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Calculation of Standard Working Hours According to Production Activities in Agricultural Enterprises

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Abstract: This study was conducted to analyze the labor in the agricultural sector and determine the employment structure according to production activities for a micro-scale structure. Within the scope of this study, according to the production patterns of agricultural enterprises, the working time realized during the season on 1 decare area was calculated. Although many components are effective on the working time of the labor, technological changes, qualifications, and skills of the labor have been ignored. In this study, agro-ecological areas were taken into consideration to make an evaluation by considering ecological, geological, and topographical conditions. The findings showed that these variables were effective on working hours. The calculated working hours were based on 1 male labor unit for 1 decare. For all regions, tomato was the crop that required the most time in production, and the average working time per decare was 127 hours 41 minutes. After tomato, apple with 119 hours 55 minutes and cherry with 111 hours 16 minutes were the crops requiring the longest working hours in Konya province. It is expected that the products grown in the research region will be a reference for standardized working hours and contribute to the studies to be conducted for planning the workforce and increasing the agricultural employment potential in the region.

Tarım İşletmelerinde Üretim Faaliyetlerine Göre Standart Çalışma Sürelerinin Hesaplaması

Anahtar Kelimeler
İşgücü,
Tarım,
Standart işgücü,
Çalışma süresi,
Tarımsal işgücü

Öz: Tarım sektöründeki işgücü varlığının analiz edilebilmesi ve mikro ölçekte bir yapı için üretim faaliyetlerine göre istihdam yapısının belirlenebilmesi amacıyla bu çalışma gerçekleştirilmiştir. Çalışma kapsamında tarım işletmelerinin üretim desenlerine göre 1 dekar alanda sezon boyunca gerçekleştirilen çalışma zamanları hesaplanmıştır. İşgücünün çalışma zamanına yönelik olarak birçok bileşen etkili olsa da teknolojik değişimler, işgücünün sahip olduğu nitelik ve yetenekler göz ardı edilmiştir. Çalışmada ekolojik, jeolojik ve topografik koşulların dikkate alınarak bir değerlendirme yapılabilmesi amacıyla agro-ekolojik alanlar dikkate alınmıştır. Söz konusu değişkenlerin çalışma süreleri üzerinde etkili olduğu belirlenmiştir. Hesaplanan çalışma süreleri 1 dekar için 1 erkek işgücü birimi üzerinden gerçekleştirilmiştir. Tüm bölgeler için üretiminde en çok zamana ihtiyaç duyulan ürün domates olup, dekarda çalışma süresi ortalama 127 saat 41 dakikadır. Domatesten sonra 119 saat 55 dakika ile elma ve 111 saat 16 dakika ile kiraz Konya ilinde en uzun çalışma sürelerini gerektiren ürünlerdir. Araştırma bölgesinde yetiştirilen ürünlerin standartlaşmış çalışma süreleri için referans olması, işgücünün planlaması ve bölgedeki tarımsal istihdam potansiyelinin artırılması için yapılacak çalışmalara katkı sağlaması beklenmektedir.

1. INTRODUCTION

In all global markets and economies, the focus is on increasing productive capacity and production volume; in short, economic growth is targeted. Within the framework of these targets, it is necessary to determine the contribution of cultural, scientific, institutional, and technological factors to economic growth [1]. The analysis of sectoral contributions is critical in economic growth processes, and it is necessary to determine partial productivity increases in agricultural and non-agricultural sectors [2]. Standardized and scientifically accepted data are needed for the theoretically accurate calculation of productivity and for comparisons at regional, national, and international levels. These data will be a reference for comparison and evaluation processes. However, it should not be ignored that this is a theoretical assumption. Structural changes in the economy make it difficult to set and manage standards, particularly for labor markets. The emergence of labor-intensive services that require less capital in the market, the restructuring of firms by taking into account numerical flexibility as a result of increased competition, the reduction of costs by firms through technological innovation, the emergence of new markets, the facilitation of employers' hiring and firing of workers through flexibility provisions in labor laws, the visibility of women in the labor market and employers' search for flexibility have increased non-standard forms of work [3-4]. In line with these effects, there has been a change in the organic structure of employment relations, and the agricultural sector has also been part of this change. Organizational units, the conditions that will arise for work areas, and the use of many inputs that can be measured in different units will produce many different outputs [5-6]. In addition, in labor-intensive sectors, such as agriculture, the qualifications and competencies of the labor will also cause productivity to change. Standardizing the working conditions of the agricultural labor is significant in increasing efficient production and quality. While standards pave the way for planned production, production processes should also be developed on this basis. In the agricultural sector, it is necessary to establish specific working standards to improve the performance of the labor working outside the enterprise and to create efficient work by combining work and knowledge.

