

**ECONOMIC ANALIZE OF MAIZE PRODUCTION IN
CONDITIONS OF DEFICIT IRRIGATION
IN REPUBLIC OF MACEDONIA¹**

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Abstract: In this paper authors had done analysis of economic parameters in three variants of maize production. The first one (TI) is traditional way of production, where number of irrigation and water use for irrigation are based on free farmer choice. The second variant (FI) represents full irrigation, where maize was irrigated up to full field water capacity in depth of 1m. The third variant (DI50) is irrigation up to 50% from FI. They confirmed that for TI variant, average 10 868 m³/ha water is used by farmers, what means about 14 % more water use, compared with variant FI and 128 % more water use, compared with DI 50. Because of the fact that water saving is significant and water use is controlled, a high yield and better value of production was realized. According that, the farmers who will practice variants with controlled irrigation water usage, would have higher profit (average 13.5 indexes) of invested capital.

Key words: production costs, yields, production value, profit.

1. Introduction

Agriculture land in RM is 1 316 335 ha or 51.19% from 2 571 300 ha total surface of the country. 43.80% of this surface or 576 673 ha are cultivated. Husbandry production is organized on about 373 thousands hectares or 64.8% from total arable area. Crops, where maize belongs, are cultivated on over 200 thousands hectares, which is 53.63% by husbandry production areas. The maize is cultivated on 34 thousands hectares area or 17.02% from crop areas [3]. In HMS “Bregalnica”

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(Kocani, Stip, Sveti Nikole), maize is cultivated on 1 905 hectares [4] or 5.59% from total surface used for maize production in Republic of Macedonia

Because of various hydrology conditions, average yields in production process are reduced. For example, average yield in Kocani region is higher for 71.39% than average yields on republic level (3 897 kg/ha), and average yield in Sveti Nikole is lower for 52.53% [4].

Because the fact that Republic of Macedonia is influenced by two zone (mediterranean and temperate east-continental) and one local (mountainous) climate condition, it has many heterogeneous climatic regions. For example, average rainfalls (for period 1995-2004) in Republic of Macedonia were 588.7 mm and during vegetation period were 293.7 mm. In the same period, the air temperature was 29.4⁰C to 40.0⁰C in year 2000 or average 36.0⁰C [3]. The Ovce Pole region, according Fillipovski at al (1996), is classified as most arid areas in Europe according rainfall distribution, temperature, winter winds and evaporation. Average amount of rainfalls during vegetation period are 245 mm, and average maximum air temperature during (July-August) is 32 ⁰C (Bosev, 2003).

In Republic of Macedonia until 2004 was built total 106 HMS. In his structure, according covered surface, systems with capacity of irrigation surface 100-500 ha dominates (49 HMS).

With irrigation surfaces are covered 164 750 ha, but with currently build network could be irrigated about 124 000 ha or 75.61% by projected. For irrigation are used 16 big accumulations with total accumulation area 510 000 000 m³. Built canal network is with total length of 47 085 km, by which 8107 km main canals, and other (38 978 km) detail canal network [6]. The largest of all 106 irrigarion systems is HMS “Bregalnica” (Chart 1).

Surface which can be irrigated is 24 372 ha with:

Kocansko Pole	8 037 ha
Vinicko Pole	1 100 ha
Stipsko Pole	6 535 ha
Ovce Pole	8 700 ha

