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USE OF ELECTRONIC DEVICES IN COMBINE HARVESTERS: A CASE STUDY FOR ANTALYA REGION IN TURKEY

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ABSTRACT Electronic devices in combine harvester have become a key factor for the efficient use of these machines. The complex process technology inside harvesters has to be managed by operators to maximize the performance of machines (ha/h, t/h) by taking into account the requirements of plant production (minimal grain loss, grain damage). The objective of the study is to analyse the use of electronic devices in combined harvesters in Antalya Region, Turkey. Electronic devices, which are used in combine harvester in Antalya are described in the paper. For this purpose, a questionnaire study was carried out with 43 combine harvester users. Users were questioned on the following sensor: grain loss sensor, hectare meter, and failure sensors. 26% of total 43 units combine harvesters belongs to the +30 age group. 25 (58%) unit combine harvester have been used only wheat and barley harvesting. 0-5 years old group combines located in the 23% of combine harvester park. 18 units combine harvester have been used the wheat-barley and corn harvesting. Annual average usage of a combine in harvesting of wheat, barley and corn fields were 411, 311 and 211 ha, respectively. The rate of the grain sensor+failure sensor was determined as 40% (17 units). 16 % (7 units) of combine harvester has got only a time indicator. There is no warning system in 28% of (12 units) combine harvester. It was determined that 31 units combine harvester (72 %) of the operator to follow the developments, 12 combine operators (28 %) to deal with the technological developments

Keywords: Harvesting technology, Electronic device, Combine harvester.

INTRODUCTION

Electronic and computers have played an important role in the development of agricultural mechanization in the last twenty years. The availability of electronic instruments more and more sophisticated, reliable and cheap has stimulated technicians and researches to study and realize specific sensors, control units and software to be employed in agriculture (Balsari et al. 2003).

Combine harvester has more advantages than other harvesting and threshing machines. These superiorities could be summarized as decreasing of harvesting costs, labor saving, low grain losses, harvesting on time period and possibility of separating stalk (Akinci et al. 2002). Combine harvester are large, complex machines sent out to all corners of the world to harvest different types of crops under all possible environmental conditions. The combine harvesting process is a highly uncertain process asking for sensors that extract immediate information from process. In Turkey, , use of combine harvester is widespread and the number of combine harvester used for harvesting different plants increases in passing day. According to age groups, the number of combine harvester in Turkey are given in Table 1.

Table 1. According to age groups, the number of combine harvester in Turkey (TUIK, 2010)

Year	Total	Age group			
		0-5	6-10	11-20	21+
2002	11539	1213	2125	3526	4675
2003	11721	1352	2214	3545	4610
2004	11519	1430	2298	3489	4302
2005	11811	1659	2405	3551	4196
2006	12359	2036	2598	3596	4129
2007	12775	2338	2739	3652	4046
2008	13084	2558	2873	3657	3996

The number of combine harvester is increasing compared to a year. The number of combine harvester in 0-5 age group is increasing with each passing year but the number of the combine harvester in 21+ age group is decreasing. We can say that this is a positive development in terms of the reduction in losses and use of new technologies and products. Field agricultural area in Turkey is approximately 16.5 million ha (TUIK, 2010). Many products such as mainly in wheat, barley, oats, corn, rice, sunflower are being harvested as widespread by combines harvesters. The usage ratio of combine harvester is about 70% in Turkey. Self-propelled combines are commonly used for harvesting the field crops. Most of the farms are small scale in Turkey (Işık and Sabancı, 1988). Hence, combine harvesters are widely rented from their contractors. Climate properties have consecutively changed from region to region. So, the harvesting period in a year has been very long time. Because of the differences in geographic region and climate, combine harvester can be used in different regions great in a years. Combines are worn very quickly due to heavy use. The maximum region of the number combines are Marmara, Central Anatolia, Aegean and Southeast Anatolia, Black Sea, Eastern Anatolia and the Mediterranean region respectively (Yılmaz, 2008). Antalya existed in Mediterranean Region is an important agricultural center in Turkey. The combine numbers are considerably high in this region. According to the years and age groups, the numbers of the combine harvester in Antalya are given in Table 2.

The aim of this research was to analyse the use of electronic devices in combine harvesters in Antalya Region, Turkey.

