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Comparison of Different Strip Soil Tillage Methods in Second Crop Maize in Terms of Input Usage in Harran Plain Conditions

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Abstract: The research was carried out in Talat Demirören research station in GAP Soil-Water Resources and Agricultural Research Institute in Harran Plain in three year period between 2005-2007. In the research, the field was cultivated as strip linguiform by using chisel, crowfoot cultivator and rotary tillage designed as being able to apply strip tillage and seeding was done by pneumatic seeding machine. Sowings were done by soil tillage drilling, stubble direct drilling and stubble ridge drilling methods in order to make comparison. The effects of the subjects on maize yield were examined in the production which was done in whole 6 subjects. Appropriate strip soil tillage methods were determined for second crop maize production towards this purpose.
As a result of the research, strip soil tillage drilling methods yielded the best results in terms of economy. In cost analyses which were done according to gross profits, strip soil tillage subject by rotary tillage provided the highest gross profit with 1600,10 TL/ha in the first year and strip soil tillage subject by crowfoot cultivator followed it with 1553,48 TL/ha. In the second and third years of the trial, strip soil tillage subject by crowfoot cultivator has provided the highest gross profit with 1172,93 TL/ha and 2547,80 TL/ha.
Key words: Strip soil tillage, second crop maize, reduced soil tillage, stubble drilling, economic analysis

INTRODUCTION

Production of maize, which has an extensive usage field with different purposes, as main and second crop has a great importance as it is the second important cereal crop after wheat. Maize has very important contributions to human and animal feeding. It is, furthermore, an indispensable crop for both the world and our country because of the raw material it provides to the industrial sector and because of the economic benefit it provides to the producer by taking place in sowing turn.

Polyculture agriculture has grown with the increase of irrigated areas in Southeastern Anatolia region. In parallel, maize plant has started to be grown as either main crop or the second crop following cool climate cereals and lentil and increases have been observed in maize production by years. With this purpose, the increase in the economic profit of growing maize in wider areas has provided an awareness and consideration for the losses that pests have caused on the crop.

Maize production areas have started to increase with irrigation as of 1995 in Şanlıurfa. Cereal production values in watery areas are 70000 hectare in last years. By the usage of these areas in second crop maize production or by the growing second crop maize in certain part of the 200000 hectare area where cotton has been grown, maize planting areas will be able to reach to extreme values.

In soil tillage, sowing preparation processes are examined generally in three parts as traditional, reduced and direct sowing. One of the reduced soil tillage methods is strip soil tillage. Strip soil tillage is a protective soil tillage technique that allows 1/3 of the

field surface to be processed for preparation before sowing. In this application, soil tillage is done with drilling generally and soil tillage is done in 5 and 30 cm width in the regions in which the sowing sequence will come back and the regions kept out of this area are left covered by stubble.

Tosun (1975), separated the soil tillage methods into three parts as tearing, overturning and underflow processing the soil. He defended that the methods processing the soil by overturning spoiled the soil structure but the underflow processing had a little damage. Nevertheless, the necessity of avoiding overturning soil tillage and the damage of this process on the physical and chemical structure of the soil were indicated by Çöke (1973).

Yalçın and Sungur (1991), researched the effects of soil tillage combination and direct drilling methods on soil, plant development and yield in second crop maize farming after cereal harvest in the Aegean region. Eventually, they determined that the soil tillage combination needed three times more fuel consumption and higher drawbar pull need besides providing soil moisture protection,, low penetration resistance, a suitable por volume, few grazing, well plant growing and high yield.

Hermawan and Cameron (1993), made a research on the structural changes of traditional soil tillage and minimum soil tillage on soils in New Zealand. In the research, the stability of soil aggregate, the relation between the hollow in the soil and the soil structure, the volume gravity, infiltration status and the resistance of the soils against distribution were tried to be determined. As a result of the research, it was determined that the traditional soil tillage carried out in each year created a decrease in the aggregate stability of the soils, increased the total and macro porosity in the sowing depth of the soil and the minimum soil tillage gave better results directed towards the soil stability in the depth subjacent this, traditional soil tillage reduced the porosity in deeper regions of the soil and increased the resistance of the soil against volume gravity and distribution.