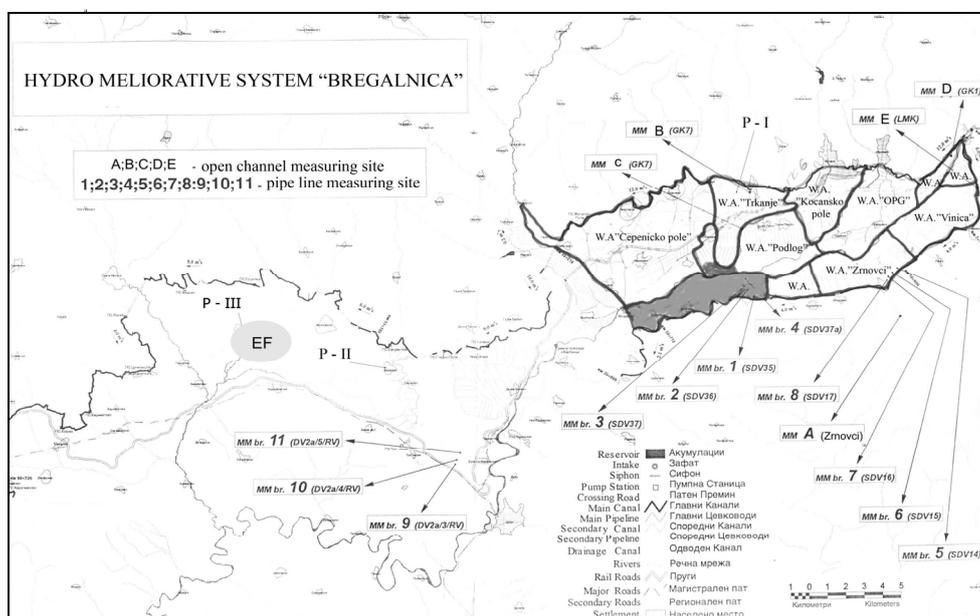


Chart 1 - HMS "Bregalnica" with survey points

Because of the fact that Ovce Pole region, is classified as one of the most arid regions in Europe according climate indicators [8] and the yields [4] are very low (1 850 kg/ha), the goal in this paper is set to perform an analyze of economic parameters in maize production for grain and the effects of deficit irrigation methods compared with traditional irrigation technique.

2. Working method and data source

Specific surveys were done (beside technological surveys), for realization of selected goal according approve of the economic indicators in the project (Water Resource Strategies and Drought Alleviation in Western Balkan Agriculture). Interview was conducted with three individual farmers in year 2005, for cost establishment by working process in traditional way of maize irrigation (TI). First of them (P - I) is located in Trkanje – Kocani, which had maize production on the arable surface of 0.8 ha, the second one (P - II) in Vrsakovo – Stip, which had maize production on 6.0 ha, and the third one (P – III) is in Erdzelija – Sveti Nikole, which had maize production on 1.5 ha surface. The data from the survey are proceeding, and the results in the following text are shown as average. In traditional way of production, number of maize irrigation is based on farmer

choice, which means that numbers of irrigations are unlimited (in our case about 3-6 times) and that water quantity is not measured. The farmers in Water Association (WA) are paying a lump sum price 5 769 den/ha or 94.12 EUR/ha (61.2 den/EUR).

Experimental researches with controlled irrigation water usage on maize (ZP 677) were done (during 2005) in the Ovce Pole region (EF) with two variants, on smolnica soil type. One of the variants (FI) is with full irrigation up to field water capacity (FWC) of the soil, and second one, deficit irrigation (DI 50), with 50% from FI. Experimental researches were done near P – III.

Total costs for maize production with controlled irrigation water quantity i.e. in experimental researches are approximated on to traditional way of irrigation and some costs are adjusted with effectuated yield by TI. Costs for irrigation water are calculated by price 0.53 den/m³.

3. Research results and discussion

3. 1. Production costs

Average costs for maize production at traditional way of production, respectively when the number of irrigations and water quantity is by free farmers choice, bills 772.08 EUR/ha. In cost structure, costs for manual harvesting dominated (Tab. 1). On the second position, comes a water and irrigation cost with common participation 19.47%. It is interesting that number of irrigation and water quantity are not limited. The interviewed farmers gave statement that during growing period, maize is irrigated 3 – 6 times with sprinklers and water quantity is not measured.

