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Research Article

Input Usage and Difference Analysis in Cotton Production: A Case Study of Hatay Province–Turkey

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Abstract

Cotton has an important place among other industrial products in the world and in Turkey in terms of holding the largest production area, a high export value, and it being a crucial input in the food and animal feed industries. Turkey is the 7th largest cotton producer in the world, and the region of Hatay where the research took place, has an 11.54% share in Turkey's total cotton production area. It has a 10.57% share in unseeded cotton, cottonseed, and in fiber production in Turkey. The primary data of the study were obtained from 136 agricultural enterprises with a 95% confidence interval and a 5% average deviation. In the enterprises that were examined, 7,767 tons of cotton unseed were produced in a 14,674 da area in 2016. The average cotton production area size was found as 108 da and the share of cotton production in the crop pattern was found as 38.20%. In the research area, in order to produce 529.29 kg/da of cotton unseed; 2.6 kg seed, 64.9 kg fertilizer, 0.85 lt agricultural pesticide, 40.5 lt diesel fuel, 641.7 kw electricity, and 2.7 labor force (manpower) were used. According to analysis results; there was a statistically significant difference at a level of 5% between small and large enterprises in terms of fertilizer, labor force, and electricity usage levels. Despite that there wasn't any significant difference between harvest method (by handpicking or machinery) and yield; this result indicates that the enterprises which harvest by machinery gain more income compared to the ones which harvest by hand. There wasn't any significant difference in terms of irrigation method (surface irrigation or drip irrigation) but there was a statistical difference at a level of 5% in terms of income. In other words, the enterprises which use the surface irrigation method gain more income compared to the ones which use the drip irrigation method.

Key words: Cotton, input usage, income, yield, Turkey

Pamuk Üretiminde Girdi Kullanımı ve Farklılık Analizleri: Hatay İli-Türkiye Örneği

Öz

Pamuk Türkiye'de ve dünyada sanayi bitkileri içinde en fazla ekim alanına ve üretime sahip, ihracat pazar değeri yüksek olan, gıda ve yem sanayinde önemli yer tutan stratejik bir üründür. Pamuk, kullanım alanı genişliği ve farklı sektörlerde sağlamış olduğu katma değer bakımından tarım ürünleri içinde özel bir yere ve öneme sahiptir. Dünya pamuk üretiminde Türkiye 7.sırada yer almaktadır. Araştırma alanı olarak belirlenen Hatay İli Türkiye pamuk üretim alanlarında %11.54, kütlü pamuk, çiğit ve lif üretiminde %10.57'lik bir paya sahiptir. Araştırmada kullanılan veriler %95 güven aralığı ve %5 ortalamadan sapma ile belirlenen 136 tarım işletmesinden elde edilmiştir. İncelenen işletmelerde 2016 yılında 14,674 da alanda toplam 7,767 ton kütlü pamuk üretimi gerçekleştirilmiştir. İşletmelerde pamuğun ekim alanı ortalaması 108 da, bitkisel üretim desenindeki payı ise %38.20'dir. Araştırma alanında incelenen işletmelerde birim alandan ortalama 529.29 kg kütlü pamuk elde etmek için; 2.6 kg tohum, 64.9 kg gübre, 0.85 lt tarımsal mücadele ilacı 40.5 lt mazot, 641.7 kw elektrik ve 2.7 EİGB kullanılmıştır. Yapılan analizler sonucunda; küçük işletmeler ile büyük işletmeler arasında gübre, işgücü ve elektrik kullanım düzeyleri bakımından %5 önem düzeyinde istatistiki açıdan anlamlı bir fark olduğu tespit edilmiştir. Pamuk üretiminde hasat yöntemi ile (elle veya makinayla hasat) elde edilen

verim arasında istatistiki yönden bir farklılık olmamakla birlikte, kazanılan gelir bakımından %5 önem düzeyinde bir fark olduğu saptanmıştır. Bu durum, makinalı hasat yapan işletmelerin elle hasat yapan işletmelerden daha fazla gelir elde ettiğini ortaya koymaktadır. Sulama yöntemi (salma sulama ve damlama sulama) ile pamuk verimi arasında, istatistiki açıdan anlamlı bir fark olmamakla birlikte, gelir açısından %5 önem düzeyinde farklılık olduğu anlaşılmıştır. Diğer bir ifade ile salma sulama yapan işletmeler damlama sulama yapan işletmelere göre daha fazla gelir elde etmişlerdir.

