



### Assessment of Tractor and Agricultural Machine Accidents Happened in Agricultural Enterprises of Çumra Town of Konya Province

Aykut ALÇAYIR<sup>1</sup>, Haydar HACISEFEROĞULLARI<sup>2,\*</sup>

<sup>1</sup>KonyaTeknokent, Cooperation and sales representative, Konya, Turkey

<sup>2</sup>Selçuk University, Faculty of Agriculture, Department of Agricultural Machines and Technologies Engineering, Konya, Turkey

#### ARTICLE INFO

##### Article history:

Received date: 13.12.2017

Accepted date: 19.12.2017

##### Keywords:

Occupational accident  
Agricultural machinery  
Tractor  
Rollover

#### ABSTRACT

Tractor and agricultural machinery accidents happened in the last 20 years in Çumra town of Konya province were investigated in this study. All of the producers involved in accidents constituted research population. Complete enumeration method was used and questionnaires were applied to 43 agricultural enterprises through face-to-face meetings. Survey results revealed that 95.30% of the enterprises were dealing with plant production activities and average land size was 189.7 da. Number of individuals per accident was identified as 1.74; 95.30% of the individuals involved in accidents were male; a tractor was involved in 41.90% of the accidents and 20.90% of these accidents happened with a trailer. Of the investigated accidents, 39.505 happened while working in the field; 58.105 happened afternoon; 34.90% happened as rollover. With regard to reasons of accidents, 32.60% were resulted from inattention, 20.90% resulted from pto-shaft accidents, 11.60% were resulted from overloads and surface impurities, 7.0% were resulted from lack of safety measures, 4.705 were resulted from overspeed and 2.30% were resulted from organ caught-ins to belt-pulley.

#### 1. Introduction

Engine power is used in agricultural machinery. Both the power of tractors and operational capacity of agricultural machinery are continuously increasing in Turkey. Therefore, proper mechanization machinery should be operated at proper settings for high efficiency of these machinery. They should be well-maintained and operated along with the recommendations or directions of the manufacturer and scientific factsheets. Agricultural machinery should have ergonomic and safe designs for humans.

Economy of several developing countries primary depend on basic industries and majority of their population deal with agricultural activities. In Turkey, number of people employed in agricultural sector is around 5.6 million and such a number constitute about 21.5% total employment. In European Union, the number of people employed in agriculture is around 12.6 million and such a number has a share of 5.9% in total employment. Agrarian population is about 21 million in

Turkey and such a population corresponds to 28% of country population. However, such a population is about 28 million in European Union, but this population corresponds about 6% of total population (Anonymous 2017). In other words, agricultural population is quite high in Turkey.

In Turkey, agrarian population has quite low education levels, thus agricultural machinery are operated unconsciously most of the time and serious accident risks are emerged. Therefore, detailed research is needed to identify risk items to reduce agricultural machinery-originated accidents, to minimize such accidents and to investigate the accidents occurred in agricultural sector. In Turkey, only the accidents with casualties or severe injury occurred over the motorways are recorded. Thus, sufficient data are most of the time unavailable to identify or analyze agricultural machinery accidents.

\* Corresponding author email: [hhsefer@selcuk.edu.tr](mailto:hhsefer@selcuk.edu.tr)

Doğan (1992) investigated agricultural machinery operational safety issues in Çukurova region, Özkan (1996) investigated the risk factors for the accidents involving tractor and agricultural machinery in Konya region, Öz (2005) in Aegean region, Bülbül (2006) in Ankara province, Akbolat et al. (2007) in Isparta region, Öztürk (2008) in Tokat province, Yücel (2012) in Erzurum province, Yıldırım and Altuntaş (2015) in Tokat province, Akpınar and Yıldırım (2016) in Trakia region investigated tractor and agricultural machinery accidents. Additionally, Perктаş (2007) carried out a nation-wide study and investigated accident reports involving tractors. Myers et al. (2009) indicated that tractors caused about 46% of the injuries in agricultural laborers. Myers and Hendricks (2010) indicated that age, type of farm, region and the relations of casualty with the farm influenced the death ratios in tractor rollovers and reported that death ratios in tractor rollovers decreased by 28.5% between the years 1992 and 2007. Murphy et al. (2010) indicated that there were about 4.2 million tractors in the USA, average tractor age was over 25 years and majority of the tractors manufactured before 1985 was missing of rollover protective structures (ROSP). Yurtlu et al. (2012) investigated risk perceptions in operation of agricultural machinery, Güğercin et al. (2016) assessed job safety and occupational health attitudes of agricultural engineers. Patel et al. (2017) carried out a study in the USA and indicated that nonfatal agricultural injuries were mostly assessed through national surveys, data quality were most of the time insufficient, data were misleading and were not integrated into the current systems.