Irrigation water quantity in traditional way of production (TI) is calculated on the base of the lamp sum (5 760 den/ha) for water which is determined by Water Economy “Bregalnica” - Kocani. Therefore is confirmed that interviewed farmers spends, average 10 868 m³/ha irrigation water for maize production (Tab. 2)

Table 1 Cost structure (%)

Production process	Participation of the different costs in total costs %		
	Variants of irrigation		
	TI ¹	FI ²	DI50 ³
Ploughing (autumn)	3,52	2,99	3,35
Ploughing (spring)	2,25	1,90	2,12
Harrowing	0,73	0,62	0,69
Furrowing (by machine)	1,42	1,21	1,35
Seeding (manual)	9,72	8,26	9,24
Levelling	0,41	0,35	0,39
Spraying I (manual)	6,14	5,22	5,83
Herbicide treatment	1,19	1,01	1,13
Fertilizing (manual)	7,66	6,59	7,37
Irrigation	7,38	6,27	7,02
Spraying II (manual)	5,08	4,32	4,83
Cultivation (by machine)	0,30	0,26	0,29
Cutting 1/3 of stem (upper part)	1,13	0,98	1,10
Harvesting (manual)	19,84	25,22	26,20
Transportation to farmyard	2,07	2,63	2,73
Seed crumbling (by machine)	5,22	6,61	6,90
Transportation and retailing	2,30	5,86	3,05
Disking	0,73	0,62	0,69
Plant rests collecting	0,85	0,72	0,80
Transport of dry stems	1,56	1,32	1,48
Water costs	12,19	10,00	5,54
1. Total variable costs	91,69	89,95	88,76
Amortization of basic assets	8,31	8,14	8,14
2. Total fixed costs	8,31	8,14	8,14
Total costs (1+2)	100	100	100

TI¹- Traditional irrigation; FI²- Full irrigation; DI50³- Deficit Irrigation (50% from FI)

Table 2 – Quantity of water used for irrigation (m³/ha)

Indicator	Variants of irrigation		
	TI	FI	DI50
Consumption	10 868	9 538	4 763
Differents from TI	/	1 330	6 105

In conditions of water deficit in RM, traditional way of irrigation should be left and new irrigation techniques should be used, respectively FI and DI 50. Usage of FI depends on current soil moisture, which is measured with digital instrument (HH2 moisture meter) and moisture sensor (PR2) in the soil depth 1m. For variant DI50, water quantity is programmed 50% from variant FI.

3. 2. Production value

Data presented in table 3 shows that both variants (FI, DI50) at controlled way of irrigation realized higher yields than the yield realized with traditional way of irrigation. Respectively, the production is with better financial value. Here, the financial value is only expression on market product i.e. maize grain.

Table 3 – Realized yield and production value

Indicator	Variants of irrigation		
	TI	FI	DI50
Yield (kg/ha)	8 500	12 015	11 514
Value (EUR/ha)	1 111.11	1 570.59	1 505.10

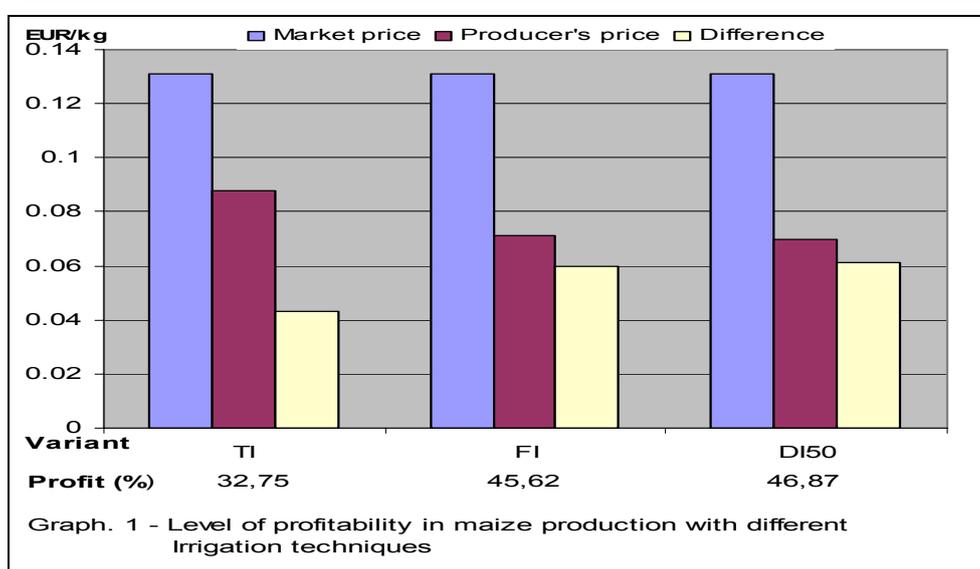
The stem and the co, which have a high nutrient and energy value are not taken in account, because they haven't market value.