Anahtar Kelimeler: Pamuk, Girdi kullanımı, Verim, Gelir, Türkiye

Introduction

It is known that there are over 1000 kinds of fiber plants in the world that are used for different purposes (Bellmann et.al., 2005). Some of the main fiber plants which have economic importance are; cotton, flax, hemp, kapok, jute, ramie, sisal, agave, abaca, etc. Globally, fiber plants are grown in about a 36 million ha area. Other than cotton, jüte, and ramie; fiber plants are losing their importance in the world. In terms of growth area size, cotton takes a share of 91% among fiber plants with 33.4 million ha (FAO, 2017).

Fibers that are aquired from fiber plants are being used in the textile industry, and also to produce products such as sacks, string, rope, paper, straw, brooms, etc. (Brink and Escobin, 2003). The most important sectors are especially, textile, thread, ready to wear, home textile, and carpet industries. Textile and ready to wear industries played important roles in the begining of industrialization in some developed countries such as England, Japan, and North America. Textile is also the one of the main industries in Turkey which provides employment for around 3 million people (Mert and Çopur, 2010).

The Global fiber cotton production amount in the season of 2014/15 was 26.1 million tons. Turkey is the 7th largest cotton producer in the world, and is the 2nd after Australia in yield with 180.9 kg/da. In terms of consumption, Turkey is in 4th place after China, India, and Pakistan with 1,486,000 tons (Anonymous, 2017). Turkey is also one of the main cotton importers in the world due to supply deficit. There was a shortage of 640,000 tons in Turkey's cotton consumption in 2014. According to Turkish Statistical Institute (TSI) data, 913,000 tons of cotton were imported for 1.75 billion US dollars in 2014, and 803.000 tons of cotton were imported for 1.23 billion US dollars in 2015 (Anonymous, 2017).

Among industrial plants, cotton has a special place in research. There are several studies on cotton production economics (Anonymous, 2001; Kaçıra and Karlı, 2004; Özden and Armağan, 2005; Mert and Çopur, 2010; Alemdar, et.al., 2014). There are also studies on the functional analysis of cotton production that were carried out by Chaudhry and Khan (2010) and Bakhsh, et.al. (2016). Since the early 2000's, there have been an increase in studies about energy usage in cotton production (Kousar, et.al., 2006; Polat, et.al., 2006; Zahedi, et.al., 2014). In addition to this, there are also studies about energy efficiency levels in cotton production (Şehri, 2012; Baran, 2016; Gökdoğan, 2016).

This study was carried out in the region of Hatay which is one of the important agricultural basins of Turkey. In the study, labor force and machine power demands in cotton enterprises were presented and input usage amounts for unit area were examined, based on enterprise size. Also, within the study, statistical relations between harvest methods (machinery or handpicking) and yield per area and income values; and statistical relation between irrigation methods (surface irrigation or drip irrigation) and yield per unit area and income values were examined. In the end of the study, solutions were offered in order to increase production in the framework of sustainable agriculture rules..

Material and Methods

Material

Main material of this study consisted of primary data that were gathered from cotton enterprises in the Hatay region by means of the face-to-face interview method in the season of 2016/2017. Also, secondary data were gathered from the Food and Agriculture Organization of the United Nations (FAO), the International Cotton Advisory Committee (ICAC), the Republic of Turkey Ministry of Agriculture and Foresty (MAF), Republic of Turkey the Ministry of Customs and Trade (MCT), and the Turkish Statistical Institute (TSI). National and international reports were also used which were published by several organizations.

Methods

In the economic analysis of agricultural enterprises, it is crucial to gather reliable data. Accounting records are important information sources about enterprises' financial and physical assets (Aras, 1988). However, in this study a questionnaire study was carried out due to a lack

of accounting records in agricultural enterprises in Hatay province.

