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Determination of the knowledge levels of the farmers of the Diyarbakir region on conservation tillage practices

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Abstract
This study is performed to determine the knowledge level of farmers in Diyarbakır province about conservation tillage practices to demonstrate the effective methods of producers were aimed. For this purpose, original data collected by a survey from 140 farmers in Diyarbakır province. Existing soil tillage practices of the farmers and the knowledge about sustainable agriculture, green manure, cover crops were defined. It is determined that 57% of the managements tilled the soil by using moldboard plough and 41% of the farmers burns the residue. 72% of the producer send samples for soil analyze but only 87% of them uses soil analyze result in production. 87% of the farmers stated that they have no knowledge and have not heard about conservation tillage likewise 58% of them are about direct seeding.

Keywords
Survey, Conservation tillage, Direct seeding, Knowledge level

Introduction
The active tillage adventure of humankind gained speed with the invention of the first wooden plow called “Ard” in the fertile Mesopotamian lands in BC. 4000-6000 years. The plowshares used in Europe in the AD. 5th century, took the most similar shape in AD. 8th-10th century to today's plows by gaining the feature of overturning the soil (Anonymous, 2007). Plows in different designs have been used in different geographies, according to regional climate and soil conditions, within the time period that will be expressed in centuries from those years until today. In the 1830s, sales of plows made of cast iron were started by John Deere in the USA. Over time, with the spread of the tractor, which is one of the most important power sources of agricultural production, the use of plows has become widespread. Thus, the plow has become the indispensable main equipment of tillage applications in the world.

Today, the protection of limited or even decreasing land and water resources has gained importance in response to the increasing world population. At this point, the concept of "conservation tillage" has developed. Conservation tillage is a tillage system in which at least 30% of the soil surface is covered with residues or 1120 kg/ha organic matter in order to reduce water and soil erosion and maintain soil fertility (Six et al., 2000; Zhang et al., 2007; Derpsch et al., 2010; Jayaraman et al., 2021). The three key principles of conservation agriculture systems are: (Derpsch et al., 2014):

1- minimizing soil disturbance, consistent with sustainable production practices,

2- maximizing soil surface cover by managing crops, pastures, and crop residues,

3- stimulating biological activity through crop rotations, cover crops, and integrated nutrient and pest management

One of the first attempts towards conservation tillage was the 'soil conservation movement' and 'conservation agriculture', which was initiated in the USA in 1937, as a state policy. In the world, practices related to soil conservation began to develop in the second half of the 20th century (Morgan, 2005). Conservation tillage areas in the world have reached 180 million hectares in 2015/16 period (FAO, 2021). This figure constitutes 14.7% of the total arable land.

When Table 1 is examined, it is seen that USA, Brazil and Argentina take the first three places. As of 2018, the presence of agricultural land in Turkey with conservation tillage is stated as 45000 ha. (FAO, 2021).

Table 1. Amount of agricultural land with conservation tillage by country (FAO, 2021)

Country	1000 ha
USA	43 204
Brazil	32 000
Argentina	31 028
Australia	22 299
Canada	19 936
China	9 000
Rusia	5 000
Paraguay	3 000
Kazakhistan	2 500
India	1 500
Uruguay	1 260
Turkey	45
Other	9 666.64
Total	180 438.64

Direct seeding is another planting method that has become widespread around the world in recent years. After the World War II, with the discovery of 2,4-D systemic herbicide and the spread of paraquat herbicide, which started to be sold in 1962, direct seeding method is applied in an increasing amount of agricultural land every year. Direct seeding is most simply defined as the seeding process performed with specially designed direct seeding machines, unlike normal seeding machines, without any tillage after the previous crop harvest (Baker et al., 2007). The success of this process depends on various factors such as suitable crop rotation, effective pest and weed control, selection of suitable machinery-equipment for the system, and the level of knowledge and experience of the implementers. According to 2019 data, direct seeding method is applied in approximately 203 million hectares of land in the world (Anonymous, 2021). The countries that adopt the direct seeding method rapidly are Latin American countries that apply this method on 70% of their arable land. The reason for this rapid increase is that many state-supported institutions, organizations and cooperatives in Latin American countries provided training, practice and financial support to the direct seeding method in the 90s.