Reliable data should be gathered to take and develop preventive measures for agricultural accidents, intervention measures should be developed to prevent casualties in accidents, the conditions creating injury and death of people under risk should be foreseen. There aren't any studies in literature about agricultural machinery accidents in Konya province and towns and there is a lack of information on this issue. Therefore, the present study was conducted to investigate agricultural machinery accidents.

## 2. Materials and Methods

This study was conducted in Çumra town of Konya province in 2016. Çumra town had a diverse cropping patterns, large agricultural fields, irrigated fields, land consolidation projects and quite many number of agricultural machineries. That is way, the town was selected as the study area. Face-to-face meetings were performed with 42 village mukhtars of the region. Within the scope of this study, as stated by the mukhtars, number of agricultural enterprises with an occupational accident was identified as 59. All of these producers involved in accidents constituted research population. Complete enumeration method was used and questionnaires were tried to be applied to agricultural enterprises through face-to-face meetings. However, 11 produc-

ers of the population were abstained from participating into the study. Also, 5 questionnaires were not taken into consideration because of inconsistent responds to survey questions. Therefore, 43 questionnaire forms were assessed within the scope of this study. Data were subjected to statistical analyses with SPSS statistical software. Frequencies, percent and mean values were used in data assessments.

## 3. Results and Discussion

### 3.1. General characteristics of the agricultural enterprises involved in agricultural machinery accidents

Of the participant enterprises involved in tractor and agricultural machinery accidents, 95.30% were dealing with plant production activities and 4.70% were dealing with livestock production activities. Participant enterprises had a total of 6 650 da irrigated lands and the average per enterprise was 154.65 da. While 11.60% of the enterprises did not have irrigated lands, 23.26% has irrigated lands size over 200 da. Total dry farm land size was 1 507 da, average dry farm lands size was 35.05 da and 72.10% did not have dry farm lands. Total land size was 8 157 da, average land size was 189.70 da and 37.20% of the enterprises had a land size of over 200 da. Average land size is 68 da in Turkey, so the present values were quite higher than country average (Anonymous, 2017a). In other words, Çumra town has almost triple land size of country average.

### 3.2. Status and age of individuals involved in accidents

According the survey results, total number of individuals involved in agricultural accidents was 76, number of individuals involved in each accident varied between 1-12 and average number of individuals effected by each accident was 1.74. High number of effected individuals per accident was because trailers and tractors were mostly used to transport agricultural laborers.

Of the individuals involved in agricultural machinery accidents, 81.40% were family members, 11.60% were non-family members and 2.30% were permanent or temporary workers or neighbor children (Figure 1).

Since the agricultural enterprises of the town commonly meet their labor needs from the household, in other words they were mostly composed of small-size enterprises, the individuals involved in accidents were mostly family members.

Of the individuals involved in agricultural accidents, 95.30% were male and 4.70% were female. Age of individuals involved in accidents varied between 7-80 years. Considering the age groups of the individuals involved in accidents, the ages of 37, 42 and 44 had the

greatest frequency (7%), 18.60% were under 18 years and 9.30% were over 65 years (Figure 2).

Of 33 individuals affected from the accidents, 60.60% were female and 39.40% were male. Ages of affected individuals varied between 6-58 years with the greatest frequency (9.10%) in 18, 20, 40 and 45 years age groups. Since the enterprises of the town are mostly composed of family enterprises, the individual affected from the accidents had a broad range of age groups. In other words, every age group provide supports in performance of production activities in family enterprise.