In order to determine the sample villages and enterprises, the "Stratified Random Sampling Methods" was used by means of data that were obtained from the Farmers' Registration System (FRS) records of MAF.

Yield is measured as partial yield and Total Factor Yield (TFY) (Prinççioğlu, 1998). In simple terms, yield is the output amount per input in a certain amount of time (Mc Connell and Dillon, 1997). The factor proportion in output gives partial yield. In the study, the TFY was calculated as the total input proportion in the total output amount.

The Republic of Turkey-Ziraat Bank interest rate for plant production in 2016 was considered in calculations for the average cotton sale price, the foreign labor payment, and the capital in cotton production (Yılmaz and Yurdakul, 2000).

The formula of the "Stratified Random Sampling Methods" that was used to determine the sample size was given below (Yamane, 2010);

$$n = \frac{[\Sigma(Nh * Sh)]^2}{N^2 * D^2 + \Sigma(Nh * Sh)^2}$$

n= Sample size
Nh= Number of unit at hth layer
Sh= Standard deviation at hth layer
N= Total unit number that belongs to the sampling frame
D= The margin of error (d/t): D2 = (d / t)2
d=Deviation ratio from average
t= "t value" in the distribution table at a degree of freedom (N-1) and at a confidence limit (Erkan and Çiçek, 1996).

In this study, 136 cotton enterprises were determined as the sample size with a 5% margin of error, and at a 95% confidence interval. Cotton enterprises were divided into two groups depending on their size as follows;

a) Small enterprise (<100 da)
b) Large enterprise (>100 da).

Cotton production income was calculated as below;

Total Income (TL): Yield (kg/da) x Product Sale Price (including subsidies)

The 2016 fall/winter prices and commodity exchange market prices were taken into consideration in order to determine the cotton purchase price. Along with the cotton purchase price, subsidies that were provided by the Ministry of Agriculture and Foresty (MAF) were used to calculate producer's cotton income.

Within the study; the irrigation methods, and the statistical differences between input usage amounts and harvest were analyzed by means of the ''T-Test''. In the analysis, enterprises were divided into two groups according to their size as ''enterpises below 100 da" and "above 100 da''.

A "T-test" was used to determine statistical relations between harvest methods (machinery or handpicking) and yield per area and income values; and statistical relation between irrigation methods (surface irrigation or drip irrigation) and yield per unit area and income values (Green et.al., 2000; Gujarati, 2009).

Results and Discussion

Cotton production in the world and in Turkey

Global cotton fiber production amount in the season of 2014/15 was 26,130,000 tons. Turkey took 7th place in world's cotton production with 847,000 tons which was 3.24% of the global cotton production (Anonymous, 2017). The first 8 cotton producing countries provide 86.44% of the world's total cotton production (Table 1).

Table 1. Global cotton fiber production (2014/15)

Countries	Production Amounts (ton)	Share (%)
India	6,510,000	24.91
China	6,480,000	24.80
USA	3,550,000	13.59
Pakistan	2,310,000	8.84
Brazil	1,550,000	5.93
Uzbekistan	890,000	3.41
Turkey	847,000	3.24
Australia	450,000	1.72
Others	3,543,000	13.56
Total	26,130,000	100.00

Source: Anonymous, 2017.

According to the International Cotton Advisory Committee (ICAC) report; the global cotton fiber production amount was around 26,000,000 tons in the seasons of 2013/14 and 2014/15. However, with a decrease of 5,000,000 tons, it dropped to 21,000,000 tons in the season of 2015/16 (Anonymous, 2016).

Cotton production in the research area

According to the TSI data of 2016; 2,100,000 tons of cotton unseed, 1,260,000 tons of cottonseed, and 756,000 tons of fiber were produced in a 4,160,098 da area in Turkey. Hatay's share in Turkey's cotton production area was 11.54%, and 10.57% in Turkey's total cotton unseed, cottonseed, and fiber production (TSI, 2017). Also, cotton farming has a 14% share of Hatay's total farming area (MAF, 2017) (Table 2).