When we look at Turkey in general, it is seen that farmers are still far away from conservation tillage and direct seeding practices. Many of the farmers are unaware of these methods, and those who are knowledgeable are hesitant to apply them (Çakır and Aygün, 2016; Altıkat et al., 2018). Studies in this area have not gone beyond the efforts of Universities and Research Centres under the Ministry of Agriculture and Forestry. These studies could not reach the farmers at the desired level. Although exemplary practices have started to be made with the producers in recent years, it is estimated that direct seeding agricultural areas are only 1% of the total arable land in Turkey. (Çelik, 2015). In the survey Studies carried out in different periods and in different regions in Turkey, it has been revealed that the farmers have very little knowledge about coonservation tillage and direct seeding, and those who have knowledge are reluctant to implement it (Küçükkongar et al., 2014; Çay et al., 2015; Turgut ve Barutçu, 2016)

Diyarbakır is a province located on the fertile lands of the Tigris Valley, with a production area of approximately 555000 hectares as of 2020 (TÜİK, 2021). The favorable climatic conditions in the region and the increase in the presence of irrigable agricultural land within the scope of the GAP allowed to grow two crops per year. In parallel with this increase in production, unconscious and intensive tillage has also increased. Also, especially burning the stubble left in the field after the harvest of the second crop, is the most

frequently used method (Sessiz et al., 2010; Öztürk, 2019).

In this study, the current soil cultivation habits of the farmers in Diyarbakır province and its districts, their knowledge levels about conservation tillage and direct seeding methods and their perspectives on these methods were investigated. In addition, it has been tried to learn under which conditions farmers can abandon conventional tillage methods, especially stubble burning.

Materials and Methods

The material of the research consisted of original data collected by questionnaire from agricultural business owners who carry out plant production in Diyarbakır province and its districts. The districts, villages and towns to be surveyed were selected from the I. Sub-Region, which has the best agricultural conditions according to the soil structure of the lands where crop production is intense, the land capability classes of the agricultural lands and the cultivation period. Sur, Kayapınar, Bismil, Ergani, Silvan and Çınar districts within this region were randomly selected and the farmers were interviewed face-to-face by going to the relevant region. A total of 140 farmers representing agricultural enterprises were surveyed. The sample number was determined with 95% confidence interval, 10% margin of error and 50% response rate using simple random sampling method.

Results and Discussion

The total land assets of the farmers participating in the survey is 3416.5 ha. Production is carried out in irrigated conditions in 772.0 ha of this land and in dry conditions in 2644.5 ha. When we look at the crop pattern, most of the farmers in dry farming conditions cultivating wheat+lentil or wheat+barley as the main crop. Farmers who cultivate in irrigated conditions produce wheat+cotton or wheat+corn. The distribution of land sizes belonging to the enterprises is shown in Table 2.

Table 2. Land size distribution of enterprises

Cultivated area (da)	Distribution (%)
<50	13
51-100	19
101-150	14
151-200	10
201-250	7
251-300	8
301-350	9
351-400	2
401-450	1
451-500	5
501-1000	11
>1000	1
TOTAL	100

As it can be seen in Table 2, enterprises with sizes between 51-100 decares and 101-150 decares are higher in terms of land assets among the enterprises included in the survey. When the education levels of the farmers participating in the survey were examined, it was determined that 46% of them were primary school graduates, 18% were secondary school graduates, 23% were high school graduates and 13% were university graduates. (Figure 1).

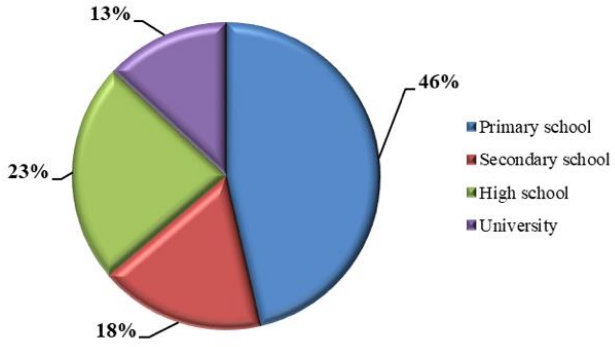

Figure 1. Education level of the farmers participating in the survey

It has been determined that 87% of the enterprises are registered to the National Record of Farmers (NRF). 72% of farmers have soil analysis. 87% of the farmers who have soil analysis take soil analysis results into consideration in production.

It has been observed that farmers obtain their equipments and machines by purchasing 63%, by leasing 25% and by borrowing 12%. (Figure 2).

