INFLUENCE OF CONSERVATION AND CONVENTIONAL TILLAGE IN COST OF LABOR WITH FARM MACHINES IN ALBANIAN CONDITIONS

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Abstract: *The basic of agricultural production unit in a country are the agricultural farms. They were established right after the privatization and distribution process of land. This in turn was accompanied by profound economic, social, legal and institutional problems. At the close of such a process a huge number of farms were created in proportionate compliance with the population in a certain rural area and the land made available from the former state farms and cooperatives. The size of the farms depended to a large degree on the number of the family members benefiting from land distribution as well. Soil tillage is, and will remain, the guiding component of soil management and consequently has far-reaching implications for agro ecosystems. Understanding structures and functions of soil ecosystems under different tillage/no tillage practices is an essential requirement for any future farming concepts. Using the knowledge of soil ecology under natural, undisturbed conditions, the paper is focused on how cultivation affects soil and the soil environment. In particular it highlights how methods of soil tillage can influence soil structure, soil chemical processes, soil borne pathogens, and pest species. Covering the aspects of soil tillage on different soil types, the paper concludes with a synthesis of the role of soil tillage in securing a sustainable agricultural environment. Soil tillage in agro-ecosystems offers a broad and comprehensive view of the interrelations of multifaceted tillage practices and the biological, chemical, and physical components of soil ecosystems. Tillage effects are highlighted within the context of the whole farming system, so as to provide the scientific basis for choosing different tillage options in order to achieve the best possible sustainable base for long-lasting agricultural production. The goal of this study is to analyze the influence of different systems of land utilization in energy indicators and cost of farm machinery. The study was conducted at the experimental field of Agricultural University of Tirana (AUT) in a 1.7 ha area in three variants of utilization: conventional, conservative and combining according to randomizer scheme. Soil texture is loam which represents over 65% of Albania's agricultural land. From calculations made on the basis of experimentation results, conservative system of utilization is more economics than others*

Keyword: ***utilization, tractor, moldboard plough, chisel plow, farm machinery cost.***

INTRODUCTION

The main requirement in today's soil tillage technology is to determine the optimal system of land tillage. The goal is to decrease the number of interventions and to create a suitable environment for plant development with and affordable cost. The data from literature (ASAE Standards) and the experience of our country (BOROVA.GJ, Teknologjia e mekanizimit buqesor) shows that soil tillage represents 50 to 60% of the total energy used where only plowing consumes 30 to 40% of this energy. What's more the cost of farm machinery work covers 50% of the total cost in cultivation. Therefore, tillage has a major impact on agricultural production costs.

Currently in the developed world there is a general tendency of applying reduced tillage systems thus limiting the usage of conventional system.

This comes as a result of high degree of mobility that earth represents today in developed countries like Europe, U.S.A, Canada, Australia etc. Using the conventional systems in these countries now is not productive as it causes many negative effects such as: the

reduction of food supply and water resources, the decline of physical and mechanical qualities, porosity reduction, large energy consumption and cost increase. These negative effects are eliminated by using reductive systems until zero soil tillage. The study was conducted to test tillage systems or their combination and the impact of energy and economic problems in terms of Albania. The selection of tillage systems or their combination was made depending on natural, agronomic and economic factors of the studied area.

MATERIALS AND METHODS

Objectives of the study

1. To determine the impact that tillage systems or their combination have on energy indicators (fuel consumption l /ha)

2. To determine the impact that tillage systems or their combination have on cost per hour Leke/h and cost per unit Leke / ha.

The study was conducted in the experimental field of AUT in Valias which is located in central mediterranean area of Albania. The average amount of rainfall varies from 950 to1200 mm. Their distribution is erratic. Average temperature varies from 14 to 16 Celsius degrees. Soil type is medium. The period of study was 3 years, from 2004 to 2006. The study was conducted with 3 variants and 4 iterations according to randomizer scheme. Each iteration covers 0,11 ha in a total area of 1.76 ha. The culture planted was maize.