Hatay's yield rates were more than Turkey's average yield by; 9.11% in cotton unseed, 9.24% in cottonseed, and 8.79% in fiber (Table 3).

Table 2. Cotton production in Turkey (2016)

Criteria	Cultivation Area (decare)	Harvest Area (decare)	Production (ton)	Yield (kg/da)
Cottonseed	4,160,098	4,160,023	1,260,000	303.00
Hatay region (%)	10.57	10.57	11.54	109.24
Cotton unseed	4,160,098	4,160,023	2,100,000	505.00
Hatay region (%)	10.57	10.57	11.54	109.11
Cotton (Fiber)	4,160,098	4,160,023	756,000	182.00
Hatay region (%)	10.57	10.57	11.54	108.79

Source: TSI, 2017. (avaliable at: https://biruni.tuik.gov.tr/bitkiselapp/bitkisel.zul)

Table 3. Cotton production in Hatay (2016)

Criteria	Cultivation Area (decare)	Harvest Area (decare)	Production (ton)	Yield (kg/da)
Cottonseed	439,594	439,594	145,416	331
Cotton unseed	439,594	439,594	242,357	551
Cotton fiber	439,594	439,594	87,248	198

Source: TSI, 2017. (avaliable at: https://biruni.tuik.gov.tr/bitkiselapp/bitkisel.zul)

The total agriculture area in the research was 38,410 da. In terms of the crop pattern of the research area; cotton production was the main product with 38.20%; wheat was second with 28.67%; and corn was third with 8.17%. The cotton production area average per enterprise was found as 108 da, and in total 7,766.9 tons of cotton were produced in a 14,674 da area in 2016. The average cotton yield was found as 529.3 kg, and the income from cotton production for a decare was found as 922.6 TL which excluded agricultural subsidies (Table 4).

Table 4. Cotton production in the research area (2016)

Cultivation Area (decare)	Production (ton)	Yield (kg/da)	Cotton Income (TL/da)
14,674	7,766.86	529.29	922.61

A study was carried out by Özüdoğru et.al. (2015) in the regions of Şanlıurfa, Aydın, Adana, Hatay, and Diyarbakır which provide 80% of the cotton production in Turkey. In total, 292 surveys were carried out with cotton producers, and 38 of those surveys took place in Hatay. The findings from the research were as follows (the findings from Hatay were stated in parenthesis); producer age average was 50.05 (45.82), years of education were 7.83 (7.56), years of experience in agriculture were 25.57 (21.72), and the household number was 5.36 (6.86). The land size was 462.39 da (246.35 da), the cotton cultivation area was 190.15 da (131.55 da), yield was 483.20 kg/da (489.02 kg/da), and the sale price was 1.45 TL/kg (1.56 TL/kg).

Yılmaz and Gül (2015), determined production costs and profitability levels of cotton production in their study that was carried out in the region of Antalya. According to the research findings of 2011, gross output value per decare was 817.4 TL, and average cotton yield per decare was 391.3 kg.

In a report that was published by the National Cotton Council about costs in cotton production from different regions in Turkey; current cotton production cost average per decare in 2016 was 1,040 US$, and average cotton unseed yield was 478 kg/da which was closer to TSI data (462 kg/da). According to these yield values, cotton unseed cost in Turkey was predicted as 2.25US$/kg in 2016 (Anonymous, 2016).

Difference Analyses in cotton production

Input usage situation in the enterprises which were examined

In order to produce 7,766,864 kg cotton unseed in the 14,674 da (529.29 kg/da) research area; 38.4 tons seed, 952.2 tons fertilizer, 12.5 tons agricultural pesticides, 594.2 lt diesel fuel, 9417763.71 kw electricity, and 39,161 labor force were used. Among the inputs, diesel fuel was used most for cultivation (Table 5).