Sağlam *et al.*, (1996), tried to determine the effects of different soil tillage methods on soil and yield in second crop maize in Harran plain conditions. In this study, four different soil tillage methods were used. Cultivator +roller, rotary tillage, plough + rotary tillage stubble burned, and plough + rotary tillage stubble unburned" methods were used. They determined that the first method cultivator + roller had the highest penetration resistance. They pointed out that there was not any significant difference between other methods. Although the renting price of the agricultural processes were lower in the first method, being the yield on a low value as 4430 kg/ha restricted the usability of the method significantly. Besides this, the yields were 8960, 7934 and 9234 kg/ha in second, third and forth methods. In the third and forth methods in which the plough was used, fuel consumptions and renting prices had the highest values among all methods. When the methods were compared, they determined that the second method was an economic soil tillage method for second crop maize farming in terms of the yield values, processes and costs in the region.

Karaağaç (2007), compared five different soil tillage and sowing systems in the study which he carried out in order to compare the different soil tillage and sowing systems technically and economically in second crop maize farming.

The methods used in the trial were;

1. Strip soil tillage and drilling: stubble unburned+ strip soil tillage+ harrow +drilling
2. Reduced soil tillage and drilling: stubble unburned + soil tillage with rotovator + harrow +drilling
3. Ridge drilling: stubble unburned + soil tillage with disc grubber + ridge lister + ridge harrow+ drilling
4. Direct sowing: stubble unburned + stubble drilling
5. Traditional soil tillage and drilling: stubble burned+ soil tillage with disc grubber+ harrow+ drilling

According to the research results, the highest silage yield was obtained from reduced soil tillage methods and the lowest silage yield was obtained from strip soil tillage method. Among the methods, the lowest value in point of fuel consumption the highest value in the point of working yield was obtained from stubble direct drilling. Direct drilling method provided approximately % 85-92 saving according to the other methods in terms of fuel consumption, time consumption and work yield.

MATERIAL AND METHOD

The research has been carried out in Talat Demirören research station in GAP Soil-Water Resources and Agricultural Research Institute in Harran Plain. The research station is in 36 ° 42' North latitude and in 38° 58' longitude and the altitude from sea is 410 m.

The researches were carried out in Harran soil serial that lay over the whole research station and had a wider spread area in the region. Harran serial soils are deep, plain and sloping close to plain, alluvial soils that are consisted of the clay flows coming from Tektek, Fatik and Urfa mountains which surround Harran plain from east, west and north sides. Typical red profiles are with clay structure. All the profile is too limy and contains lime pockets in increasing depth toward the lower parts. They are soils with A,B,C horizon, their pH is between 7.3 - 7.8, their organic matter content is low but their cation change capacity is high (Dinç, 1998).

Agricultural tools and machines used in the trial were tractor with 60 HP, plough with four hulls and in 120 cm work width, septet crowfoot, cultivator which was suitable to process with four lines appropriate among the plant sequence, septet chisel which was suitable to process with four lines appropriate among the plant sequence, rotary tillage type in 215 cm work width, harrow in 300 cm work width, fertilized pneumatic drilling machine with four lines and in 320 cm work width, inter line anchor machine in 210 cm work width with fertilizer extending unit and with three lines and fraise, atomizer with 400 liter storage capacity, in 12 meter work width and in hanging type. RX.788 maize type was used in the trials. The features of the maize type were thus and so. Average plant length was 218 cm, blooming day number was 54.50, corncob height was 109.9 cm, piece corncob ratio was % 81.5 (Kabakçı and Tanrıverdi, 2000).

The trial was carried out in randomized blocks trial design with three repetitions. Parcel dimensions were 25x9.6=240 m^2 and the edge facility proportions were considered in the harvest.

In this study, sowing methods were used with three different reduced soil tillages such as traditional soil tillage, stubble direct drilling and strip soil tillage. In trial parcels, plant inter sequence distance and sequence upper surface distance was considered as 80 cm and 18 cm respectively. Soil tillage machines were designed and arranged as to process maximum % 30 of 80 cm distance of inter sequence with the processing principle of the area on which only the sowing would be done and with the necessity of strip soil tillage. In reduced soil tillage system, a narrow strip on the sequence on which only the seed would be drilled was processed with soil tillage tools and plant inter sequence was left with stubble.