Seasonal working conditions in the agricultural sector, especially in crop production, prevent the standardization of the workforce, which is reflected in contractual, wage and social security conditions. Non-standardized employment leads to much lower incomes than standard jobs. For example, in EU countries, temporary jobs are paid on average 20% less than permanent jobs [7-8]. Short-term work allows employers to avoid redundancy costs and offers numerical flexibility with easy hiring and firing [9]. Non-standardized forms of work are usually characterized by fixed-term or short-term work [10-11]. Setting standards for working hours in agricultural enterprises is crucial for the sustainability of the enterprise. In terms of accounting for the activities in the enterprise and determining product prices, the reference prices in the agricultural sector constitute the labor given to the product. The wages of the people who work in agricultural production units and carry out production are expressed in labor expenses. Since these expenses can be directly associated with the cost of the product, they are directly charged to the cost of the product. Apart from the main labor expenses, wages, such as overtime work and product premiums, are also included in direct labor expenses [12-13]. Considering the time worked by the entrepreneur and his family members as labor in the cost calculation, "if the entrepreneur and his family members did not work, the work done by them would be done by foreign labor for a fee" and secondly," it should provide the opportunity to compare with enterprises employing foreign labor" [14]. The labor and time spent on agricultural work are usually calculated in real prices. For example, if hoeing is done by unpaid family labor, the total working time spent on hoeing should be considered, as well as the prevailing labor wages in the region [14].

Agricultural labor and labour practices play a central role in the sustainability of enterprises [15-16] and are one of the main components of social sustainability [17-18]. Therefore, planning for agricultural enterprises is likely to contribute to the effective and efficient use of resources. However, it is necessary to regulate the labor and working conditions within the enterprise. Since the agricultural sector constitutes the basis of economic activities, the successful implementation of planning in the sector will directly contribute to the management and planning of other sectors. Given the changing conditions for agricultural production and the constraints specific to agricultural production, it is necessary to calculate product-based standard working hours in rural areas. Within the scope of this study, working hours were calculated by considering agro-ecological regions and product pattern with a micro-scale application.

2. MATERIAL AND METHOD

The study was conducted with the permission of Selcuk University, Agricultural Faculty, Scientific Ethics Committee, decision numbered 528366 dated 01.06.2023.

Agro-ecological zones refer to regions divided into sub-areas with similar environmental characteristics, potential yield, and land suitability [19]. Konya is among the provinces with high agricultural production potential in Türkiye. The province stands out in terms of its high product diversity and agricultural employment diversity. Agro-ecological zones of Konya province is provided in Table 1 below.

Table 1. Agro-Ecological Zones of Konya Province

Region	Districts in the Region	Area (ha)	Percentage (%)	Annual (mm)
Region 1	Çumra, Karatay, Meram, Selçuklu	704.649	16.90	<400
Region 2	Akören, Ahırlı, Bozkır, Güneysınır, Hadim, Taşkent, Yalıhüyük	525.234	12.60	>400
Region 3	Akşehir, Ereğli, Halkapınar, Ilgın, Tuzlukçu	597.982	14.30	>400
Region 4	Beyşehir, Derbent, Derebucak, Doğanhisar, Hüyük, Seydişehir	589.385	14.20	<400
Region 5	Altınekin, Cihanbeyli, Çeltik, Emirgazi, Kadınhanı, Karapınar, Kulu, Sarayönü, Yunak	1.752.150	42.00	<400
Total	31 District	4.169.400	100.00	-

Source: [20-21]

There were more than 120,000 agricultural workers employed only in the livestock sector in Konya. This study was carried out to determine the perspective towards the labor employed permanently and seasonally in various jobs. A stratified random sampling method was used to determine the number of enterprises to be surveyed; 5% error and 90% confidence limits were used. As in determining the number of surveys, Yamane's [22] formula was used to determine the stratum distribution. In line with the results obtained, 375 surveys were conducted in 2022. The questionnaires were obtained from face-to-face data. Accordingly, the distribution of the number of enterprises to be surveyed according to districts and strata was determined by proportioning the number of enterprises of each district to the "k" value of the strata (number of enterprises/k).

