B4

Determination of safety level of some sprayers manufactured in Turkey

Y. B. Yurtlu, B. Ö. Koçtürk and A. T. Serim

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PROCEEDINGS

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Determination of Safety Level of Some Sprayers
Manufactured in Turkey

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Abstract: The people working in agricultural sector are mostly deprived of safety. The main reason of these unsafely working conditions is without safety machines placed in market. In this research, it was determined that safety level of some field and orchard sprayers manufactured in Turkey. A control list which is prepared according to the standard TS EN 907 Agricultural and Forestry Machinery-Sprayers and Liquid Fertilizer Distributor was used as evaluation criteria. This standard is published as harmonized standard in EU Official Journal under 98/37/EC Machinery Directive. Ministry of Industry and Trade is the authorized organization for 98/37/EC Machinery Directive which is mandatory in Turkey. This investigation was conducted on 35 sprayers. Data were analysed according to grouped evaluation criteria. As a result, weak and strong side of these machines were determined for being a guide to the manufacturers.

Key words: safety, agriculture, sprayer.

INTRODUCTION
A vast majority of the world’s workers are employed in agricultural activities and are exposed to a wide variety of occupational hazards. Despite a declining level of manpower in the industry due to an increase in mechanization this has brought with it its own special problems relating to accidents. Increased technology in the field of pesticide control have brought problems of systemic chemical poisoning, whilst infectious and non-infectious diseases also present other sources of hazards to agricultural workers.

Agriculture is one of the most hazardous sectors in many countries. According to ILO, each year, approximately 170,000 agricultural workers die and a high number of world’s 1.3 billion agricultural workers suffer from serious injuries or occupational diseases. Exposure to pesticides and other chemicals and farm machinery accidents are two important factors of these fatalities, injuries and diseases (Anonymous, 2000). Farm machinery is an important contributor to the high rates of occupational injury in agriculture.

According to European Statistics Office, agriculture is the second most hazardous sector after construction works in the region. In England, agriculture has one of the worst fatal accident and occupational ill health records of any major employment sector. In France, mechanization is the main cause of injury accounting for 25% of all cases. In Spain and other European countries at a similar level of development, some 40% of accidents are machinery related (Gölbaşi, 2005).

As a rule, the safety employees and experts attach high value on two points for the purpose of safety. The first one is safe design of product/material/manufacture and the second one is safety education/training. Thus, all products, machinery, systems that will be used in agriculture should be manufactured accepted safety standards. In this regard, it is very much crucial to put into force of 98/37/EC Machinery Directive in the proper sense. Furthermore, market inspection which is conducted by the Ministry of Industry and Trade, agricultural machinery tests executed by the Ministry of Agriculture and Rural Affairs are also valuable works to provide safe and standard products to the agricultural employees. But, the stated inspection and tests are valid for manufacturers who apply to Ministries for certain purposes. Therefore, the products/machinery manufactured in small shop
locally and in accordance with domestic demand have not been safety standards and out of certain inspection circumstances. This situation creates an important problem for safe works in agriculture. In this regard, to create awareness it is necessary to perform multipurpose education/training for the people who manufactured these types of machineries have been mostly in rural.

As for the other agricultural equipment and machinery, there are of course many standards to do with the fabrication of sprayer. All these standards are primarily useful for sprayer manufacturers; in addition, they help to reduce costs, which is beneficial for the customer, too. National, Regional (European) and international standards help to ensure a high level of state of the art of sprayers and lead to uniform criteria for the evaluation of spraying systems concerning working quality, operator safety and environmental protection.

In Europe there is a context between legislation and standardisation that is also valid in Turkey. Following the "New approach", the EU Council issues Directives to define essential health and safety requirements needed to ensure the free movement of products in the market. These requirements have to be underpinned by relevant technical rules, so called harmonised standards. Products manufactured in conformity with harmonised standards are presumed to be conformant to the essential health and safety requirements. These standards remain voluntary; alternate paths are possible but the producer has an obligation to prove his products are conformant to the essential health and safety requirements.

In accordance with the 98/37/EC Machinery Directive it specifies safety requirements and their verification for the design and construction of sprayers for pesticides and liquid fertiliser distributors. Although the application of international standards is voluntary in general, they do have the character of a guideline, and therefore a certain influence on the design and construction of sprayers.