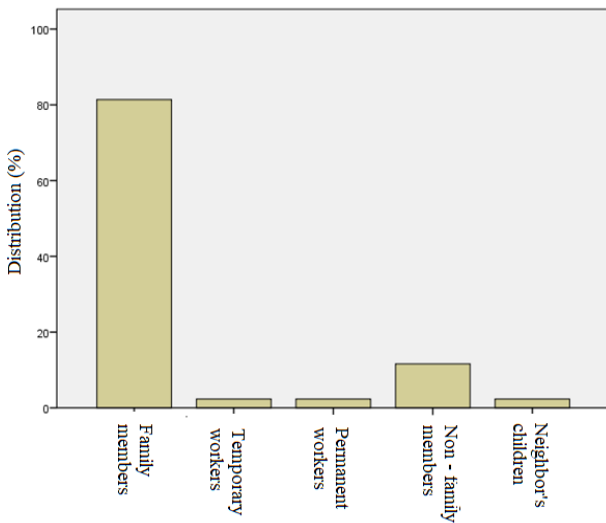


Figure 1  
Relativeness of the individuals involved in accidents

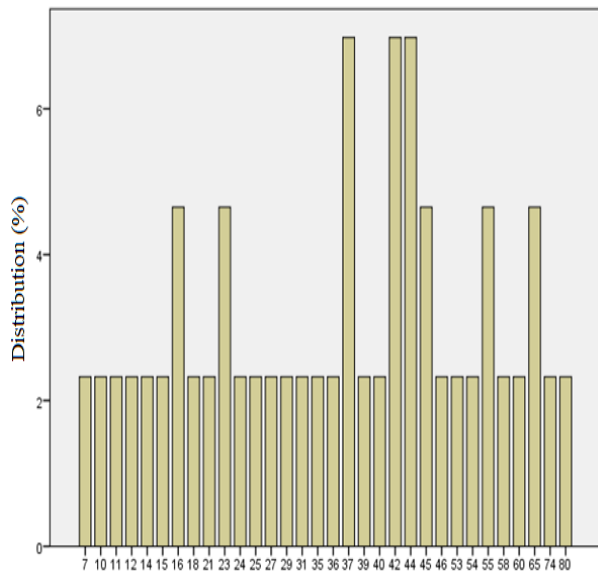


Figure 2  
Age groups of individuals involved in accidents (years)

3.3. Driver license and training status of the individuals involved in accidents

Of the individuals involved in accidents, 72.10% had a driving license and 27.90% did not have any driving licenses. In other words, 27.90% were unlicensed. Such a number is quite high.

Considering the educational levels of the individuals involved in accidents, 41.90% were primary school graduates, 23.30% were high school graduates and 20.90% were secondary school graduates (Figure 3). The ration of university graduates was 7%. Low ratio of university graduates may be effective in having high agricultural machinery accident ratios. High educational levels will probably reduce number of accidents occurred in agricultural sector.

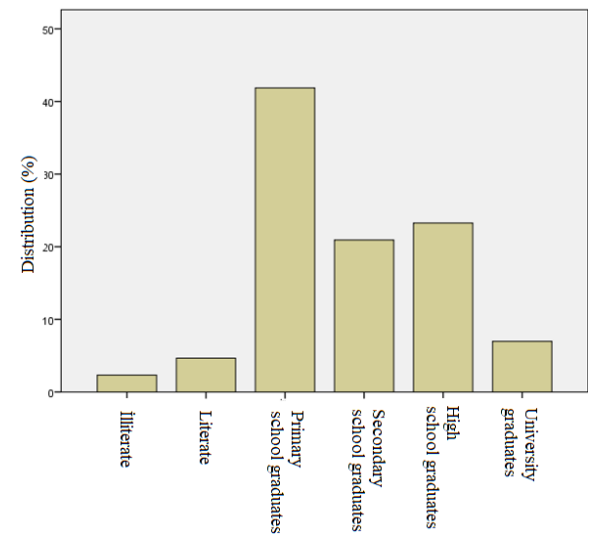


Figure 3  
Educational levels of the individuals involved in accidents

3.4. The status of the individual at the time of accident

The status of the individuals involved in accidents at the time of accident is presented in Figure 4. Of the participant individuals, 65.10% was determined that they were driving tractor and operating agricultural machinery at the time of accident, 7% was determined that they were working either in their own business or working as day-laborer in some else's business and 9.30% was determined that they were present in the site of the accident for any reasons. Also, 2.30% was determined that they were near by the tractor driver, or were travelling to the working place with trailer or controlling the operation of the combine harvester in the field.