Table 2. According to the years and age groups, the number of the combine harvesters in Antalya (TUIK, 2010)

Year	Total	Age group			
		0-5	6-10	11-20	21+
2002	234	10	2	24	198
2003	221	17	3	16	195
2004	246	21	11	25	203
2005	272	20	13	28	211
2006	274	22	13	28	211
2007	279	24	14	31	210
2008	281	26	15	31	209

MATERIAL and METHOD

In this study, a questionnaire was conducted on the combine harvester operators in Western Mediterranean Region in the province of Antalya, determination of electronic equipment used in combine harvesters and to determine operator views on this issue. The interviews were made with 43 combines operator and total 10 units questions related to electronic instruments used in combine harvester were asked. In the questionnaire study are determined to reflect properties of operators in the region. Informations related to the combine harvester models, which are used in the harvesting of products, the annual total usage area, which combines the original parts, electronic systems, fault and warning system obtained and evaluations were made.

RESULT AND DISCUSSION

Combine harvester used by the operator are given in Table 3, according to age group distribution of combine harvesters. 26% of total 43 units combine harvester belongs to the +30 age group. This shows that park combine harvester is the old and the old technology. However 0-5 years old group combines located in the 23% of combine harvester park, this is an important indicator in terms of the new harvesters into the park. More than 37% of combine harvesters have been determined in 5-15 age group

Table 3. According to age group, combine harvester distribution

Combine	Age Group				Total
	5	5-15	15-30	30+-	
Number	10	16	6	11	43
%	23	37	14	26	100
Average age	4.7±0.2	10.9±0.4	25.0±1.9	35.0±0.6	17.6±1.9

The crops harvested by combine harvester were given in Figure 1. Evaluated combine harvesters in survey were determined to harvest for wheat, barley and corn. Combine harvester has been identified to not used in the the sunflower, rice etc. harvesting. 25

(58%) unit combine harvester have been used only wheat and barley harvesting. 18 unit combine harvester have been used the wheat-barley and corn harvesting. Wheat harvesting starts at the end of May in coastal areas, it continues in inland until the end of August. Corn harvesting starts after the wheat harvesting. Cutterbar of the combine harvesters used in these products has been changed for corn harvesting. Annual usage area and tear ration of combine harvester increase with corn harvesting.

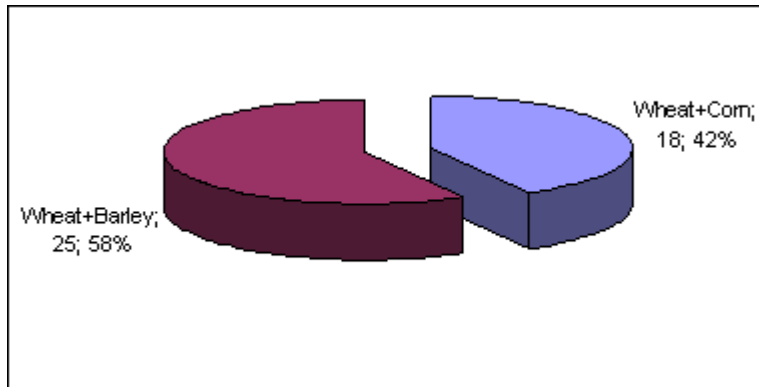


Figure 1. The crops harvesting are used by combine harvester

Combine harvester in survey harvested 29420 ha field between 2008 and 2009. According to the crops distribution, annual average harvested area by combine harvester were given in Figure 2.

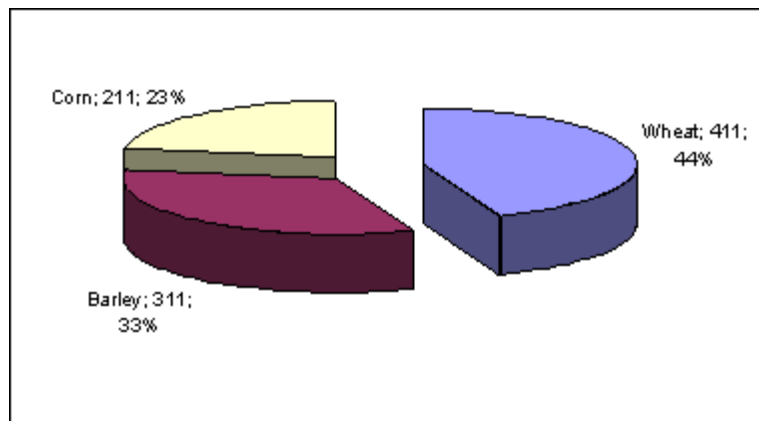


Figure 2. Annual average harvested area by combine harvester

Combine harvester has been harvested an annual average 411 ha wheat. This rate constituted 44% of total annual usage. Barley harvested field and corn harvested field followed the wheat as 311 ha (33%), 211 ha (23%) respectively.