Table 2. 1st Region Distribution of Survey Numbers by Districts

Region 1	Total Number of Enterprises	1st Layer	2nd Layer	3rd Layer
	Sample Number	3	25	49
	k value	5.076	609	311
Çumra	5.548	1	9	18
Karatay	5.621	1	9	18
Meram	2.126	0	3	7
Selçuklu	1932	0	3	6
Toplam	15.227	3	25	49

Table 3. 2nd Region Distribution of Survey Numbers by Districts

Region 2	Total Number of Enterprises	1st Layer	2nd Layer	3rd Layer	4th Layer
	Sample Number	3	14	23	10
	k value	1.363	292	178	409
Akören	630	0	2	4	2
Ahırlı	386	0	1	2	1
Bozkır	780	1	3	4	2
Güneysınır	980	1	3	6	2
Hadim	1.024	1	4	6	3
Taşkent	171	0	1	1	0
Yalıhüyük	118	0	0	1	0
Toplam	4.089	3	13	23	10

Table 4. 3rd Region Distribution of Survey Numbers by Districts

Region 3	Total Number of Enterprises	1st Layer	2nd Layer	3rd Layer	4th Layer
	Sample Number	2	18	49	19
	k value	8.700	967	405	916
Akşehir	4.215	0	4	10	5
Ereğli	5.585	1	6	14	6
Halkapınar	499	0	1	1	1
Ilgın	5270	1	5	13	6
Tuzlukçu	1.830	0	2	5	2
Toplam	17.399	2	18	43	19

Table 5. 4th Region Distribution of Survey Numbers by Districts

Region 4	Total Number of Enterprises	1st Layer	2nd Layer	3rd Layer
	Sample Number	6	30	47
	k value	1.663	333	212
Beyşehir	2.895	2	9	14
Derbent	824	1	2	4
Derebucak	128	0	0	1
Doğanhisar	2098	1	6	10
Hüyük	1.571	1	5	7
Seydişehir	2.460	1	7	12
Toplam	9.976	6	30	48

Table 6. 5th Region Distribution of Survey Numbers by Districts

Region 5	Total Number of Enterprises	1st Layer	2nd Layer	3rd Layer
	Sample Number	3	28	52
	k value	12.001	1.286	692
Altınekin	3.085	0	2	4
Cihanbeyli	6.215	1	5	9
Çeltik	1.677	0	1	2
Emirgazi	1905	0	1	3
Kadınhanı	4.758	0	4	7
Karapınar	5.263	0	4	8
Kulu	4.856	1	4	7
Sarayönü	3.622	0	3	5
Yunak	4.621	1	4	7
Toplam	36.002	3	28	52

The total amount of labor that agricultural enterprises have is a factor that restricts production processes. To calculate the amount of labor used in agricultural production, a standard male labor unit is needed. "Standard Male Labor Unit" (SMLU) is the value of an average labor working at most 8 hours a day [23]. In this study, the working hours of an ESU (between the ages of 15-49) needed based on crops on one decare of land according to the agro-ecological regions of Konya province were calculated. Regarding the use of labor, the unit of time measurement (hours, minutes) is the most appropriate distribution method. For example, it is a very healthy measure since the hours of machine and labor used in tillage activities overlap [13]. Thus, the hour unit was used to express the labor within the scope of this study.