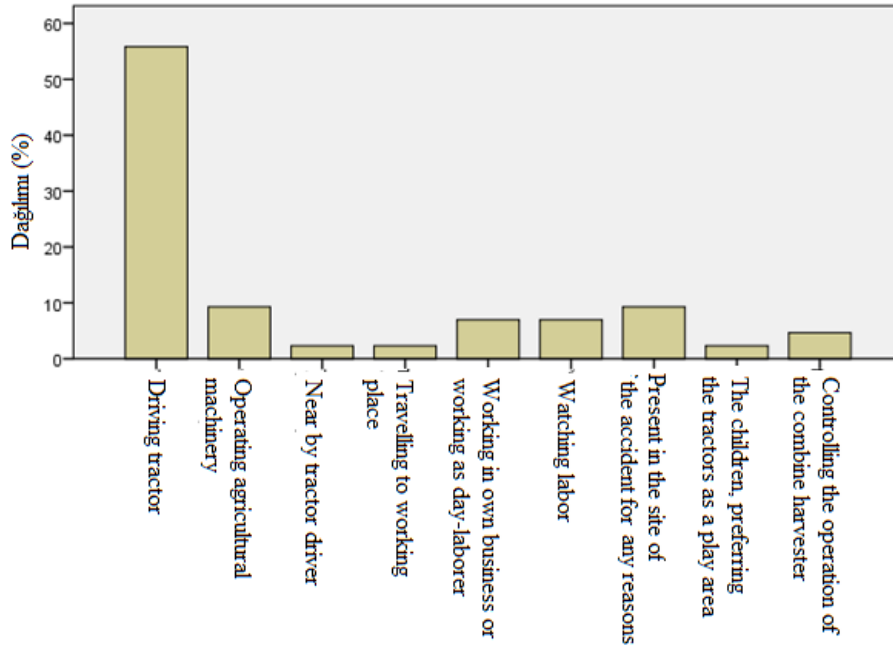


Figure 4  
Status of the individuals involved in the accident at the time of accident

3.5. The tractor and agricultural machinery involved in accident

A tractor was involved in 41.90% of the accidents. These accidents mostly happened as rollover, overturn and crashing. The second largest accident group in-

cluded trailers and such accidents mostly resulted in injury or death of the individuals carried in trailers. Of the accidents, 9.30% included thresher machinery and 4.7% included combine harvesters. These agricultural machinery accidents were followed by the accidents involving other machineries presented in Figure 5.

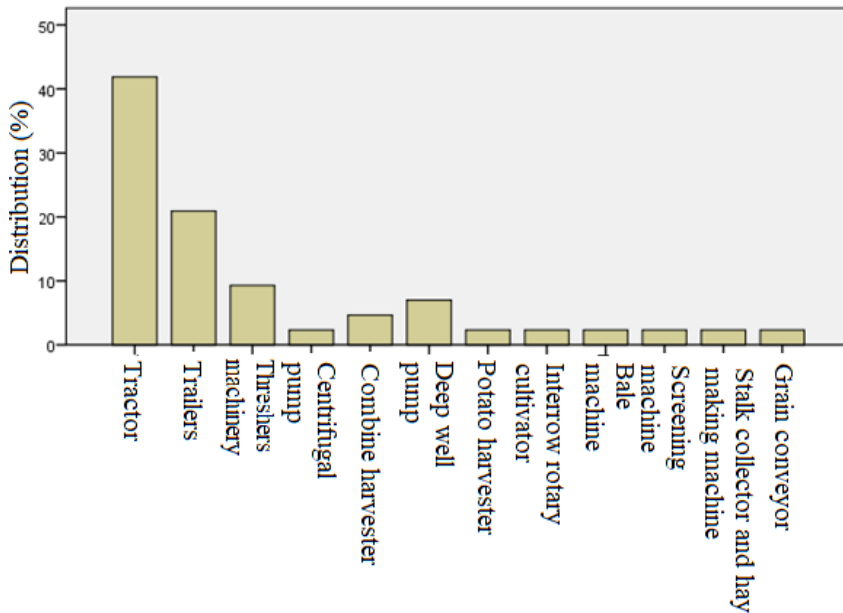


Figure 5  
Ratios of tractor and other agricultural machineries involved in accidents

### 3.6. Data about the tractor and combine harvester involved in accidents

The data about the tractor and combine harvesters involved in accidents are provided in Table 1.

Table 1

Traffic compliance of tractor and combine harvesters involved in accidents

Tractor / Combine harvester	Quantal Response	
	Yes	No
Traffic insurance	51.20	48.80
Traffic inspection	55.80	44.20
Beacon lamp	53.50	46.50
Periodic maintenance	95.30	4.70
Tractor standard cabin	46.34	53.66

According to survey results, 48.80% of the tractors and combine harvesters involved in accidents did not have traffic insurance and 44.20% did not have traffic inspections. It was also observed that 53.66% of the tractor in the region did not have a cabin and the only 4.70% of the other tractors had a protective safety roof. In other words, 48.78% of the tractors did not have a cabin and a protective safety roof. About 46.50% of the tractors did not have beacon lamps and such a lack of these warning lights increased the risk of accident. Maintenance is also a significant factor in tractor accidents and 4.70% of the tractors did not have their periodic maintenance done.