Trial factors:

T1- Traditional soil tillage (Plough + disc harrow+ harrow + drilling)

T2- Stubble direct drilling

T3- Strip soil tillage-1 (Strip soil tillage with chisel + drilling)

T4- Strip soil tillage -2 (Strip soil tillage with crowfoot cultivator + drilling)

T5- Strip soil tillage -3 (strip soil tillage with rotary tillage + drilling) (Rotary tillage blades were designed as to process three lines by being removed to plant inter sequence appropriately)

T6- Stubble ridge direct drilling

Pneumatic sowing machine was used in all the trial subjects.

Human labor time need (man-h/ha)=1/ field working success x the number of personnel who were assigned in the process (numeral)

Field work success (ha/h) = Field (ha) / working time in the field (h) were calculated by using these formulas.

Expenditure on fuel was calculated by the following formula.

Total fuel cost (TL/h) = hourly fuel consumption (L/h) x unit fuel price (TL/L)

Metallic oil cost account was calculated by the following formula.

Metallic oil price : (% 4.5 x fuel consumption amount) x metallic oil unit price (Soğancı.A, 1999).

The stubbles were collected with grubber after the wheat harvest. According to the soil analysis result, the whole 7 kg P_2 O_5 kg/da phosphorous fertilizer was used. As for the 17 kg/da ammonium nitrate, half of it was given in sowing and the other half given as surface fertilizer. 1.2 kg/da maize plant was drilled in all parcels.

The harvest was started in the period on which the maize leaves and corncob holes dried and the seed hardened. The yields were calculated according to the % 14 moisture value.

RESEARCH FINDINGS

Fuel Consumption Values

Total fuel consumptions of the tools and machines used according to the subjects during the trial were given in Table 1. As seen in the table, T1 subject gave the highest fuel consumption value with 85.48 L/ha and T2 subject gave the lowest value with 12.86 L/ha by years. In chi square homogeneity testing applied to the subjects by years, it was observed that the fuel consumption values were homogenous and a combined analysis was done. In combined analysis, as " year x subject " interaction was important, it was evaluated among itself each year. As a result of the variance analysis, the effect of the systems on fuel consumption was found different statistically in % 1 importance level each year and the average comparisons were done according to Duncan classification. According to this, T1 subject had the highest fuel consumption, T2 and T6 subjects had the lowest fuel consumptions in the first year. T2 subject had the highest fuel consumption, T2 and T6 subjects had the lowest fuel consumptions in the second year and nevertheless T1 subject had the highest fuel consumption, T2 and T6 subjects had the lowest fuel consumptions in the third year.

Human Manpower Values

According to the trial subjects, human manpower requirement values were given in table 2. As seen in the table, T1 subject had the highest human manpower value with 16.97 man-h/ha and T2 subject had the lowest value with 4.52 man-h/ha by years.

In Chi Square homogeneity control testing done by years, it was observed that human manpower values were homogenous and a combined analysis was done. In combined analysis, as " year x subject" interaction was important, it was evaluated among itself each year. As a result of the variance analysis, the effect of the systems on human manpower requirement was found different statistically in % 1 importance level each year and the average comparisons were done according to Duncan classification. According to this, T1 subject indicated the highest manpower requirement in first, second and third years and T2 and T6 subjects indicated the lowest requirement in first and second years. In the third year, T2 and T6 subjects indicated the lowest requirement.