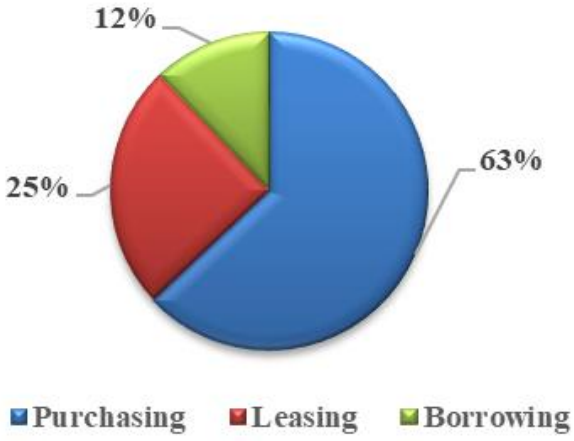

Figure 2. Ways of enterprises to supply equipments and machines

When the data on the tillage habits of the enterprises within the scope of the survey were examined, it was seen that the conventional tillage method, in which the plow was used in the field preparation before planting, was used with a rate of 57% throughout the province. It was determined that the farmers had soil analysis with a rate of 72% and the majority of them (87%) complied with this analysis in fertilization planning. Küçükkaya ve Özçelik (2014), in their survey conducted with the farmers in the Gölbaşı district of Ankara, it was determined that the farmers who did not comply with the results of the soil analysis were more than those who comply with the results of the analysis with a rate of 56.66%.

Table 3. Pre-seeding practices of enterprises

	Yes	No
Cultivating second crop	83%	17%
Stubble burning	41%	59%
Had soil analysis	72%	28%
Considers soil analysis	87%	13%

Continuous stubble burning is a widespread application in Turkey (Akbolat et al., 2016; Altıkat et al., 2018; Çelik et al., 2019). This practice still continues throughout the region and the province. 57% of the farmers in 41% group of farmers who burn stubble, know the harms of burning stubble, but still prefer to burn stubble. When the farmers within the scope of the survey were asked in which case they would give up burning stubble, the majority of them answered if the straw became valuable (52%) and if financial support was given to the direct seeding. On the other hand, the rate of producers who stated that they would give up burning stubble if the penalties for burning stubble were increased remained at only 7%. This situation, which emerged with the survey, showed that the reward and support system would be more effective than the punishment method at the point of adopting new methods. Figure 3 shows in which situations the farmers can give up burning stubble.

57% of the farmers stated that they use plows before each planting period. It was observed that the level of knowledge of the farmers about the relationship between tillage and soil organic matter (SOM) and soil erosion was low. (Table 4). 88% of the 43% farmer group who know both of these relationships continue to use plows.

In the Council of Ministers Decision dated 29.12.2015 and numbered 2015/8353 published in the Official Gazette dated 01.01.2016 and numbered 29580; VAT rates, SCT rates and amounts and tobacco fund amounts to be applied to some goods have been redefined (Anonim, 2016). Among these goods are fertilizers registered by the Ministry of Agriculture and Forestry. In the following years, there was an increase in fertilizer prices again due to the exchange rate difference. This has affected the purchasing power of farmers and the amount of fertilizer use has decreased throughout the country. In the survey, farmers were asked whether there would be a change in the amount of fertilizer they use in case of a decrease in fertilizer prices again. 57% of the enterprises stated that they would use more fertilizer if fertilizer prices decreased.

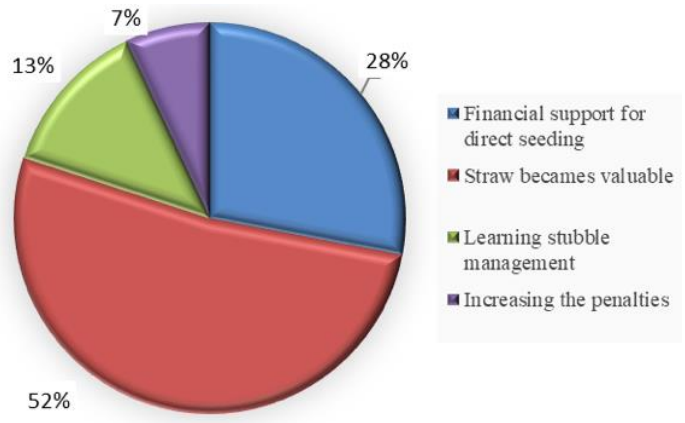

Figure 3. Conditions for farmers to stop burning stubble

Table 4. Pre-planting practices of farmers

	Yes	No
Uses plow	57%	43%
Knows the relationship between tillage and SOM	48%	52%
Knows the relationship between tillage and erosion	60%	40%
Knows both	43%	57%