The age of tractors involved in accidents are presented in Figure 6. Model year of 1973 had the greatest ratio and it was followed respectively by the model years of 1967, 1969, 1974, 1975, 1976, 1984, 1987, 1996 and 1998 (4.7%). It was remarkable herein that the ratio of the tractors with a model year of 2005 or over was 17.07%. Model years of the combine harvesters varied between 1975 and 1995.

It was observed that guarantee periods of the tractors and combine harvesters already ended by the time of accident, but enterprises (except for two of them – 4.60%) had on-time maintenance. Of the tractors and combine harvesters involved in accidents, 72.10% had the latest maintenance six months ago, 23.30% had a month ago and 2.30% had a year ago. Maintenance was not performed in one enterprise.

### 3.7. Occurrence of agricultural accident

Present findings revealed that accidents happened in town covered the last 20 years and 70% of the accidents happened in the last 10 years. Of the accidents, 44.20% were not reported to authorities since the tractors were mostly uninsured (48.80%), individuals were

slightly wounded or serious material damages were not observed in these accidents.

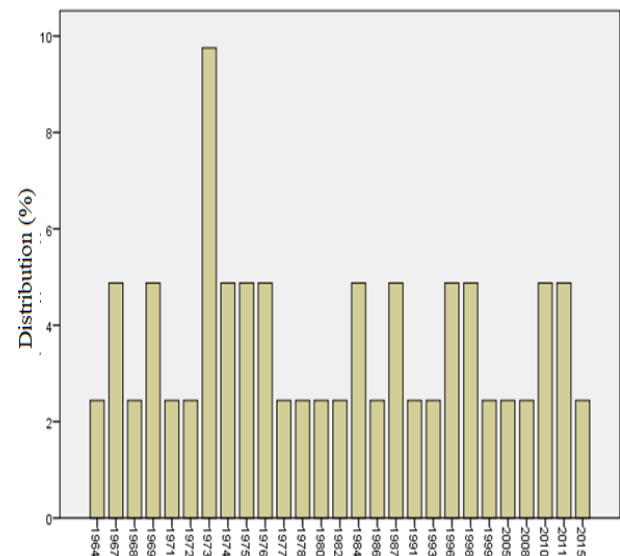


Figure 6

Models of the tractors involved in accidents

#### 3.7.1. The place where the accident happened

Of the agricultural accidents considered within the scope of the study, 39.50% happened while working over the fields, 23.30% happened over the motorways, 11.60% happened over the field roads between the enterprise center and the field, 9.30% happened over the village road and 4.70% happened over the railroads. The accidents happened during field works occurred with an agricultural machinery operated by tractors. The accidents happened over the roads were mostly resulted from the mistakes of tractor operator and these accidents were mostly occurred as rollover or run-off-road. The accidents happened in enterprise center were mostly occurred as fall-off from the parking tractors or trailers.

#### 3.7.2. Time of accident

Present findings revealed that majority of the accidents happened afternoon (58.10%) and the least happened at evening hours (2.30%). About 20.90% of the accidents happened in noon time frame, 14.0% happened at morning time frame and 4.70% happened at night time frame. The high ratios at afternoon hours were mostly because individuals kept working after lunch without having sufficient resting after lunch.

#### 3.7.3. How the accident happened

Of the accidents, 34.90% happened as rollover (Figure 7). Tractor rollovers are usually resulted from overloads of the tractor and trailers. In present study, 37.50% of rollovers were resulted from overloads of trailers. About 30.20% of agricultural accidents happened as agricultural machinery entanglement. Lack of protective devices or parts over the rolling sections of the tractors or machinery and lack of proper job-suits increased the risk of accidents. The remaining accidents happened as traffic accident (18.60%), run over (11.60%) and squeeze in three-point linkage system and hit by combine harvester.