3. RESULTS

Working hours by crop differ according to the climatic and topographical characteristics of agro-ecological regions. For example, Akören, Ahırlı, Bozkır, Güneysınır, Hadim, Taşkent, and Yalıhüyük districts are in the second region. These districts are generally mountainous, and their land structures are small and fragmented. This situation causes the working time of the enterprises to be prolonged due to their land structures, even if the tractor-pulling power and machinery and equipment features are similar. The level of specialization of the workforce in the study area was ignored to determine a standard working time. Because, although the labor does not have similar physical characteristics in every enterprise, the practices acquired for the work, the techniques used and the way the work is done are the features that directly affect the change in working hours.

In addition to climatic and topographical characteristics, the environmental and economic opportunities of the enterprises may also cause changes in the duration of work. In crops, such as wheat, barley, and chickpea, which are both irrigated and dry farmed, working hours vary according to irrigation activities. For example, in the first region where Çumra, Karatay, Meram and Selçuklu districts are located, the same procedures are applied for irrigated barley and wheat and three hours and 28 minutes of work is needed for all operations from planting to harvesting in one decare. For wheat and barley produced in the dry, 52 minutes of working time is sufficient. Therefore, in irrigated areas where sprinkler irrigation is used, separate working time is needed for laying, transporting, and collecting the pipes and working times differ.

Tomato is the crop that requires the most working time on average across all regions. In the third region, which includes the districts of Akşehir, Ereğli, Halkapınar, Ilgın and Tuzlukçu, the working time required for tomato, which is cultivated mainly in Ereğli, is 127 hours and 41 minutes for a male laborer. Intensive labor is needed for tomatoes, especially during irrigation, top rowing, hoeing, and harvesting periods. After tomatoes, apple is the crop that requires the most working time. For apples, 119 hours, and 55 minutes of working time is needed for a male labor in one decare of land in the regions' average. Although the working time varies according to the variety and yield in apple production, considering that there are approximately 200 trees and an average yield of 100 kg per tree in semi-dwarf varieties grown throughout Konya, the average working time required in the harvest period for one decare is 63 hours and 39 minutes. In addition, acting precisely in apple harvesting is significant for the preservation and trade of the fruit and is effective in extending the working time. The third product that requires the longest working time is cherry. The average working time of cherries in the regions is 111 hours and 16 minutes. In cherry production, harvesting accounts for approximately 50.00% of the working time.

Table 7. Standard Working Hours in the Agricultural Enterprises Investigated are Presented

Regions	Region 1	Region 2	Region 3	Region 4	Region 5	RegionAverage
Wheat (Irrigated)	3.28	4.21	3.43	4.07	3.44	3.52
Barley (Irrigated)	3.28	4.21	3.43	4.07	3.44	3.52
Wheat (Dry)	0.52	1.31	1.03	1.22	1.02	1.10
Barley (Dry)	0.52	1.31	1.03	1.22	1.02	1.10
Grain Maize	4.45	5.51	5.21	5.36	4.55	5.17
Silage Maize	4.45	5.51	5.21	5.36	4.55	5.17
Sunflower (Oil)	3.21	0.00	3.55	0.00	3.29	3.35
Sunflower (Snack)	6.20	7.06	6.27	0.00	6.11	6.31
Clover	3.25	0.00	3.50	4.20	3.48	3.51
Sugar Beet	20.45	0.00	21.26	22.24	21.30	21.25

Chickpea	6.17	9.38	6.22	9.48	6.09	7.39
Beans (Dry)	13.19	14.08	0.00	14.23	13.30	13.43
Potato	25.26	0.00	26.45	27.43	0.00	26.38
Hungarian Vetch	2.41	3.25	3.00	3.16	2.48	3.02
Oats	3.42	1.49	0.00	1.41	3.48	2.45
Zucchini (Snack)	11.04	12.25	11.33	12.08	11.17	11.41
Onion (Dry)	13.21	0.00	0.00	0.00	13.34	13.28
Grape	0.00	44.41	0.00	42.19	0.00	43.30
Lavender	0.00	29.41	0.00	28.10	0.00	28.56
Peach	0.00	38.46	0.00	0.00	0.00	38.46
Walnut	0.00	55.23	0.00	0.00	0.00	55.23
Cherry	0.00	113.16	109.15	0.00	0.00	111.16
Pear	0.00	74.07	0.00	0.00	0.00	74.07
Apple	0.00	124.36	115.13	0.00	0.00	119.55
Strawberry	0.00	83.43	0.00	81.05	0.00	82.24
Rye	0.00	0.00	1.49	0.00	1.39	1.44
Poppy	0.00	0.00	25.45	27.16	25.49	26.17
Tomato	0.00	0.00	127.41	0.00	0.00	127.41
Sour Cherry	0.00	0.00	109.00	0.00	0.00	109.00
Plum	0.00	0.00	65.40	0.00	0.00	65.40
Lentil	0.00	0.00	0.00	34.25	31.53	33.09
Safflower	0.00	0.00	0.00	3.01	0.00	3.01
Melon	0.00	0.00	0.00	27.34	0.00	27.34
Canola	0.00	0.00	0.00	0.00	3.18	3.18
Cumin	0.00	0.00	0.00	0.00	3.33	3.33
Millet	0.00	0.00	0.00	0.00	4.03	4.03
Grass	0.00	0.00	0.00	0.00	3.22	3.22
Fallow	0.12	0.20	0.15	0.18	0.15	0.16

