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Assessment of Tractor and Work Machine Accidents in Karaman

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Abstract— **The aim of this research is to evaluate the accidents of tractors and agricultural machinery in the important agricultural regions of Karaman province in 2016. A Microsoft Excel file is prepared for this purpose. News sites and daily newspaper news, being reflected in the press in 2016, were analyzed and evaluated. The correctness of the news was checked by comparing it with other news sites. Events that are unspecified or contain contradictory information are out of consideration.**

As a result of the study, the main causes of accidents are; Rollover, collision and crash. The results also show that farmers are not sufficiently informed and conscious about the use of safe tractors and agricultural machinery. Years of potential life lost (PLL) were found to be 145,6 years.

Keywords— Tractor accidents, work machine, Karaman; Turkey

I. INTRODUCTION

Located in Central Anatolia region, The Karaman city has the geographic coordinates of 37°-11'N latitude and 33°-13'E longitude, and is surrounded by Mersin and Antalya in the south and Konya in the west, north and east. The area of Karaman Province is 8.851 km² and the elevation of the city center is 1,033 m. There are 6 districts, one of which is the central district, 5 towns and 158 villages. Karaman's population in 2016 is 245,610 people [1] (Fig. I).

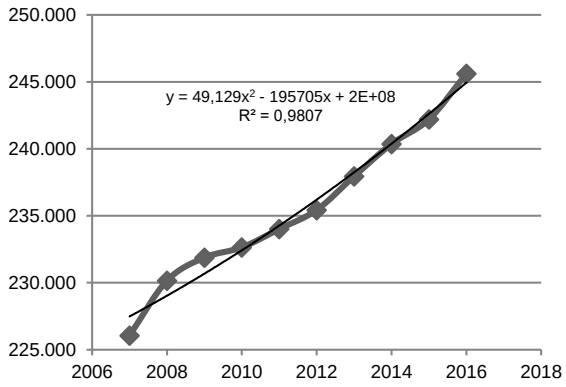

Fig. 1. *Karaman Population from 2007 to 2016.*

TABLE I. KARAMAN POPULATION BASED ON DISTRICTS.

District	Town Population	Man Population	Woman Population	(%)
Central	188.221	93.294	94.927	76.63
Ermenek	29.475	14.993	14.482	12.00
Sarıveliler	11.428	5.812	5.616	4.65
Ayrancı	8.345	4.162	4.183	3.40
Kazımkara bekir	4.479	2.061	2.418	1.82
Başyayla	3.662	1.831	1.831	1.49

The northern part of the Karaman lands are covered with steppe vegetation and the southern part is covered with forest cover. Two-thirds of the land is mountainous. The province center was established in the ovary, and the extensions of the Taurus are located to the south. The total area of Karaman is 885,100 hectares. 39% of the land is covered by agricultural land, 21% by meadow pastureland, 27% by forest area and 13% by other areas. Plant production is carried out in the area of 346,848 hectares of our province. 72% of these areas were allocated to field crops. Fallow field has a 12% share. 9% of the agricultural land is used for fruit growing, 4% of the land is used for vegetable growing and 3% of land is not used [2].

Agricultural machinery used during many agricultural activities is one of the main causes of accidents that occur in this sector. Tractors are one of the main power sources for agricultural production. Because many tools and machines used in agricultural production are driven by tractors, they are one of the tools of modern agriculture. Along with the development of technology, there has been rapid change and development in the agriculture sector. These changes and developments are not only related to the power and performance of the tractor, but also to driver safety and worker safety. Today, modern tractors are at a higher standard in terms of electronics and computer technology developments, tractor power and performance and ergonomic design. Tractor and agricultural machines have found the application area in the technology, many applications that can control the driver more easily, commands, can be operated by the developed devices.

Despite all safety and security measures taken, tractors take the first place in the agricultural sector,

which is considered the second most dangerous sector after mining [3].

In India, it was determined that 46% of agricultural casualties were caused by tractors and about 43% of those involved in the accident lost their lives [4].

According to the February 2009 report issued by the Agricultural Safety & Health Council of America (ASHCA), the causes of accidents in rural areas are summarized as follows.