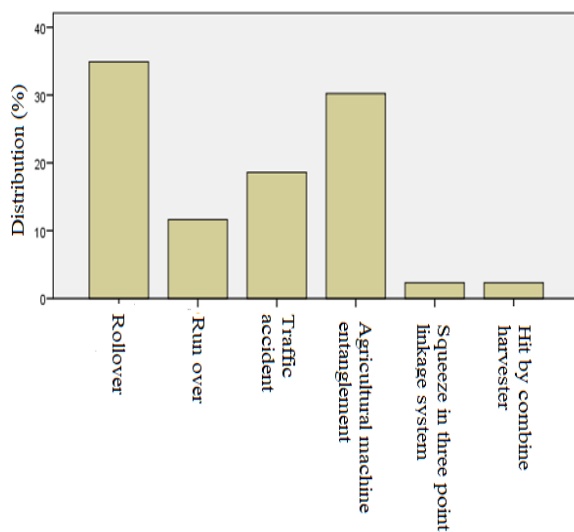


Figure 7  
Occurrence of accidents

#### 3.7.4. Surface conditions over which the accident happened

Survey results revealed that the ground or surface over which accidents happened was wet and slippery in 4.70% of the accidents and dry in 95.30% of the accidents. Considering the surface types of the accidents, it was observed that 67.40% were soil, 25.60% were asphalt and 7.0% were agricultural field with green plant cover. The accidents over asphalt surface were mainly occurred as crush of tractors with the other vehicles. Considering 34 accidents involving tractors and combine harvesters, it was observed that 29.40% of the accidents happened over stabilized roads, 23.50% happened over slopes, 17.60% happened over curves, 2.90% happened over ploughed fields and 5.90% happened over bumpy or plowed lands.

#### 3.8. Status of the agricultural machinery involved in accident at the time of accident and reason of accident

The status of the tractor or combine harvester at the time of agricultural accident is presented in Figure 8.

Present findings revealed that 46.50% of the accidents happened while the agricultural machine was in operation, 39.50% happened while driving over the roads and 7.0% happened in parking position. The least ratio (2.30%) was observed for repair and maintenance, machine setting or cleaning of stucked pieces.

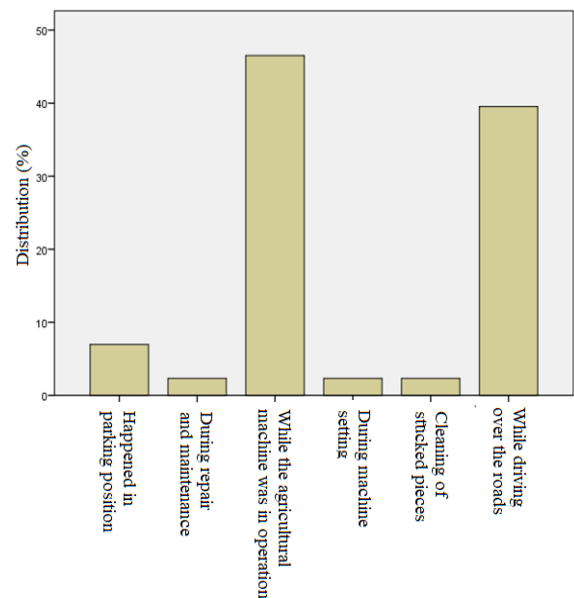


Figure 8  
The work done by the individuals at the time of accident

The reasons of accidents involving agricultural machineries and happened in Çumra town are presented in Figure 9. Survey results revealed that 32.60% of the accidents were resulted from inattention, 20.90% were resulted from pto-shaft accidents, 11.60% were resulted from overloads and rough surface and 7.0% were resulted from lack of safety measures. The least ratios were observed for overspeed (4.70%) and organ raptures of belt and pulley (2.30%).

In six accidents in which humans were carried with the tractors involved in accidents, humans were carried over mudguards in half of them and in trailers in the other half. In accidents in which a part of the body was caught up in tractor shaft or guide pulleys (23.26%), jacket or shirt sleeves were caught in (8 accidents), headscarf was caught in (1 accident) and trouser sleeves were caught in (1 accident). A question was asked to survey participants about the guards of moving parts (shaft and belt-pulley) (for 15 accidents), 46.70% indicated that guards were removed, 40.0% indicated that there were not any guards at all and 13.30% indicated that guards did not exist in original machinery.