The distribution of operator's answers of the questions of "Is there any attachment you added later, which is not originally part of combine after purchasing or is there any attachment that you don't use, which you think that is unfunctional" were given in Figure 3.

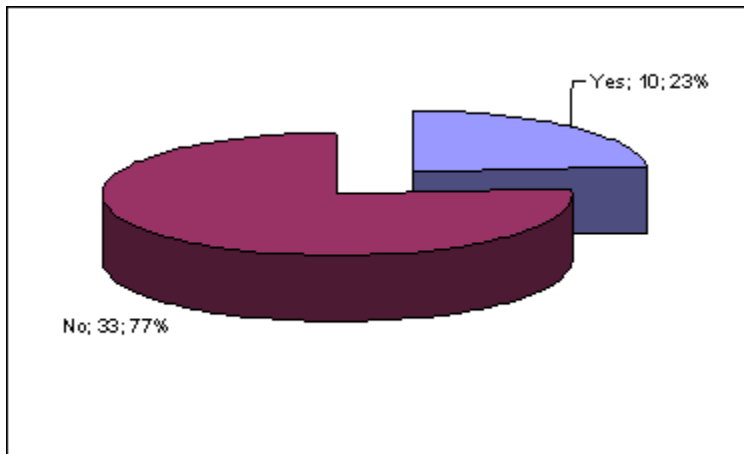


Figure 3. Operators to use the original track

33 combine operators (77%) do not use just do not work or non-original tracks. But 10 combines operator (23%) do not use the original track or releases some parts. Answered the question that is there any features or systems not use in combine harvester features given are given in Figure 4. 95% combine harvester operators used the system in combine harvester but 5% combine harvester operators not used the systems or features.

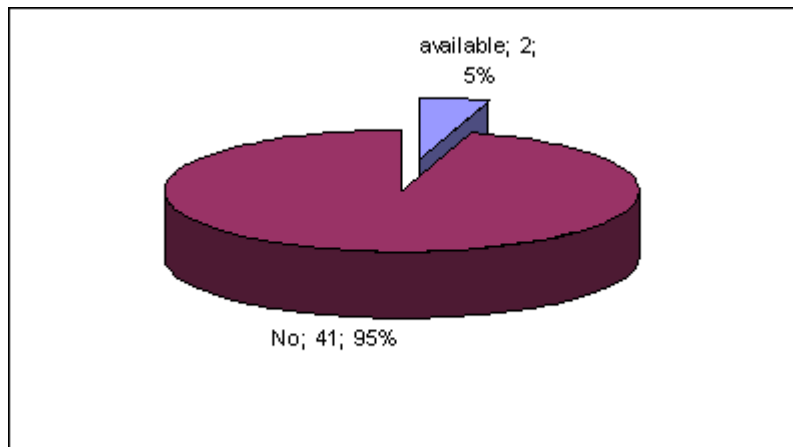


Figure 4. Use of the systems or features in combine harvester

Use of electronic devices in the combine harvesters is very important. Distributions of the electronic devices in combine harvester were given in Figure 5. The rate of the grain sensor+failure sensor was determined as 40% (17 units). 16 % (7 units) of combine harvester has got only a time indicator. There is no warning system in 28% (12 units) of combine harvester.

Distribution of electronic devices the most widely used is given in Figure 6. 26 units of (60%) combine harvester operators are using all of the electronic devices and takes into account. 5% of the operators just used the hectare meter to determine harvested area and 28 % operators not used any devices.