Table 1. Fuel consumption values of soil tillage and sowing methods by years and multiple comparison testing results

Years	Repetition	Fuel Consumption Values (L/ha)					
		T1	T2	T3	T4	T5	T6
1st year	1	74.21	13.16	28.99	25.66	29.41	13.54
	2	75.80	11.67	28.34	27.08	28.34	12.71
	3	72.52	13.75	29.17	28.35	31.67	14.58
	Average	**74.18 a**	**12.86 c**	**28.83 b**	**27.03 b**	**29.81 b**	**13.61 c**
2nd year	1	87.00	13.50	30.40	28.40	34.15	14.00
	2	83.18	12.70	31.50	28.77	31.90	13.80
	3	86.26	13.10	31.10	28.30	33.50	12.90
	Average	**85.48 a**	**13.10 d**	**31.00 bc**	**28.49 c**	**33.18 b**	**13.57 d**
3rd year	1	72.23	15.50	38.40	37.90	42.50	15.00
	2	72.83	14.00	40.00	38.40	40.80	14.30
	3	71.90	14.90	38.70	37.50	41.30	14.80
	Average	**72.32 a**	**14.80 d**	**39.03 c**	**37.93 c**	**41.53 b**	**14.70 d**
Averages of the subjects		**77.33**	**13.59**	**32.96**	**31.15**	**34.84**	**13.96**

Table 2. Human Manpower Requirement Of Soil Tillage and Sowing Methods By Years and Comparison Results

Years	Repetition	Human Manpower Requirement (Man-h/ha)					
		T1	T2	T3	T4	T5	T6
1st year	1	15.86	5.35	9.85	8.39	9.38	4.63
	2	14.96	3.9	11.51	9.13	8.41	5.05
	3	14.2	4.48	10.43	9.04	8.77	5.58
	Average	**15.01 a**	**4.58 c**	**10.60 b**	**8.85 b**	**8.85 b**	**5.09 c**
2nd year	1	18.1	5.55	9.61	9.81	10.6	5.65
	2	16.25	4.87	8.55	8.88	9.57	5.13
	3	16.55	5.38	6.93	9.76	9.46	4.70
	Average	**16.97 a**	**5.27 c**	**8.36 b**	**9.48 b**	**9.88 b**	**5.16 c**
3rd year	1	14.78	4.43	8.71	8.45	9.41	4.62
	2	13.81	4.6-3	8.66	8.61	9.94	4.75
	3	14.25	4.51	8.68	8.41	9.43	4.93
	Average	**14.28 a**	**4.52 d**	**8.68 c**	**8.49 c**	**9.59 b**	**4.77d**
Averages of the subjects		**15.42**	**4.79**	**9.21**	**8.94**	**9.44**	**5.00**

Machine Manpower Values

Machine manpower requirement values according to the trial subjects were given in table 3. As seen in the table, T1 subject had the highest machine manpower value with 12.12 machine-h/ha and T2 subject had the lowest value with 1.83 machine-h/ha by years. In chi square homogeneity testing applied to the subjects by years, it was observed that the machine manpower values were homogenous and a combined analysis was done. In combined analysis, as " year x subject " interaction was important, it was evaluated among itself each year.

As a result of the variance analysis, the effect of the systems on machine manpower requirement was found different statistically in % 1 importance level each year and the average comparisons were done according to Duncan classification. According to this, T1 subject took place in group "a" in first, second and third years and T2 and T6 subjects took place in group "d" in the second and third years.

Table 3. Machine Manpower Requirement Of Soil Tillage and Sowing Methods By Years and Comparison Results

Years	Repetition	Machine Manpower Requirement (Machine -h/ha)					
		T1	T2	T3	T4	T5	T6
1st year	1	10.55	2.14	5.74	4.57	5.37	1.85
	2	10.41	1.56	4.63	5.28	5.16	2.02
	3	9.57	1.79	4.57	5	5.23	2.23
	Average	**10.18 a**	**1.83 c**	**4.98 b**	**4.95 b**	**5.25 b**	**2.03 c**
2nd year	1	12.38	2.22	5.43	6.45	6.39	2.26
	2	10.93	1.95	4.79	5.16	5.73	2.05
	3	11.2	2.15	5.1	5.76	5.61	1.88
	Average	**11.50 a**	**2.11 d**	**5.11 c**	**5.79 bc**	**5.91 b**	**2.06 d**
3rd year	1	12.56	2.21	6.5	6.24	7.2	2.31
	2	11.76	2.31	6.45	6.4	7.73	2.38
	3	12.04	2.26	6.46	6.2	7.21	2.46
	Average	**12.12 a**	**2.26 d**	**6.47 c**	**6.28 c**	**7.38 b**	**2.38 d**
Averages of the subjects		**11.27**	**2.07**	**5.52**	**5.67**	**6.18**	**2.16**