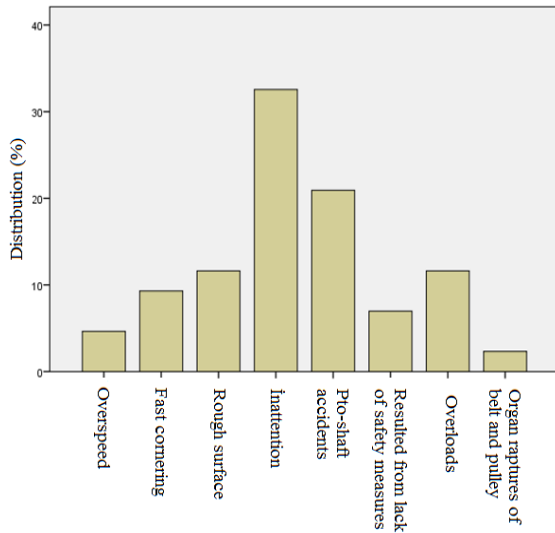


Figure 9  
Reasons of accidents

### 3.9. How the individuals were influenced from the accidents

#### 3.9.1. Physical influence ratios of the accidents

Of the individual involved in accidents, 32.60% were not influenced at all, again 32.60% were slightly influenced, 11.60% heavily wounded, 7.0% became physically disabled and 16.30% died. Of the other individuals involved in accidents (33 of them), 20 were not influenced from the accidents (60.61%), 11 were slightly wounded (33.33%), 1 was heavily wounded (3.03%) and 1 died (3.03%). In general, of all individuals involved in agricultural accidents, 44.74% were not influenced at all and 9.21% of the accidents end up with death.

For 36 accidents which was not ended up with death, influences of accidents on body parts of the individuals involved in accidents are presented in Figure 10. Survey results revealed that one hand of individuals was wounded (22.75%), one leg was wounded (22.72%) and chest section was wounded (13.64). The least ratio (9.09%) was observed for head section and for total loss of an arm.

#### 3.9.2. First-aid to individuals involved in accidents

It was observed that first-aid was provided in 37.20% of the agricultural accidents (in 16 accidents) happened in town. In those accidents, first-aid was provided by the people around the accident in 25.0% of them and health-care professional provided first-aid in 75.0% of them.

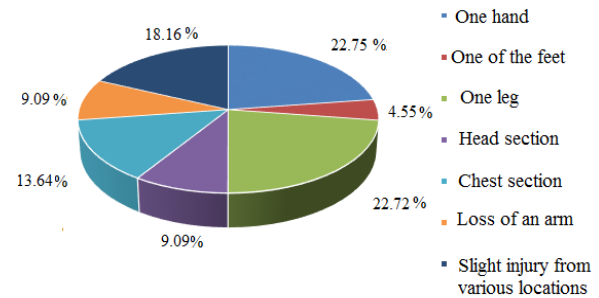


Figure 10  
Body parts influenced from the accidents

#### 3.9.3. Off-days of the individuals involved in accidents

In agricultural accidents without casualties, 47.22% of the individuals involved in accidents had a week off-days, 19.44% had three months off-days, 11.11% had one month and six month off-days. The lowest off-days were observed for two and three weeks. The ratio of the ones with off-days more than six months was 5.56% (Figure 11).

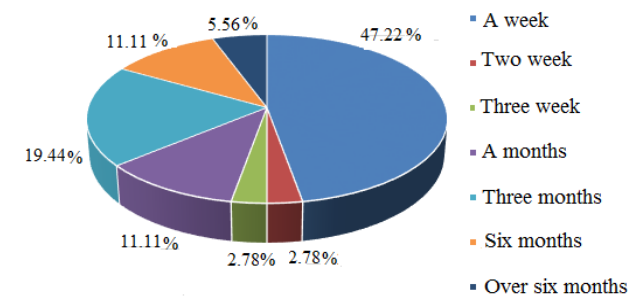


Figure 11  
Off-days of wounded individuals

Since reliable data were not able to be obtained for the off-days of other individuals involved in accidents, an assessment was not able to be made for them.

#### 3.9.4. Psychological status of the individuals involved in accidents

Of the individuals involved in accidents, 13.90% indicated that they were psychologically influenced from the accident, 38.90% indicated that they used the machine doubtfully after the accident and 47.20% indicated that they were not influenced from the accident.

#### 4. Conclusion

The enterprises in the region were generally composed of family businesses, thus family members were mostly exposed to accidents. Therefore, training activities should be organized for occupational health and safety in agricultural enterprises. Initially, provincial and town directorate of agriculture should provide such training to agricultural engineers working in their institutions and then they should provide training on occupational health and safety to farmers.

Of the accidents assessed in this survey study, 41.90% involved a tractor. But, 48.78% of the tractors did not have a cabin and protective safety roof. The low ratio of 2005 and higher model tractors (13.0%) was found to be effective in operator deaths in agricultural accidents. Therefore, a support should be provided to farmers to install a cabin or a protective safety roof to tractors. Actually, installation of a cabin or protective safety roof should be considered as a state policy.

In study region, Konya Basin Project (KOP) Development Administration can be put into action for training programs about occupational health and safety. Training TV programs can also be arranged to reach large masses for the works to be done to reduce agricultural accidents.

#### 5. Acknowledgements

The present study was derived from Master's Thesis of Aykut ALÇAYIR.