1. The death rates of accidents in rural areas are almost twice as high as those in urban areas.

2. The likelihood of death in rural areas is higher than in urban areas.

3. Some of the accidents between motor vehicles and agricultural vehicles are only seen in rural areas. These accidents often occur between slow-moving tractors and high-speed motor vehicles [5].

In order for these studies to be carried out effectively and intensively in our country, it is necessary to establish a healthy database and with the obtained information from this database, awareness of farmers, drivers, operators living in these regions and are engaged in agricultural activities, should be raised. For this purpose, in this research, a study was carried out to evaluate the accidents caused by agricultural tractor accidents and agricultural machinery in 2016 in Karaman Region which has 0.9109% (11,600 numbers) of Turkey Machine Park [6]. Ultimately the reduction of accidents and the considerations to be taken to minimize it are summarized.

TABLE II. MACHINE PARK IN TURKEY AND KARAMAN PROVINCE [6].

Vehicle Type	Vehicle Quantity (Number)
Tractor (Turkey)	1.273.531
Tractor (Karaman)	11.600
Combine Harvester (Turkey)	16.247
Combine Harvester (Karaman)	145
Trailer (Turkey)	1.137.709
Trailer (Karaman)	13.731
Hoeing Machine (Turkey)	136.942
Hoeing Machine (Karaman)	3.650
Agricultural Equipment and Machinery (Turkey)	10.570.235
Agricultural Equipment and Machinery (Karaman)	106.178

II. MATERIAL AND METHOD

The research has evaluated the accidents of tractors and agricultural machinery in the towns of Merkez, Ermenek, Sariveliler, Başyayla, Ayrancı, Kazımkarabekir of Karaman Region. News sites and daily newspaper news, being reflected in the press in 2016, were analyzed and evaluated. The correctness of the news was checked by comparing it with other news sites. Events that are unspecified or contain contradictory information are out of consideration.

This study investigated the answers to some questions such as 2016 tractor and tractor mounted machinery accidents, causes, types of injuries, hours, days, months, places where the accidents happened etc. Accidents have been evaluated to evaluate the data in Microsoft Excel program.

III. RESEARCH RESULT

According to the results of the study, a total of 21 accidents were detected in the newspapers and news sites between January and December 2016 in the Karaman Region.

The month the accidents happened and the number of accidents is given in Table III. 5 of 21 accidents occurred in October and this is followed by August with 4 accidents. It can be said that the agricultural activities, which have a lot of accidents during the summer months, are done more and more intensively in this period. In the winter months, when the agricultural activities are at its minimum, there are scarcely any incidents. No accidents were recorded in November, December, January and March (Table III).

TABLE III. DISTRIBUTION OF ACCIDENTS ACCORDING TO MONTHS.

The Month Accident Happened	Number of Accident (Number)
January	0
February	1
March	0
April	3
May	2
June	3
July	2
Agust	4
September	1
October	5
November	0
December	0
TOTAL	**21**

The number of accidents detected on Thursday was the maximum of 21 accidents, which was found to be 6 accidents, followed by Monday with 5 accidents. On Saturday and Sunday, three accidents were identified (Table IV).

TABLE IV. DISTRIBUTION OF ACCIDENTS ACCORDING TO DATES

The Day of the Accident	Number of Accident Detected (Number)
Monday	5
Tuesday	0
Wednesday	2
Thursday	6
Friday	2
Saturday	3
Sunday	3
TOTAL	**21**

When examined in terms of the time of the accidents, it is noticed that the accidents happened at late hours of the day. When 6 crashes were detected between 3-6 pm hours at most, this is followed by 12-3 pm accidents. (Table V) No accidents were detected between 12 am and 6 am.

TABLE V. DISTRIBUTION OF ACCIDENTS HOURLY

Accident Time	Number of Accident Detected (Number)
12-3 am	0
3-6 am	0
6-9 am	2
9 am -12 pm	4
12-3 pm	5
3-6 pm	6
6-9 pm	3
9 pm-12 am	1
TOTAL	**21**

When we look at the distribution of the types of accidents, 33.33% of the accidents are caused by hoeing machine. This is followed by four tractors over turnings and 4 accidents caused by hoeing machine trailer, used especially in mountainous area. (Table VI)

TABLE VI. DISTRIBUTION OF TYPES OF ACCIDENTS.