Table 5. Knowledge level of farmers about some conservation tillage terms

Term	I have not heard and I have no knowledge	I have heard but I don't know	I have heard and I have knowledge	I am applying
Sustainable agriculture	25%	34%	41%	0%
Green manuring	37%	28%	35%	0%
Cover crop	28%	31%	41%	0%
Conservation tillage	51%	36%	16%	0%
Direct seeding	38%	20%	42%	0%

It has been observed that the level of knowledge and especially the application of sustainable agriculture, green manuring, cover crop and direct seeding practices, which are among the methods included in the concept of conservation tillage, are quite low among the farmers within the scope of the survey (Table 5). Of the surveyed farmers, 51% stated that they had never heard of the term "conservation tillage" and 38% stated that they had never heard of the term “direct seeding” before and had no knowledge of it. From the answers given to the questionnaire, it was determined that while the rate of farmers who heard all of the terms in Table 5 was 4%, there was an 11% farmer group who had not heard of any of these terms before and had no knowledge of them. This farmer group also did not feel the need to access information about these issues from anywhere.

When the sources from which the producers accessed information about conservation tillage and direct seeding were examined, it was determined that the vast majority obtained information from the Provincial/District Directorates of Agriculture and Forestry (42%) and Farmer TV (36%) (Figure 4). Çay et al. (2015) determined that the farmers in the Çanakkale region mostly reach the information about the conservation tillage concepts via Farmer TV and the internet. Gülter et al. (2018) ve Turgut ve Barutçu (2016) similarly, in their studies, determined that the farmers primarily accessed technical information via TV and the internet, and that official institutions and universities remained in the lower ranks in terms of being a source of information.

38% of the farmers who participated in the survey stated that they had never seen a direct seeding machine before. Farmers stated that they saw the direct seeding machine mostly at the fair (52%) (Figure 5).

73% of the 62% of the farmers who have seen the direct seed drill know the difference between the direct seeding machine and the normal seed drill.

The producers within the scope of the survey were asked about their willingness to participate in a training program on conservation tillage and direct seeding methods. 90% of the farmers stated that they would like to participate if the training was organized (Figure 6).

The farmers within the scope of the survey were asked under which conditions they could try conservation tillage and direct seeding methods. 46% of the producers stated that they would make trial plantings if they were given training support, and 43% said that they would be given financial support. The rate of farmers who stated that they could make trial seedings if the method became widespread, along with financial support, remained at 9% (Figure 6).