#### 6. References

- Akbolat D, Evren N ve Yılmaz Ş (2007). Isparta il sınırları içinde 1995-2003 yılları arasında meydana gelen traktör ve tarım iş makineleri kazalarının değerlendirilmesi. *SDÜ Ziraat Fakültesi Dergisi* 2 (1): 7-14.
- Akpınar T, Özyıldırım K (2016). Trakya Bölgesinde Tarımsal Faaliyette Bulunan Çiftçilerin İş Sağlığı ve Güvenliği Açısından Değerlendirilmesi *Çalışma ve Toplum* (3): 1231-1270.
- Anonim (2017). TARMAKBİR Sektör Raporu.
- Bülbül H (2006). Ankara'nın Bazı İlçelerinde Tarım Alet ve Makinaları ile Çalışmada Gerçekleşen İş Kazalarının İncelenmesi Üzerine Bir Araştırma. Yüksek Lisans Tezi, Ankara Üniversitesi Fen Bilimleri Enstitüsü Tarım Makineleri ABD, (Basılmamış), Ankara.
- Doğan H (1992). Çukurova Bölgesinde Tarımsal Mekanizasyon İş Güvenliği Sorunları Üzerine Bir Araştırma. Yüksek Lisans Tezi, Çukurova Üniversitesi Fen Bilimleri Enstitüsü Tarım Makineleri ABD (Basılmamış), Adana.

- Güğercin Ö, Baytorun N ve Koç DL (2016). Ziraat Mühendislerinin İş Sağlığı ve Güvenliği Konusundaki Görüş ve Yeterlilikleri Üzerine Bir Araştırma (Adana Örneği). *Çukurova Tarım Gıda Bil. Der.* 31: 37-48.
- Murphy DJ, Myers J, Mc Kenzie Jr EA, Cavaletto R, May J, Sorensen J (2010). Tractors and rollover protection in the United States. *Journal of agro-medicine* 15 (3): 249-263.
- Myers JR, Hendricks KJ (2010). Agricultural tractor overturn deaths: assessment of trends and risk factors. *American journal of industrial medicine* 53 (7): 662-672.
- Myers JR, Layne LA. and Marsh SM (2009). Injuries and fatalities to US farmers and farm workers 55 years and older. *American journal of industrial medicine* 52 (3): 185-194.
- Öz E (2005). Ege Bölgesi'nde Meydana Gelen Traktör Kazalarının Tarımsal İş Güvenliği Açısından Değerlendirilmesi. *Ege Üniversitesi Ziraat Fakültesi Dergisi* 42 (2): 191-202.
- Özkan A (1996). Konya İlinde Tarımsal Mekanizasyon Alanındaki İş Kazalarına Ait Risk Faktörlerinin Belirlenmesi. Yüksek Lisans Tezi, Selçuk Üniversitesi Fen Bilimleri Enstitüsü Tarım Makinaları ABD (Basılmamış), Konya.
- Öztürk İ (2008). Tokat İl Sınırları İçerisinde Tarım Makineleri Kazaları ve İş Güvenliği Üzerinde Bir Araştırma. Yüksek Lisans Tezi Gaziosmanpaşa Üniversitesi Fen Bilimleri Enstitüsü Tarım Makineleri ABD (Basılmamış), Tokat.
- Patel K, Watanabe- Galloway S, Gofin R, Haynatzki G and Rautiainen R (2017). Non- fatal agricultural injury surveillance in the United States: A review of national- level survey- based systems. *American journal of industrial medicine* 60 (7): 599-620.
- Perktaş M (2007) Türkiye'de Traktörlerin Karıştığı Trafik Kazalarının Değerlendirilmesi. Yüksek Lisans Tezi, Gazi Üniversitesi Fen Bilimleri Enstitüsü Trafik Planlaması ve Uygulaması ABD (Basılmamış), Ankara.
- Yıldırım C ve Altuntaş E (2015). Tokat İlinde Traktör ve Tarım Makinaları Kullanımından Kaynaklanan İş Kazalarının İş Güvenliği Açısından Değerlendirilmesi. *Gaziosmanpaşa Üniversitesi Ziraat Fakültesi Dergisi* 32 (1): 77-90.
- Yücel S (2012). Erzurum İlinde Traktör ve Alet-Makine Kullanımı Sırasında Oluşan Kazalar ve Sonuçları Üzerine Bir Araştırma. Yüksek Lisans Tezi Atatürk Üniversitesi Fen Bilimleri Enstitüsü Tarım Makineleri ABD (Basılmamış), Erzurum.