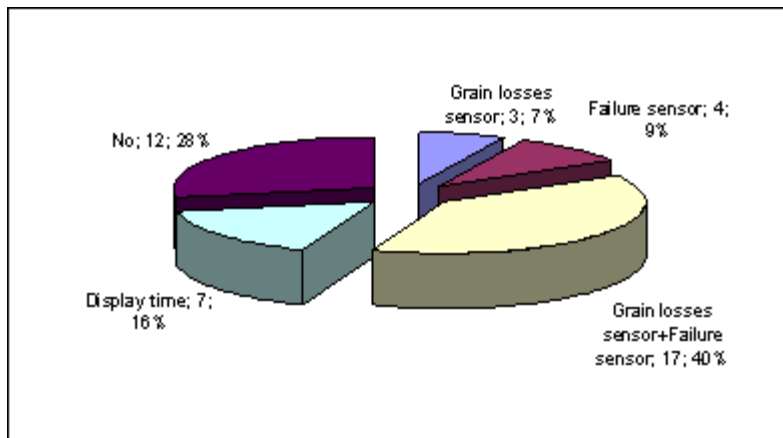


Figure 5. Distribution of the electronic devices in combine harvester

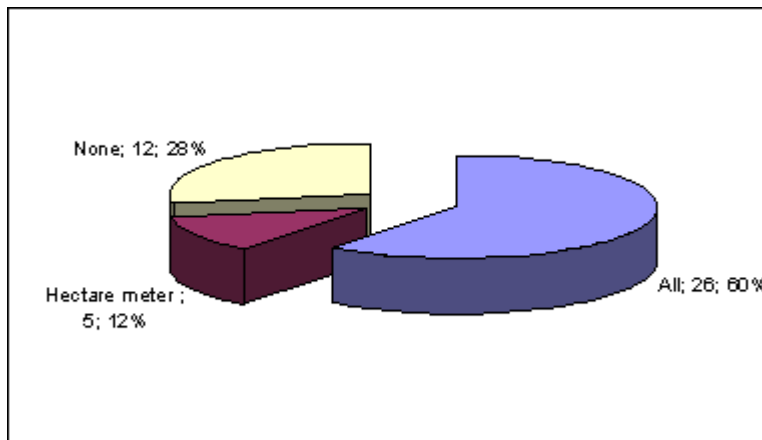


Figure 6. Distributions of the most widely used electronic systems

Distribution of operator’s answer of the question of “do you have any information about electronic devices which are not in your combine harvester” is given in Figure 7.

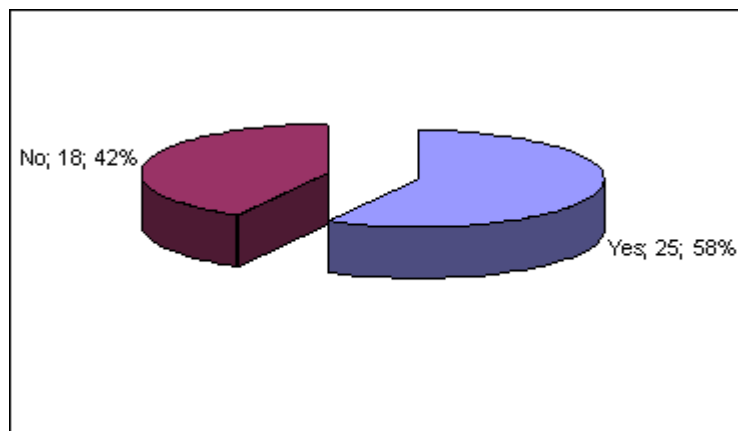


Figure 7. To have information about electronic devices

25 numbers of combine harvester operators have information regarding current and advanced electronic devices, but 18 numbers of that have only information about electronic systems in their combine harvester. Due to small land and harvest price

volatility, owners hesitant about getting the combines harvesters with new technology. Addition, the majority of the combine harvester in this region combines are second hand and electronic devices of these do not work.

It is very important that combine harvester operators follow the technological developments about combine harvesters. In recent years, reducing the loss of grain and combines business efficiency-enhancing technological progress have been continued. The distribution of the follow the technological developments of the combine harvester operators are given

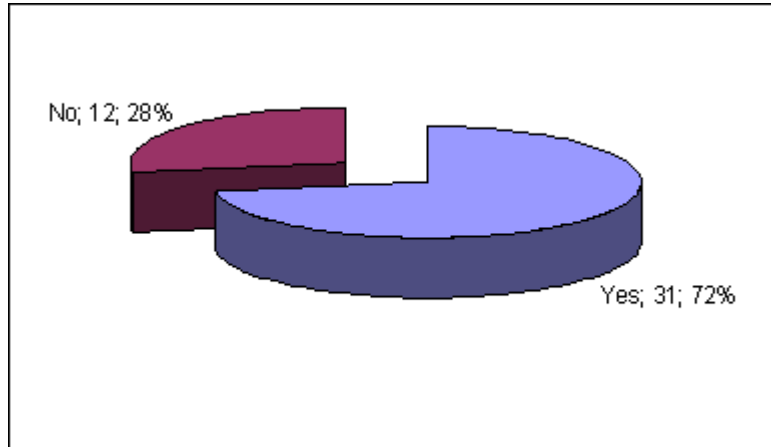


Figure 8. The distribution of the follow the technological developments of the combine harvester operators

Figure 8. It was determined that 31 harvesters (72 %) of the operator to follow the developments, 12 operators (28 %) to deal with the technological developments. A large part of the combines the operator has following the new technology and the electronic devices but some combine harvester operators does not want to go to the usual because of the insufficient information and difficulty using use of information challenges, but because of insufficient.