3. 3. Financial results

Based on value of financial result, i.e. differences between product value and total production value it can be concluded that in the future, the third variant (DI50) should be in practice, because of the fact that in this variant the profit is on highest level (Tab. 4).

Table 4 – Realized profit

Variants of irrigation	Indicator		
	Value of products (EUR/ha)	Value of total cost (EUR/ha)	Differents (EUR/ha)
TI	1 111.11	772,08	339.03
FI	1 570.59	908,55	662.04
DI50	1 505.10	812,15	692.95



The farmers which will continue with maize production with traditional way of irrigation will effectuate 32.75% profit. On the other hand, farmers which will organize the production with deficit irrigation (DI 50) will effectuate 46.87% profit on investment capital (Graph. 1).

4. Conclusion

Based on results from the survey which were conducted with purpose to evaluate some economic indicators in the maize production process in the conditions on deficit water use for irrigation, it could be highlighted the following conclusions:

1. Republic of Macedonia in the past period cultivated maize on the surface of only 34 thousands hectares or 17% from the crop surface. Total production at average yields 4 t/ha is 136 thousands tones maize grain. This quantity is not enough for this crop need, so Republic of Macedonia is forced to import the maize grain.
2. In the structure of production costs, harvesting costs dominates (20-26%) because the yield was harvested manually. After this type of costs, comes a water and irrigation cost (12.56-19.74%).
3. Results for yields and spent water quantity for irrigation shows that there are unnecessary spending of assets and water because the fact that with two times less water quantity can be reached relatively higher (for about 36%) yields.

4. As a result of higher yields a higher financial results are reached in variants with controlled irrigation water amount than in traditional way of irrigation.
5. Beside that total costs are higher, in variants with controlled water amount, farmers would effectuate higher profit, because the yields are higher.

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**EKONOMSKA ANALIZA PROIZVODNJE KUKURUZA U USLOVIMA
DEFICITARNE POTROŠNJE VODE ZA NAVODNJAVANJE
U REPUBLICI MAKEDONIJI**

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Apstrakt

U radu autori vrše analizu ekonomskih parametara u procesu proizvodnje kukuruza u tri varijante. Prva varijanta (TI) je tradicinonalni način navodnjavanja gde broj navodnjavanja i količina vode za navodnjavanje je po slobodnom izboru farmera. Druga varijanta (FI) je sa punim navodnjavanjem do PVK zemljišta na dubini od 1m. I treća varijanta (DI50) je navodnjavanje do 50 % od FI. Pri tome je utvrđeno da kod varijante TI farmeri troše prosečno 10 868 m³/ha, što u odnosu na varijantu FI je više za oko 14 %, a u odnosu na varijantu DI50 je više za 128%. Na osnovu činjenice da ušteda vode je značajna a potrošnja vode kontrolisana, postizu se veći prinosi i veća vrednost proizvodnje. U vezi s tim, farmeri koji bi praktikovali varijante sa kontrolisanom količinom vode za navodnjavanje, ostvarili bi veći profit (u proseku za 135 indeksnih pojenja) uloženog kapitala

Kljune reči: troškovi proizvodnje, postignuti prinosi, vrednost proizvodnje, profit.

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