4. DISCUSSION AND CONCLUSION

This study was carried out to determine working time and standard labor units in the agricultural sector. The labor requirements for different crops, especially in agro-ecological regions, were examined as crop production is generally carried out in open areas and varies according to seasonal conditions. Within the product group, cherry has the highest SMLU value. Since the maintenance processes of cherry are sensitive and require intensive labor during harvest periods, its value in the regions' average was 2.259. In addition, there is a need for a labor that is advanced regarding qualifications in the harvesting processes of cherries and that will contribute to reducing the wastage rate without damaging the product. After cherries, sugar beet was determined as the crop with the highest SMLU requirement in the regions' average. The SMLU value of sugar beet is 1,652. As a result of the need for intensive use of labor, especially during the hoeing periods of the product, the SMLU value was high. Wheat, frequently preferred in the production processes in the research region and the enterprises examined, has an SMLU value of 0.734. According to the regions' average, the enterprises in the 5th region had the highest value in the SMLU in irrigated wheat production. In the 5th region where Altınekin, Cihanbeyli, Çeltik, Emirgazi, Kadınhanı, Karapınar, Kulu, Sarayönü, and Yunak districts are located, the SIB used in the production process is 1.145. The use of standard labor is an important data for calculating labor needs and planning areas where employment opportunities can be provided according to the production pattern. Standard labor needs may decrease due to the participation of specialized labor in employment or the widespread use of technology. Therefore, there is a need for controlled development in the agricultural sector, which contributes to the employment of many people.

The definition of standard work units is important for increasing productivity and optimizing the use of labor on farms. Standards ensure the planning of business processes and the efficient use of resources, while creating a competitive advantage for businesses. However, the applicability of these standards may vary depending on the geographical and climatic conditions of farms. For example, long working hours in regions with mountainous and fragmented terrain may make it difficult to set standards. For this reason, it is necessary to define standard working units in the agricultural sector and to evaluate the specific conditions of each region and each product when planning production at both micro and macro levels.

As in all sectors, the aim is to create sustainable production processes and optimize the use of resources in the agricultural sector, and existing policies are being renewed with these objectives in mind. Determining the standard labor force in the agricultural sector makes it possible to measure and improve labor productivity over a given period. This will help to reduce energy consumption and therefore the carbon footprint, while increasing the accuracy of reporting by providing reference values for the calculation of labor-related emissions. In addition to environmental contributions, a mechanism can be established to ensure social sustainability. Standardized labor is critical to ensuring decent working conditions. Standardization of labor in the agricultural sector helps to ensure the protection of workers' social rights, fair remuneration and healthy working conditions.

It is necessary to collect standardized, gender-disaggregated and more detailed data on time use and to formulate specific policies for agricultural employment. To this end, special funding should be allocated to project/program designs and activities that can provide

information on this issue. A map of working hours should be prepared, considering the technologies used in all agricultural activity areas. Develop and test specific indicators, methodologies, and tools (e.g., surveys and censuses) to measure agricultural workload. In this way, it will be possible to identify alternative working areas and income-generating activities for both on-farm and off-farm labor. It is important to identify and manage working hours to increase income-generating activities, especially for seasonal labor.

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