V1	***V3***	***V2***	***V3***	***V2***	***V1***
P1	***P1***	***P1***	***P3***	***P3***	***P3***
V1	***V3***	***V2***	***V3***	***V2***	***V1***
P2	***P2***	***P2***	***P4***	***P4***	***P4***

Figure 1. Randomizer scheme

The versions studied were:

Version 1, The Conventional system, V1- Soil tillage was made with moldboard plough in 30 to 35 cm depth. Additional tillage was completed with the D-2.2 m disc twice. Version 2, Combination of conventional and conservative systems. V2- Soil tillage was made with moldboard plough in 20 cm depth and chisel plough in a depth 30-35 cm. Additional tillage was completed with rotary in 10cm depth
Version 3, Conservative system, V3- Soil tillage was made with chisel plough in 25-30 cm and 45-50 cm depth. Additional tillage was completed with rotary at 10-15 cm depth

Aggregates used for each variant:The selection of aggregates was done on the basis of analytical calculations determinate by the ratio of tractor pulling power and the farm machines resistance (by ASAE Standard 2000), as well as on the possibility of their existence in the studied area.

Table 1

Aggregates for each variant

Variant	Operation	Agriculture aggregate	
		Tractor	Farm machine
V_1	Plowing a=31-35 cm	FIAT 70-56	P3-35
	Disc (twice)	FIAT 70-56	D-2,2
V_2	Plowing a=20cm+Chisel a=30-35 cm	FIAT 70-56	P2-35 + KC 45
	Rotary a = 7-10 cm	FIAT 70-56	F – 2.1
V_3	Chisel (twice) 25-30 & 40-45 cm	FIAT 70-56	Chisel 45
	Rotary a = 10-15 cm	FIAT 70-56	F – 2.1

Calculation of farm machiney cost, Leke/h was made:

Table 2

Method of cost calculation

Elements of cost		Calculation
Fixed cost	Depreciation	Constant%*Price (according to tax laws)[1]
	Interest	[(Price+Remaining value)/2]*I (according to bank interest)
	Housing	Not into consideration from albanian farmers
	Year taxes	According to tax laws, calculated only for tractors [1]
	Insurance	According to insurance laws [1]
Operating cost	Repair and maintenance	Constant*Price (0.02% for tractor, 0.045% for plough and rotary, 0.063% for other machineries [2]
	Fuel	Hour consumption * price
	Lubrication	10%* fuel cost
	Labour cost	Operators number*average payment per hour

[1] - Calculation were made according to Albanian's tax and insurance laws

[2] - Tsubuka Internatinal Centre 2003; Rumsej, J 2003

Based on work capacity ha / h and cost per hour Leke / h it was calculated cost per hectare (Leke / ha) for each variant.

All the above calculations give us enough data to make possible the evaluation of different soil tillage systems.

RESULTS AND DISCUSSIONS:

1. Analysis of energy indicator: Fuel consumption

Calculation of fuel consumption is done through direct measurement of each operation until the planting of any variant taken in study. Results are presented in table 3.

Table 3

Fuel consumption liters / ha

V	Nr	OPERATIONS	Calendaric period	Fuel l/ha
V_1	1.	Plowing 31-35 cm	25-30 March	35
	2.	Chemical fertilization, 2kv/ha (twice)	20-25 March	10
	3.	Organic fertilization 200kv/ha	1-5 April	7
	4.	Heavy disc twice	5-6 April	30
	5.	Seeding N=65000 plants/ha	6-10 April	10
Total: 92				
V_2	1.	Chemical fertilization 2kv/ha. 2 here	20-25 March mars	10
	2.	Organic fertilization 200kv/ha	1-5 April	7
	3	Plowing 20cm + Chisel 30-35cm	25-30 March	30
	4.	Rotary 7 -10 cm	5-6 April	20
	5.	Seeding N=65000 bime/ha	6-10 April	10
Total: 77				
V_3	1.	Chemical fertilization 2kv/ha. 2 here	20-25March	10
	2.	Organic fertilization 200 kv/ha	1-5 April	7
	3.	Chisel twice: 25-30cm and 45-50cm	25-30 March	23
	4.	Rotary 10-15 cm	5-6 April	16
	5.	Seeding N=65000 plants/ha	6-10 April	10
Total: 66				

On the basis of the results was done the comparison of the consumption liters / ha for plowing process and the total for each variant.