Table 5. Input usage in cotton production

Inputs	Enterprise Groups								
	Small Enterprises (<100da)			Large Enterprises (>100da)			Total		
	Total	The number of enterprises	The amount per decare	Total	The number of enterprises	The amount per decare	Total	The number of enterprises	The amount per decare
Diesel fuel									
Cultivation	68,799.90	63	20.12	217,669.88	73	19.34	286,469.78	136	19.52
Care Operations	44,722.10	63	13.08	131,979.55	73	11.73	176,701.65	136	12.04
Irrigation	17,609.50	31	5.15	40,664.05	31	3.61	58,273.55	62	3.97
Harvest	6,881.20	25	2.01	33,036.75	47	2.94	39,917.95	72	2.72
Transportation	7,539.05	63	2.21	25,331.52	73	2.25	32,870.57	136	2.24
Total Diesel Fuel (lt)	145,551.75	63	42.57	448,681.75	73	39.87	594,233.50	136	40.49
Seed (kg)	9,116.40	63	2.67	29,305.30	73	2.60	38,421.70	136	2.62
Fertilizer (kg)	237,050.65	63	69.33	715,181.91	73	63.54	952,232.55	136	64.88
Pesticides (lt)	2,794.36	63	0.82	9,671.77	73	0.86	12,466.12	136	0.85
Labor Force (MP)	12,348.24	63	3.61	26,813.59	73	2.38	39,161.83	136	2.67
Electricity (Kw)	1548491.96	40	452.91	7869271.75	59	699.18	9417763.71	99	641.71

In the research area; 2.62 kg of seeds, 64.88 kg of fertilizer, 0.85 lt of agricultural pesticide, 40.49 lt of diesel fuel, 641.71 kw of electricity, and 2.67 of labor force were used in order to obtain 529.29 cotton unseed from a unit area.

In a study that was conducted by Yılmaz et.al. (2005), direct and indirect energy inputs in cotton production per hectare were examined. According to the research results, 4.973 Gjda-1 energy was used in cotton production; 31.1% was

diesel fuel, followed by fertilizer and machinery as the energies that were used most. The energy input/output ratio was 0.74, and energy productivity was found as 0.06.

Dağıstan et.al. (2009) aimed to determine energy input and output in cotton production in the Hatay region. In the study, average energy usage was found as 1,956 MJda-1. The distribution of energy sources were; 2.87% was direct energy, 71.13% was indirect energy, and 12.30% of it was renewable energy. Energy usage productivity was calculated as 2.36. The total energy input requirement to produce 1 kg of cotton was predicted as 4.99 MJ. Energy inputs that were used most were; nitrogenous manure (40.28%), irrigation water (22.37%), and diesel fuel (17.04%). In the research area, cotton production cost was 224,6 US$/da. Also in the study, cotton production was found economically productive according to the benefit cost ratio which was 1.24.

The labor and machinery power requirements for cotton production in the research area were given in Table 6. According to the research findings, the machinery power requirement was 1.75 hour/da, and the labor force requirement was found as 13.65 hour/da.

Table 6. Labor force and machinery power requirements in cotton production (hour/da)

Operations	Machinery (hour/da)	Labor Force (hour/da)
Cultivation	0.51	0.73
Planting and fertilizing	0.11	0.14
Weeding	0.36	10.35
Fertilizing	0.10	0.14
Agricultural spraying	0.49	0.63
Irrigation	0.00	1.37
Harvest	0.18	0.29
Total	1.75	13.65

According to the research findings, 29.14% of the machinery power requirements consisted of cultivation, and that was followed by agricultural spraying (pesticide application), and weeding as machinery power requirements. In terms of the labor force requirement in cotton production, weeding took first place with 75.82%, and this was followed by irrigation and cultivation.

Input usage average differences between enterprises which were smaller than 100 da and larger than 100 da were analyzed by the “T-Test”. According to the test result, a statistical difference was found in fertilizer, labor force, and electricity usage at a 5% significance level. There wasn’t any significant difference in terms of diesel fuel, seed, or pesticide usage amounts. Accordingly, while fertilizer and labor force usage amounts were greater in small enterprises, the electricity usage amount was found to be higher in large enterprises (Table 7 and 8).