Type of Accident	Number of Accident Detected (Number)	(%) Distribution
Tractor Over turnings	4	19.05
Pressing Between Two Trailers	1	4.76
Falling From Trailer	1	4.76
Hoeing Machine	7	33.33
Tractor's Fell in Well	1	4.76
Tractor - Car Collision	1	4.76
Getting on a Tractor	1	4.76
Hoeing Machine Trailer	4	19.05
Collection of Irrigation Equipment	1	4.76
TOTAL	**21**	**100,0**

Examining the work machines in the accidents, it is understood that most of the accidents are caused by tractors and hoeing machines (Table VII).

TABLE VII. ACCIDENT-CAUSING WORK MACHINE

Vehicle Type	Number of Accident Detected (Number)
Tractor	7
Hoeing Machine Trailer	4
Agricultural Vehicle	2
Hoeing Machine	7
Drip Irrigation Equipment	1
TOTAL	**21**

As the place where the accidents take place, 6 accidents happened in the town Ermenek, followed by the villages centrally located. The reason for the accidents in town Ermenek is that the agricultural land is small, rugged and mountainous (Table VIII).

TABLE VIII. ACCIDENT PLACE

Accident Place	Number of Accident (Number)
Kazımkarabekir-Konya Way	1
Karaman Central	4
Ermenek Town	6
Başyayla Town	3
Sarıveliler Town	2
Centrally Located Villages	5
TOTAL	**21**

According to the accidents, when the distribution of the age group of casualties is examined, it is seen that 4 persons, 3 male and 1 female, lost their lives. One of the male casualties was a 9 years old child. It is especially important that young children should be kept away from agricultural activities. 27 were male and 4 were female of the 31 injured. (Table IX).

TABLE IX. DISTRIBUTION OF THE AGE GROUP OF CASUALTIES

Age Group	Dead Casualties (Number)		Injured Casualties (Number)		TOTAL
	Man	***Woman***	***Man***	***Woman***	
0-10	1	0	1	0	2
11-20	1	0	1	1	3
21-30	0	0	5	1	6
31-40	0	0	6	1	7
41-50	0	0	7	0	7
51-60	1	0	3	1	5
61-70	0	0	3	0	3
70 >	0	1	1	0	2
TOTAL	**3**	**1**	**27**	**4**	**35**

When Table X is examined, rates of 51.43% (18/35) of the accidents result in crushing, scratch, sprain and cracking (Table X).

TABLE X. DISTRIBUTION OF INJURED ORGANS AND INJURIES

Injured Organ	Number
Crush	**6**
Slightly Wounded	5
Head Crush	3
Scratch	**6**
Foot Fracture	3
Foot Crushing	4
Sprain, Cracking	**6**
Squash	2
TOTAL	**35**

It is seen that 3 of the 4 people who died in the accident lost their lives at the scene. It can be said that the greatest reason for this is the accidents due to the overturning of the tractor and collisions. The other one lost his life either in the hospital or on the road (Table XI).

TABLE XI. DISTRIBUTION OF THE PLACES OF DEATH

Death Places	Number of Accident (Number)
On the Scene	3
At Hospital	1
TOTAL	**4**

Years of Potential Life Lost (PLL) were assessed according to the accidents resulting in death. (Chart 10) In order to emphasize the importance of life losses that occur in the accident, the potential life losses in the accident are calculated with the Eq. (1) [7].

$$PLL = \sum_{i=1}^{n}(AL - A) \qquad (1)$$

PLL :Potential Life Lost (Year),
AL :Average Life (Year)
For Man AL : 75,3
For Woman AL : 80,7
A :Age (of casualties) (Year)
n : Casualties (Number)

Tractor overturning caused the deaths of two men aged 19 and 60, a 9-year-old boy died after being trapped between two trailers and a 73-year-old woman died after an hoeing machine trailer toppled According to Turkish Statistical Institute data, the average life span in Turkey is 78 years and it is below the EU average. The number is calculated as 75.3 for males and 80.7 for females [1].

As can be seen from table XI, the total years of potential life lost (PLL) for four people who died in accidents were found to be 145.6 years.

TABLE XII. YEARS OF POTENTIAL LIFE LOST (PLL) OF AGRICULTURAL ACCIDENTS CASUALTIES IN KARAMAN REGION.