Yield Analyses

The best result by yield was obtained from T4 crowfoot cultivator and strip soil tillage + strip drilling method. The yields in these parcels changed between 7996.67 and 9209.33 kg/ha. The average yield was found as 8420.89 kg/ha in these parcels. The lowest yield values were obtained from T1 traditional soil tillage method which was the control subject. The yields in these parcels changed between 5540.00 and 7879.67 kg/ha. The average yield in these parcels was found as 6812.11 kg/ha (Table 4).

In chi square homogeneity testing applied to the subjects by years, it was observed that the yield values were not homogenous and the analysis results related with the yield were evaluated independently for each year. As a result of the variance analysis of the yield values for each year, a difference between subjects was found statistically in % 5 importance level and Duncan classification was done according to this. Any difference between subjects could not be determined in the first year. T3, T4 and T5 subjects took place in group a in the second and third years.

Economic Analysis

Input costs of the tools and the machines used in the trials, fuel consumption, human manpower usage values were obtained as a result of the measurement and calculations and they were given in table 5. In addition to these costs, gross profit analysis was done by adding harvest-threshing and transport, anchoring and maintenance processes, seed-fertilizer-pesticide and irrigation prices (Table 6).

The best result materialized in stubble direct drilling methods named as T2 and T6 and the highest input usage materialized in traditional soil tillage and sowing method named as T1 subject. According to the trial subjects and years, gross income, total expenses and the values which constituted the net incomes were calculated and they were given in table 6. Gross income, gross expense and gross profit values were given in given in table 7 by the summarization of these results.

Table 4. Maize Yield Values of Soil Tillage and Sowing Methods by Years

Years	Repetition	Yield values (kg/ha)					
		T1	T2	T3	T4	T5	T6
1st year	1	10630	10192	8401	12072	9786	7666
	2	6786	7546	7505	8515	8177	7796
	3	6223	8765	7630	7041	10286	9687
	Average	**7879.7 a**	**8834.3 a**	**7845.3 a**	**9209.3 a**	**9416.3 a**	**8383.0 a**
2nd year	1	5880	5210	6800	8390	7620	8170
	2	5520	6030	8400	7320	7680	5560
	3	5220	6180	6840	8280	7880	6500
	Average	**5540.0 b**	**5806.7 b**	**7346.7 a**	**7996.7 a**	**7726.7 a**	**6743.3 ab**
3rd year	1	6600	5850	7890	7500	7040	5707
	2	7300	5300	6970	8500	7420	7045
	3	7150	7020	7720	8170	7480	5850
	Average	**7016.7 ab**	**6056.7 b**	**7526.7 a**	**8056.7 a**	**7313.3 a**	**6200.7 b**
Averages of the subjects		**6812.1**	**6899.2**	**7572.9**	**8420.9**	**8152.1**	**7109.0**

Table 5. Input costs of soil tillage systems

Subjects	Year	Fuel consumption (liter/ha)	Fuel cost[1] (TL/ha)	Metallic fuel cost[2] (TL/ha)	Human manpower use[3]		Total cost (TL/ha)	Average cost (TL/ha)
					(h/ha)	(TL/ha)		
T1	1st year	74.18	148.34	7.78	15.01	22.52	178.64	204.25
	2nd year	85.48	188.8	11.35	16.97	25.46	225.61	
	3rd year	72.32	168.18	11.75	14.28	28.56	208.49	
T2	1st year	12.86	25.72	1.35	4.58	6.87	33.94	38.17
	2nd year	13.10	25.17	1.51	5.27	7.91	34.59	
	3rd year	14.80	34.50	2.44	4.52	9.04	45.98	
T3	1st year	28.83	57.66	3.02	10.60	15.90	76.58	89.87
	2nd year	31.10	63.23	3.80	8.36	12.54	79.57	
	3rd year	39.03	89.77	6.34	8.68	17.36	113.47	
T4	1st year	27.03	54.06	2.83	8.85	13.28	70.17	86.58
	2nd year	28.49	61.29	3.69	9.48	14.22	79.2	
	3rd year	37.93	87.24	6.16	8.49	16.98	110.38	
T5	1st year	29.81	59.62	3.13	8.85	13.28	76.03	95.43
	2nd year	33.18	69.79	4.20	9.88	14.82	88.81	
	3rd year	41.53	95.52	6.75	9.59	19.18	121.45	
T6	1st year	13.61	25.72	1.35	5.09	7.64	34.71	38.54
	2nd year	13.57	25.17	1.51	5.16	7.74	34.42	
	3rd year	14.70	34.50	2.44	4.77	9.54	46.48	