Whether combines a problem with the use of the electronic system were asked at the last question of the questionnaire. Distributions of the answer to this question were given Figure 9.

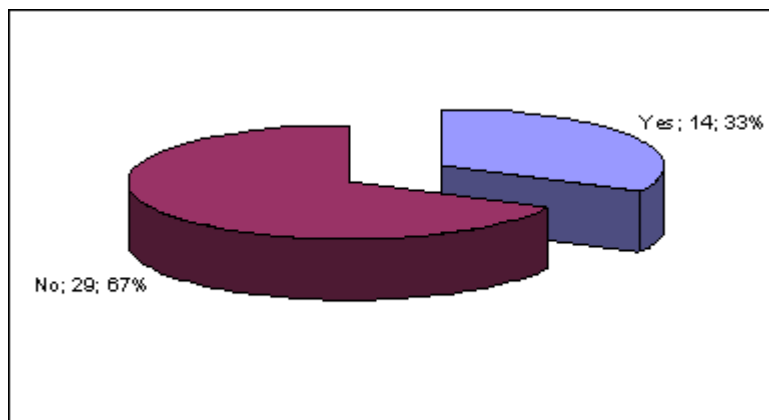


Figure 9. Problem of the electronic devices usage

29 numbers of the combine harvester operators 29 (67%) said that use the electronic system is not the problem, and help was doing their jobs. However, 14 combine operators stated that electronic system failure occurred during operation and service is inadequate. Due to work in dusty conditions, malfunctions occur in electronic devices. Electronic devices used in combine harvesters and technical support are needed to be told by especially companies and associations of combine harvesters

CONCLUSION

The results obtained from this research related to electronic instruments usage of combine harvesters in the Antalya region, Turkey and recommendations are given below.

- Assessed combine harvesters in the questionnaire ranged as 23 % of total combine harvester is 0-5 years, 14 % of total combine harvester is 6-10 years, 26 % of total combine harvester is 11-20 years and 37 % of total combine harvester is 21+ years.
- 58% of the combine harvester has been used only wheat and barley harvesting, 48% of the combine harvester has been used both wheat and corn harvesting.
- The majority of combine harvesters operators are used the system and electronic instruments in combines. Electronic devices as grain loss sensor, hectare meter, and failure sensors have been used in combine harvester.
- A large part of the combines the operator has following the new technology and the electronic devices but some combine harvester operators does not want to go to the usual because of the insufficient information and difficulty using use of information challenges, but because of insufficient
- Due to work in dusty conditions, malfunctions occur in electronic devices
- Electronic devices used in combine harvesters and technical support are needed to be told by especially companies and associations of combine harvesters
- Due to small production area and harvest price volatility, owners hesitant about getting the combines harvesters with new technology. Addition, the majority of the combine harvester in this region combines are second hand and electronic devices of these do not work.
- Combine harvester with electronic devices in the park should be increased to precision agriculture applications increase, reduce grain losses and increase business.

REFERENCES

1. Akinci, I., Canakci, M. and M. Topakci. 2002. Determination of basic machinery management data for a combine harvester. 8th International Congress on Mechanization and Energy in Agriculture, October 15-17, 2002, pp: 366-371, Kuşadası, İzmir.
2. Balsari, P., Tamagnone, M. and P. Marucco. 2003. Use and Performance of Electronic Devices in Machinery for Rice Cultivation in Italy. XXX CISTA-CIGRV Congress. Management and technology applications to empower agro-food systems, pp: 691-699. Turin, Italy.

3. Işık, A. and A. Sabancı. 1988. Türkiye’de Biçerdöver İşletmeciliği ve Sorunları. Tarımsal Mekanizasyon 11. Ulusal Kongresi, ss. 93-106, 10-12 Ekim, Erzurum.(in Turkish)
4. TUIK. 2010. Turkish Statistical Institute (Turkstat), Number of combine harvester.
5. Yılmaz, D. 2008. Türkiye’de Biçerdöver Durumu ve Gelişimi. Tarımın Sesi Dergisi, ZMO Antalya Şubesi, Sayı 17, ss. 20-23, Antalya (in Turkish)