Table 7. Input usage levels in cotton production based on enterprise size

Inputs	Enterprise Size (da)	N	Mean	Std. Dev.	Std. Err. Mean
Diesel Fuel	<100	63	42.91233	8.166360	1.028865
	>100	73	40.51568	8.770384	1.026496
Seed	<100	63	2.67778	.237048	.029865
	>100	73	2.61507	.254772	.029819
Fertilizer	<100	63	68.79048	16.794564	2.115916
	>100	73	62.66356	17.630223	2.063462
Pesticide	<100	63	.81641	.159778	.020130
	>100	73	.86116	.162438	.019012
Labor Force	<100	63	3.64065	2.150997	.271000
	>100	73	2.36715	2.058977	.240985
Electricity	<100	63	450.99957	397.639166	50.097826
	>100	73	693.09130	426.123303	49.873960

Table 8. Statistical input usage differences in cotton production

Inputs	Levene's Test for Equality of Variances		"t-test"		
	F	Sig.	t	df	Sig.
Diesel Fuel	.211	.646	1.640	134	.103
Seed	.078	.780	1.478	134	.142
Fertilizer	.125	.724	2.066	134	.041(*)
Pesticide	.106	.746	-1.614	134	.109
Labor Force	.632	.428	3.523	134	.001(*)
Electricity	.437	.510	-3.407	134	.001(*)

(*)at a 5% significance level

Cotton harvest

In the research area the harvest operation was being conducted in two ways, by machinery or by handpicking. Among the enterprises, 58.38% of them were conducting harvest operations by machinery, and the rest were conducting it by handpicking (Table 9).

Table 9. Information about harvest by machinery in cotton

No	The number of enterprises	Area (da)	Production (kg)	Yield (kg/da)
Small Enterprises	25	1,393	764,158	548.57
Big Enterprises	47	7,174	3,665,987	511.01
Total	72	8,567	4,430,145	517.12

Yield in the machinery method was 517.12 kg/da, and was 555.42 kg/da in the handpicking method. In other words, comparing to the machinery method, handpicking was found to be 7.39% more productive (Table 10).

In the research area, 57.34% of the cotton was being harvested by machinery, and 42.66% of it was being harvested by handpicking (Table 11).

Table 10. Information about harvest by handpicking in cotton

No	The number of enterprises	Area (da)	Production (kg)	Yield (kg/da)
Small Enterprises	38	2,026	1,092,244	566.38
Big Enterprises	26	4,081	2,244,475	549.98
Total	64	6,107	3,336,719	555.42

Table 11. Information about cotton production based on harvesting method

Criteria	Total	Machinery	(%)	Handpicking	(%)
Area (da)	14,674	8,567	58.38	6,107	41.62
Production (kg)	7,767,864	4,430,145	57.34	3,391,969	42.66

In summary, the handpicking method level was found high. Despite that the amount that was gained by the handpicking method seemed higher than the machinery method, the handpicking method decreases the product efficiency (quality) and the product value.

Yield, and in income values in terms of harvest method

Statistical differences in yield, and in income values in terms of harvest method were analyzed by the "T-Test". There wasn't any significant difference between harvest method and yield, but there was a difference in terms of income at a 5%

significance level. So, it was found that enterprises which were harvesting by machinery were gaining more income (Table 12 and 13).

Table 12. Statistics about cotton harvest

	Harvest Method	N	Mean	Std. Dev.	Std. Err. Mean
Yield	Handpicking	64	543.71875	122.802263	15.350283
	Machinery	72	529.50000	74.142801	8.737813
Income	Handpicking	64	1290.03531	294.400729	36.800091
	Machinery	72	1394.11694	225.392683	26.562782

Table 13. Differences in yield, and in income values in terms of harvest method

	Levene's Test for Equality of Variances		T-Test		
	F	Sig.	t	df	Sig.
Yield	8.976	.003	.828	134	.409
Income	2.461	.119	-2.329	134	.021(*)

(*)at a 5% significance level

Irrigation in cotton

Among the enterprises in the research area, 71.45% (103) of them were using the surface irrigation method. The yield average of the enterprises was found as 535.4 kg/da (Table 14).

Among the enterprises, 33 of them were using the drip irrigation method. Cotton yield was found to be 16.47% more in group 1 (Table 15).