[1]2005 year fuel unit price:2.00 TL/L, 2006 year fuel unit price:2.20 TL/L, 2007 year fuel unit price:2.35 TL/L
[2]2005 year metallic oil unit price:2.33 TL/L, 2006 year metallic oil unit price:2.94 TL/L, 2007 year metallic oil unit price:3.61 TL/L
[3]2005 year hourly workman price value: 1.50 TL/h, 2006 year hourly workman price value: 1.50 TL/h, 2007 year hourly workman price value: 2.00 TL/h

Table 7. Comparison of the results in terms average yield and income according to the results

Subjects	Average yield by years (kg/ha)	Average G.P.V. by years (Gross income) (TL/ha)	Average total input cost by years (TL/ha)	Average gross profit by years (TL/ha)
T1	6812.11	2234.00	1067.54	1166.46
T2	6899.22	2196.74	901.46	1295.28
T3	7572.89	2470.13	953.17	1516.96
T4	8420.89	2726.34	949.88	1776.47
T5	8152.11	2632.78	958.72	1649.76
T6	7109.00	2263.53	901.83	1361.70

Table 6. Economic analysis of the yield results

Subjects	Tools and machines	Year	Average yield (kg/ha)	Crop selling price* (TL/kg)	G.P.V. (Gross income) (TL/ha)	ELEMENTS OF COST FOR DIFFERENT PROCESSES					Total input cost (TL/ha)	Gross profit (TL/ha)	Average gross profit (TL/ha)
						Soil tillage and sowing (TL/ha)	Tractor anchor (TL/ha)	Irrigation, pesticide and maintenance (TL/ha)	Harvest - threshing transport (TL/ha)	Seed-fertilizer and pesticide (TL/ha)			
T1	plough + disc harrow + harrow pneumatic drilling machine	1.Yıl	7879.67	0.26	2048.71	178.64	63.22	91	175	440	947.86	1100.85	
		2.Yıl	5540.00	0.27	1495.8	225.61	66.66	110	194	480	1076.27	419.53	1166.46
		3.Yıl	7016.67	0.45	3157.5	208.49	70	127	223	550	1178.49	1979.01	
T2	Pneumatic drilling machine	1.Yıl	8834.33	0.26	2296.93	33.94	63.22	91	175	440	803.16	1493.77	
		2.Yıl	5806.67	0.27	1567.8	34.59	66.66	110	194	480	885.25	682.55	1295.28
		3.Yıl	6056.67	0.45	2725.5	45.98	70	127	223	550	1015.98	1709.52	
T3	Chisel+ Pneumatic drilling machine	1.Yıl	7845.33	0.26	2039.79	76.58	63.22	91	175	440	845.80	1193.99	
		2.Yıl	7346.67	0.27	1983.6	79.57	66.66	110	194	480	930.23	1053.37	1516.96
		3.Yıl	7526.67	0.45	3387	113.47	70	127	223	550	1083.47	2303.53	
T4	Cultivator+ Pneumatic drilling machine	1.Yıl	9209.33	0.26	2394.43	70.17	63.22	91	175	440	839.39	1555.04	
		2.Yıl	7996.67	0.27	2159.1	79.2	66.66	110	194	480	929.86	1229.24	1776.47
		3.Yıl	8056.67	0.45	3625.5	110.38	70	127	223	550	1080.38	2545.12	
T5	Rotary tillage+ Pneumatic drilling machine	1.Yıl	9416.33	0.26	2448.25	76.03	63.22	91	175	440	845.25	1603.00	
		2.Yıl	7726.67	0.27	2159.1	88.81	66.66	110	194	480	939.47	1146.73	1649.76
		3.Yıl	7313.33	0.45	3291	121.45	70	127	223	550	1091.45	2199.55	
T6	Pneumatic drilling machine + ridge drilling	1.Yıl	8383.00	0.26	2179.58	34.71	63.22	91	175	440	803.93	1375.65	
		2.Yıl	6743.33	0.27	1820.7	34.42	66.66	110	194	480	885.08	935.62	1361.70
		3.Yıl	6200.67	0.45	2790.3	46.48	70	127	223	550	1016.48	1773.82	