Accidents		Casualty (person)	% Casualty	PLL (Year)	% PLL
Tractor	***Woman***	0	0	0	0
	Man	2	50	71,6	49,18
Agricultural Machine	***Woman***	1	25	7,7	5,29
	Man	1	25	66,3	45,53
TOTAL		**4**	**100,00**	**145,6**	**100,00**

This shows that; it means that the deceased were excluded from agricultural production activities as much as the recalled year, and that their contributions would not be possible (Table XII).

IV. CONCLUSION AND DISCUSSION

The results of the accidents in this research carried out in the important agricultural regions of Karaman Region can be listed as follows.

Investigations reveal that accidents are often caused by carelessness and ignorance. The elimination of this deficiency is only possible with an educational program. A trained driver knows precisely how to use and control an operator, tractor or work machine and takes precautions accordingly.

If an operator takes good care of the machine he will use, he will fulfill the safety requirements to a great extent. On the contrary, unless adequate care is given, it is inevitable that it will always face accidents. Appropriate training about a machine aims to learn all the controls of the machine and to get used to the machine. Having different machines in agriculture, not all controls work the same way and in the same direction. Operating a machine with a driver or operator who is not adequately trained may be extremely dangerous in terms of life and property safety.

Protective security measures; it is important in terms of work safety attaching the housing to the moving parts of the vehicles and checking the tension of the belt in the belt-pulley mechanism from time to time.

Due to carelessness and ignorance, the accidents that take place cost dearly. Intangible damages are more important than pecuniary loss. No matter how expensive it is, a damaged machine can be replaced with a new one. However, it is never possible to restore the health of man. For this reason, adhering to the rules set forth for work safety will be crucial in avoiding saddening developments in the future.

The accidents are caused by the farmers who are in all ages. It can be said that the people aged 30-50 years in the agricultural sector in the study area are mainly working. Özkan and Dilay (2013) stated that the ages of the agriculture workers are predominantly in

the 21-70 age group. Therefore, this result is in parallel with the results obtained in the study [8].

The first order among the causes of the accidents is the tractor overturning. One of the reasons for the high turnover rate is that farmers and employees do not have as much knowledge about the factors that affect the overthrow of the tractor. The accidents were mostly carried out by farmers in the age group 4-73. In addition to overthrowing, the high rates of collisions and crashes support this idea. Young children should be kept away from the agricultural sector.

According to the results of the research, 21 accidents have been detected, and accident v casualties (31 persons) were injured after the accident and (4 persons) lost their lives. It is seen that (1 person) died in the hospital and (3 people) lost their lives at the scene. This shows that tractor accidents cause instantaneous deaths

Years of potential life lost (PLL) were found to be 145.6 years. Four people died as a result of the accident. This loss corresponds to about 7 people in the age of 20 years.

The results of the research revealed that the tractor accidents are at a significant level in Karaman province. On the other hand, since these were events that had passed on the police forces and the gendarmerie, the situation in the whole region makes it even more important when those who do not reflect on the records or the newspapers are also taken into consideration. In order for these accidents, which cause serious injuries and losses, to be reduced to the minimum level, the farmers' traditional behavior must be abandoned and made more conscious. In addition, the nature and significance of the subject in scientific conferences, workshops and seminars should be presented realistically.

It can be said that despite being prohibited by traffic law, farmers' use of tractors as passenger vehicles due to lack of adequate control in rural areas causes the accidents which cannot be prevented. In a similar study by Akbolat et al. (2007), they found that tractor accidents were more likely to occur on the way to the cropland, rather than during agricultural work [9]. The fact that more than one vehicle tractor accidents have been detected more than accidents alone has indicated that the tractor is used out of purposes rather than going to work. They emphasized that when worker and load carriage on the road combined with inefficient and wrong use, accidents can increase.

The work to be carried out in order to reduce the number of agricultural accidents has to reach large masses. For this reason, regulation of non-formal education through television can be considered. Training at places where the technical infrastructure is appropriate and online education for computer-trained farmers may also be useful for safe use of agricultural machinery. Participants who successfully participate in these trainings should be awarded certificates, certificate holders should be rewarded and the owners of these certificates could be able to benefit from agricultural support.

As it is known, it is very important that the tractor has a cabin or safety ring in order to prevent the driver from putting his life in danger, especially during overturning of the tractor.

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