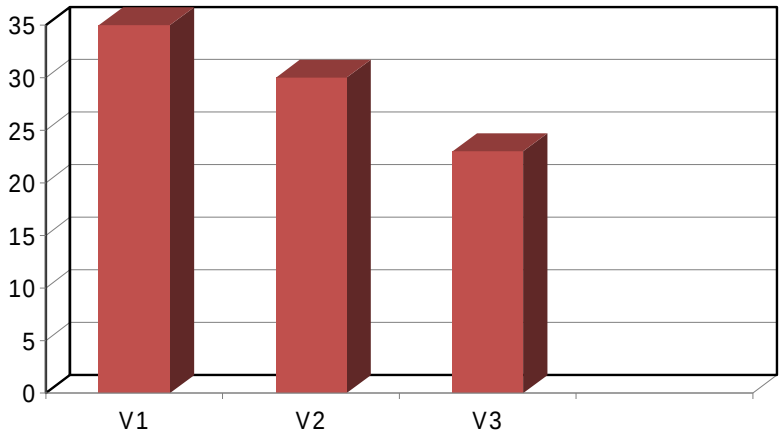

Chart No. - 1 Fuel consumption l / ha for plowing by variant

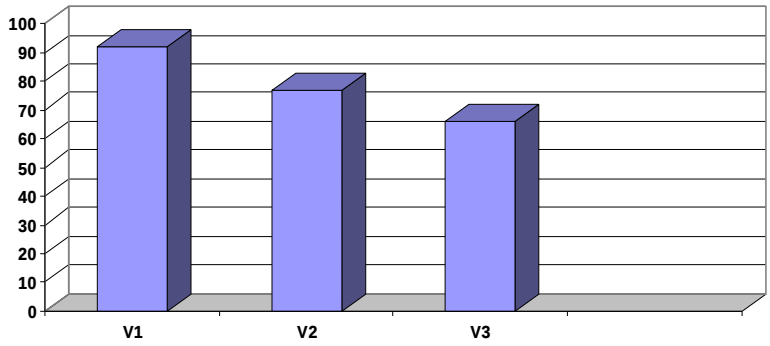

Chart No. - 2 Total fuel consumption l/ha by variant

As seen from the graphics No. - 3 and 4 the differences in total fuel consumption and only in plowing for each tillage system are significant. Reductive systems of tillage are more effective in fuel consumption then conventional

2. Economic indicators: Cost per hour L / h, Cost per unit L / ha. The results of cost calculations by variant are presented in table 4

Table 4

Cost of farm machinery, L/h by variant

	Nr	Operations	Tractors cost						Machinery cost						Aggregate cost	
			Type Kw	Age in years	Price LEKE	Own	Lekë /h	Lekë /ha	type	Age in years	Price LEKE	Own	Lekë /h	Lekë /ha	Lekë /h	Lekë /ha
VARIANT V_1	1.	Plowing 31-35cm	Fiat70-56	9	1330297	P	1325	3701	P 3-35	9	350000	P	350	977	1675	4678
	2.	Chemical fertilization, 2kv/ha. 2 here	Fiat70-56	9	1330297	P	1183	355	Sh.C-6	9	122096	P	216	65	1399	420
	3.	Organic fertilization, 200 kv/ha	Fiat70-56	9	1330297	P	1183	1126	R-3	9	326272	P	440	419	1623	1915
	4.	Heavy disc, 2 here	Dt-75	15	1003650	P	1424	1356	D-2.2	9	35000	P	304	290	1728	1646
	5.	Seeding N=65000 plants/ha	Fiat70-56	9	1330297	P	1183	870	BJT-6	15	764609	P	1170	861	2353	1731
		Total:					6298	7408	Total:				2480	2612	8778	10080
VARIANT V_2	1.	Chemical fertilization 2kv/ha. twice	Fiat-70-56	9	1330297	P	990	297	Sh.C-6	9	122096	P	216	65	1206	362
	2.	Organic fertilization. 200kv/ha	Fiat-70-57	9	1330297	P	990	942	R-3	9	326272	P	440	419	1430	1361
	3.	Plowing 20cm+ Chisel 30-35 cm	Fiat70-58	9	1330297	P	990	3486	P.35+ KC-35	15	350000	P	356	1253	1346	4739
	4.	Rotary 7-10cm	Fiat70-	9	1330297	P	990	1246	F-2.1	10	150000	P	153	162	1143	1408
	5.	Seeding N= 65000 plants /ha	Fiat70-60	9	1330297	P	990	728	BJT-6	15	764609	P	1170	861	2160	1589
		Total:					4950	6699				Total:	2335	2760	7288	9469
VARIANT V_3	1.	Chemical fertilization 2 kv/ha twice	Fiat-70-56	9	1330297	P	1042	313	Sh.C-6	9	122096	P	216	65	1258	378
	2.	Organic fertilization 200kv/ha	Fiat-70-57	9	1330297	P	1042	992	R-3	9	326272	P	440	419	1482	1411
	3.	Chisel twice 25-30cm + 45-50cm	Fiat70-58	9	1330297	P	1042	2300	KC35+C 45	15	300000	P	231	510	1273	2810
	4.	Rotary,10-15 cm	Fiat70-59	9	1330297	P	1042	1382	F-2.1	10	150000	P	153	162	1195	1544
	5.	Seeding N=65000 plants /ha	Fiat70-60	9	1330297	P	1042	766	BJT-6	15	764609	P	1170	861	2212	1627
		Total:					5210	5753				Total	2210	2017	7420	7770