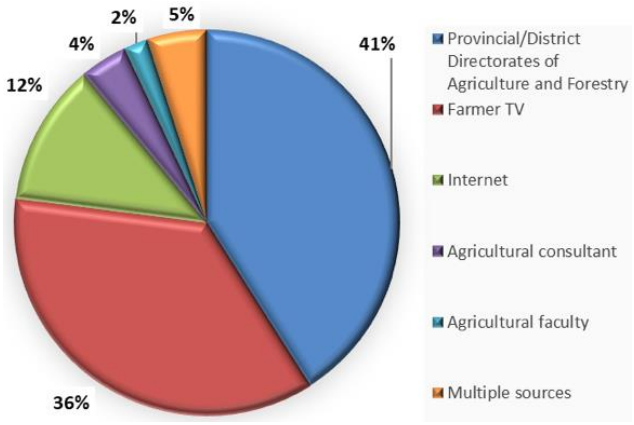

Figure 4. Ways for farmers to learn about conservation tillage terms

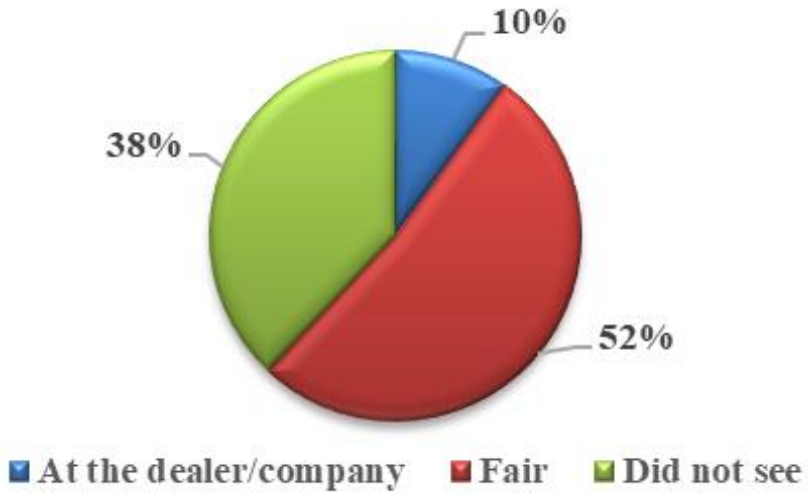

Figure 5. Where the direct seeding machine sees

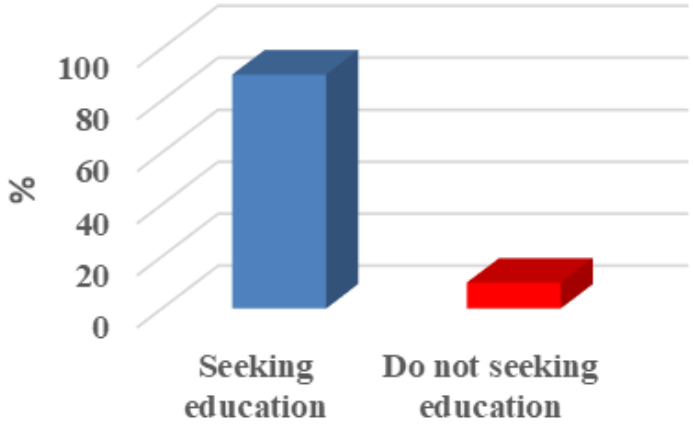

Figure 6. Farmers' willingness to receive training in conservation tillage and direct seeding

Table 6. Conservative tillage and direct seeding trial conditions of farmers

Conservative tillage and direct seeding trial conditions	%
Provided training and application support	46
Financial support	43
Financial support-Educational support	9
If it becomes widespread in the region	2

Conclusion

When the information obtained within the scope of the research is evaluated, it has been observed that the knowledge level of the farmers about the conservation tillage and direct seeding methods is quite low in the I. Sub-Region, where agriculture is intensively made in Diyarbakır. Although the farmers are eager to learn the concepts of conservation tillage and direct seeding, they are reluctant to implement them without educational support and financial support. Both the low profit margins in domestic agricultural production and the low competitiveness in foreign markets are one of the most important obstacles for farmers to adopt new production techniques. Because our farmers do not have the luxury of taking financial risks for new methods of which they do not know the end. Dissuading farmers from their centuries-old soil cultivation habits and making them adopt new production methods can only be achieved through socio-economic planning. When we look at the examples in the world, it is seen that governments firstly spread conservation agricultural policies on a national basis, and then provide serious training and financial support to conservation tillage and direct seeding practices as sub-factors. While providing these funds, support is received from many international organizations such as FAO.

Within the scope of the survey, it has been observed that farmers tend to abandon the use of plows over time due to increased fuel costs, moisture loss in the soil, etc. Some farmers are not aware that the methods they apply are within the scope of conservation tillage. It has been seen that the education, reward and incentive system should be introduced in order for the producers to adopt new agricultural practices and especially the harms of stubble burning, and the penalty system is no longer a deterrent to the farmers.

It has been revealed that farmers try to reach information on conservation tillage and direct seeding from farmer TVs and the internet rather than Agriculture Faculties and agriculture provincial/district directorates. Based on this, it is seen that the knowledge and experience of agriculture faculties and agriculture provincial/district directorates are weak in transferring them to farmers. Perhaps, this knowledge and experience should be conveyed through visual, audio and written media, taking into account the new habits of the society.

Establishing a data bank similar to this study, which was carried out in the example of Diyarbakir province, with studies to be carried out in different regions of Turkey, and follow a national strategy according to these data will be beneficial in terms of establishing the concept and practices of conservation soil cultivation and direct cultivation.

Compliance with Ethical Standards

Conflict of interest

The authors declared that for this research article, they have no actual, potential or perceived conflict of interest.

Author contribution

The contribution of the authors to the present study is equal. All the authors read and approved the final manuscript. All the authors verify that the Text, Figures, and Tables are original and that they have not been published before.

Ethical approval

Ethics committee approval is not required.

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Data availability

Not applicable.

Consent for publication

Not applicable.

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