While the surface irrigation usage ratio was 72.28%, the drip irrigation usage ratio was found as 27.72% (Table 16).

Table 14. Information about surface irrigation in cotton production

No	The number of enterprises	Area (da)	Production (kg)	Yield (kg/da)
Small Enterprises	54	2,951	1,581,272	535.84
Big Enterprises	49	7,534	4,032,865	535.29
Total	103	10,485	5,614,137	535.44

Table 15. Information about drip irrigation in cotton production

No	The number of enterprises	Area (da)	Production (kg)	Yield (kg/da)
Small Enterprises	9	468	275,130	587.89
Big Enterprises	24	3,721	1,877,597	504.59
Total	33	4,189	2,152,727	513.90

Table 16. Information about drip and surface irrigation methods in cotton production

Criteria	Total	Surface	(%)	Drip	(%)
Area (da)	14,674	10,485	71.45	4,189	28.55
Production (kg)	7,766,864	5,614,137	72.28	2,152,727	27.72

Yield, and in income values in terms of irrigation method

Statistical differences in yield, and in income values in terms of irrigation method were analyzed by the "T-Test". There wasn't any significant difference between irrigation method and yield. There was a significant difference in terms of income at a 5% significance level. According to this result, it was concluded that enterprises which were using the surface irrigation method were gaining more income compared to the ones which

were using the drip irrigation method (Table 17 and 18).

Table 17. Information about irrigation methods

	Method	N	Mean	Std. Dev.	Std. Err. Mean
Yield	Surface	103	537.78788	77.613931	13.510851
	Drip	33	535.67961	106.381501	10.482081
Income	Surface	103	1424.04000	249.523820	43.436522
	Drip	33	1319.85786	265.142312	26.125248

Table 18. Differences in yield, and income values in terms of irrigation method

	Levene's Test for Equality of Variances		"t-test		
	F	Sig.	t	df	Sig.
Yield	2.162	.144	.105	134	.916
Income	.396	.530	1.992	134	.048(*)

(*):at a 5% significance level

Conclusions

Among fiber plants, cotton has an important place due to its specific characteristics. Turkey is in 7th place in the fiber production of the world. However, Turkey imports as much cotton fiber as it produces.

The Hatay region is an important area in Turkey in terms of cotton production. According to TSI data of 2016; Hatay has a share of 11.54% of Turkey's cotton production area and has a share of 10.57% in Turkey's total cotton unseed, cottonseed, and fiber production. In the research area, input usage in cotton production was analyzed in different aspects.

One of the biggest cost items in cotton production is energy (regardless of ground rent). In the research area, around 85% of the producers were irrigating their lands from underground water that was pumped out by means of diesel fuel and/or electrical power. This situation effects production costs directly. Primarily, solving the problems with the irrigation water supply would decrease production costs considerably.

According to the analyzed results, there were statistical differences between small enterprises and large enterprises in terms of fertilizer, labor force, and electricity usage levels at a 5% significance level. There wasn't any significant difference between harvest method and yield average, however, a significant difference was found in terms of income and harvest method at a 5% significance level. In other words, enterprises which were harvesting by machinery were gaining more income than the ones which were harvesting by hand. There wasn't any statistical difference between irrigation method and yield average but there was a significant difference in terms of income at a 5% level. Enterprises which were using the surface irrigation method were gaining more income than the ones which were using the drip irrigation method. However, this finding is not enough by itself to make a conclusion that drip irrigation gains more income. At this point it is also necessary to examine other input usage levels between drip and surface irrigated enterprises, which is a topic for a different study. Therefore, it is necessary to conduct studies that focus on the relationships between irrigation methods, yield, and income.

Cotton production is one of the field crops that requires intensive input usage, and this situation directly affects production costs. Accordingly, the amount of subsidies for cotton production such as, deficiency payments and field size based subsidies provided by MAF, increased in 2019 compared to the previous years. Within the study, it was found that diesel fuel and fertilizer costs had more importance than the other inputs. Therefore, cotton producers have the expectation of an increase in subsidy values for both diesel fuel and fertilizer. Moreover, it is also necessary to use more realistic methods in the determination of deficiency payment amounts.

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