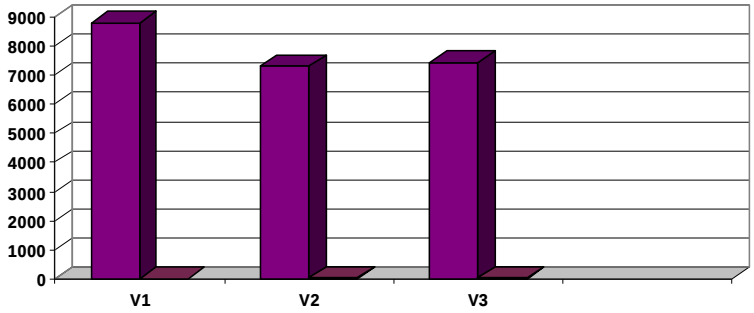

Chart No. - 3 Total Cost per hour Leke / h

Differences from V1 (as the variant on the basis of which was made the comparison) to V2 are - 1493 Leke / h, and to V3 are - 1358 Leke / h

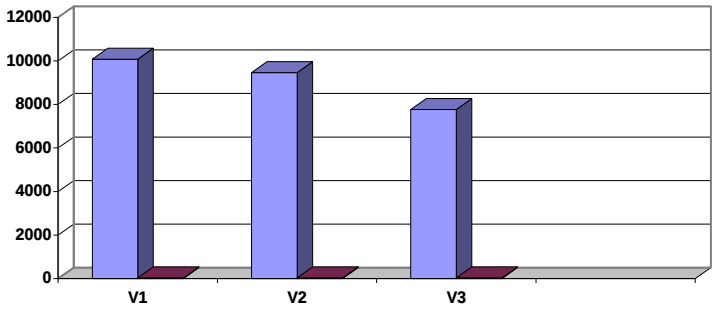

Chart No.- 4 Cost per unit Leke / ha

Differences from V1 which is the indicator to V2 are - 561 Leke / ha, V3 - 2250 Leke / ha.

Data analysis of Tab No. 4 shows that in V2, V3, there is a significant reduction of cost per unit and cost per hour for all operations provided in the technology cart.

As seen from the graphics No. 3 and 4 for Total costs per hour Leke / h and Cost per unit Leke / ha the difference between tillage systems used by variants are significant which shows the advantage that conservative tillage has to V1 that represents the traditional method of tillage. The same is also seen between the combination of systems in V2 and V3.

Both indicators analyzed above in details are well estimated but they are more completed when the degree of soil fertility and the efficiency achieved of agricultural production is analyzed as well.However it is important that ways of tillage are evaluated in total from both agronomic and economic aspects to make the best choice for this purpose.

Table 5

Efficiency of production in years according to tillage are

Variants	Production kv/ha					
	2004		2005		2006	
	Kv/ha	% ndaj V_1	Kv/ha	% ndaj V_1	Kv/ha	% ndaj V_1
V_1	64.8	100	75	100	85,5	100
V_2	59.1	91.2	67.4	90	78.9	92.3
V_3	55.4	85.5	63.2	84	73.9	86.4

CONCLUSIONS:

1. Tillage systems have a great impact on agronomic and techno-economic indicators
2. Reduced tillage system results more appropriate in terms of tillage cost
3. Differences in production efficiency referred to traditional methods (V1) are to: V2 __ 7.7% - 10% and to V3 __ 14.5% - 16%. Differences in production drop after the second.
4. The second variant (combined) of tillage: Plowing a = 20cm + Chisel a = 30-35 cm and Rotary a = 7 to 10 cm is the best option.

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