* The crop price was taken as the price of TMO via % 14 moisture

As seen in table 7, the highest average gross income with 1776.47 TL/ha per one hectare area was obtained from "strip soil tillage with cultivator + strip drilling" parcels named as T4 by years. The lowest gross income was obtained with 1166.46 TL/ha from "**plough + disc harrow+ harrow+ drilling"** named as T1 control parcel.

DISCUSSION AND RESULT

When the research results were compared with the trials done before, in the research which was carried out by Ferhatoğlu (1989) in order to determine the soil tillage technique of second crop soybean, the sowing subject which was done by soil non tillage stubble direct drilling machine and which provided the highest yield (273.4 kg/da) constituted the first group, the sowing subject which was done by cultivator+ harrow+ soybean drilling machine constituted the second group and the other three subjects constituted the third group. In our study, the sowing subject which was done by cotton drilling machine and stubble ridge direct drilling gave the best result in terms of both yield and economy. Stubble ridge drilling subject was determined as a subject which would be able to be presented to farmer application in the end of the trial. In the study of sesame which was carried out by Çıkman *et al.* (2005), subjects with lower input and with higher yields were determined by examining the stubble drilling and strip soil tillage methods in maize production as an alternative to soil tillage and sowing methods.

The most important step in adapting the results of the trial to practice is both the easily supply and the appliance opportunities of the tools and devices necessary for strip soil tillage drilling done by cultivator by the farmers. In this situation, there are no problems which the producers can encounter. Cultivator is produced by the producers in our city and it is presented to the farmers in the region. It has been determined that the strip soil tillage method which has been done by cultivator is favorable according the traditional method in terms of some inputs. There are some advantages in terms of yield, fuel consumption, machine usage need, human manpower usage need and time. Nevertheless, the greatest problem in such studies is the necessity of preparing other sub projects towards the development of pest eradication methods with wild weed problem.

The yields of the maize were obtained as 6899.22 kg/ha in stubble direct drilling, 7572.89 kg/ha in strip soil tillage drilling with chisel, 8420.89 kg/ha in strip soil tillage drilling with crowfoot anchor cultivator, 8152.11 kg/ha in strip soil tillage drilling with rotary tillage, 7109.00 kg/ha in stubble ridge drilling, 6812.11 kg/ha in soil tillage drilling which was chosen as a control parcel. In the first year of the trial, strip soil tillage drilling with rotary tillage and in the other two years, strip soil tillage drilling with crowfoot anchor cultivator gave the best results in terms of the yield. T5 subject gave the best result with 9416.33 kg/ha in 2005, T4 subject gave the best result with 7996.67 kg/ha in 2006 and again T4 subject gave the best result with 8056.67 kg/ha in 2007. According to the cost analysis result, in the first year, T5 subject with 1603.00 TL/ha had been the most profitable subject according to the subjects and T4 subject with 1555.04 TL/ha followed this. In the second year of the trial, T4 subject with 1229.24 TL/ha had been the most profitable subject and T5 subject with 1146.73 TL/ha followed this. In the third year of the trial, T4 subject with 2545.12 TL/ha had been the most profitable subject.

The soil tillage drilling that has been done with cultivator has given the best result in terms of both yield and gross profit in average of three year period in the trial and strip soil tillage method with cultivator is suggested as the most suitable method as it can be easily applied as well.

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