seems that policy makers took measures both in terms of infrastructure investment and the granting of facilities aimed at electricity price with high share in the cost structure of irrigation.

CONCLUSIONS

1. Dobrogea is known as the driest region of Romania, with a total annual rainfall of 400-450 mm, distributed unevenly during the growing season. This feature limits the productive potential of soils medium to good.
2. The drought phenomenon has been reported with long ago, but concrete steps have been taken to combat until the mid twentieth century through the planting of protective forest in the central and southern region. The results were encouraging, but small protected area has not had a significant beneficial effect for the whole agricultural area.
3. In the period 1967-1989, in Dobrogea were arranged for irrigation large areas representing over 422 000 ha of agricultural land in the county of Constanta and 159 000 ha in Tulcea. Exploiting poor the equipped perimeters associated with some infrastructure deficiencies have not led to technical and economic parameters of the project than in some years, to some agricultural units in some crops.
4. Destruction and then abandoning irrigation infrastructure, liquidation of large-scale farming, the market economy after 1990 had the effect of reducing irrigation activity until minor surface of 10,000-20,000 ha.
5. Instead, the rehabilitation studies, surveys, analysis and reorganizations, legislation, were continuing concerns without significant effects on irrigation, so that their future is still uncertain while the drought decreases yearly harvests.

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