The standard TS EN 907 "Agricultural and Forestry Machinery-Sprayers and Liquid Fertilizer Distributors" (Anonymous, 1999) is the main standard for sprayers with regard to operator safety. This is an additional specification to TS 5066 EN 1553 "Agricultural Machinery-Agricultural Self-propelled, Mounted, Semi-mounted and Trailed Machines-Common Safety Requirements". These standards are published as harmonized standard in EU Official Journal under 98/37/EC Machinery Directive.

The objective of this study is to determine the general weak and strong side of sprayers manufactured in Turkey for being a guide to the manufacturers in safety aspect.

MATERIAL and METHOD

In this research, verifies has been conducted on randomly selected 35 field and orchard sprayers manufactured in Turkey before put in the market. A control list which is prepared according to the standard TS EN 907 was used as evaluation criteria. Requirements on sprayers (except knapsacks) regarding operator safety are defined in the standard TS EN 907.

Following TS EN 907, all subassemblies of the sprayer shall be manufactured in a way that minimises hazards for the operator. The main health and safety requirements are as follows:

- Operator can operate the machine when he wears protective clothes (1).
- If the tank full of liquid there should be no leakage in pomp and filters on maintenance and cleaning operation (2).
- To ensure protection against hazards related to accessible moving power transmission parts, the machines shall be fitted with fixed guards (3).
- When frequent access is foreseen, the machine shall be fitted with guards needing a tool to open them. These guards shall remain attached to the machine when opened (for example by means of hinges) (4).
- Machines shall be designed to be stable when parked according to the instruction handbook on firm ground, with an inclination up to 8,5° in any direction (all the attachments on it, tank is full and empty) (5).
- Stability in the machines with carrying wheels (6).
- Boom height should not be more then 4 m when completely open and close (7).
- It should be two handle fitted to the boom, if boom fold and open with hand, minimum 300 mm far from joint point (8).
- If the boom is moving with another power supply, control parts should take part first position by itself and it's location should be out of boom moving area (9).
- If the booms are folded, it will be a locking device to prevent unwanted movement (10).
- If there is a boarding means, theirs' handholds should not be a part of the boom (11).
- The boom height control unit should require an actuating force < 250 N (12).
- If the boom height adjustment is doing with another power supply, control parts should take part first position by itself and operator can use this control unit from normal working position (13).
- The boom horizontal position should be fixed (14).
- The tank filling hole shall be located not more than 1500 mm above the ground or a platform (or transfer device for chemical like introduction bowl) (15).
- The tank filling hole-tank rim horizontal distance should not be more than 300 mm (16).
- The tank should have at least 5 % oversize (17).
- Cover of the tank: Tight lids, pressure compensation, hitch to the machine (18).
- Liquid level indicator (19).
- Pressure compensation (20).
- Safe draining outlet (21).
- Pressure indicator required, readable from driver's position, no operator contamination in case of leakage (22).
- Pressure indicator minimum diameter 63 mm (if positioned within easy reach) (23).
- Or in other cases diameter should be 100 mm (24).
- Permission pressure should be marked on pressure indicator with red line (25).
- Safety valve required, pressure must not exceed 120 % of allowed value (26).
- Fan protection from drawing or discharging foreign matters and from access and drive able to be disengaged (27).
- Hoses, if cab, no hoses in the cab allowed, if no cab, hoses shall be covered, marked with allowed pressure (28).
- Spraying manual control, positioned within easy reach of the operator and after switching off, maximum dripping volume from each nozzle 2 ml (29).
- Clean water tank with at least 15 l and it should have a tap that not need to press continuously (30).
- Manually control spraying unit (for example spraying gun) should not work without permission and can locked when it closed, unlocked when it is open (31).
- Comprehensive instructions and information on all aspects of maintenance and the safe use of the machine shall be provided in the instruction handbook (32).
- Marking
  i. Name and address of the manufacturer (33),
  ii. Year of construction (34),
  iii. Designation of series or type (35),
  iv. Permission operating pressure (36),
  v. Mass of the machine (empty) (37),
  vi. Permission total mass (38),
  vii. Nominal rotation frequency and direction of rotation of the power input connection (marked by an arrow) (39),
  viii. If self-propelled machine, nominal power (kW) (40).
- Warnings
  i. On the tank, it is forbidden to enter to the tank (41),
  ii. If the boom is height than 4 m, there is a warning label (42),
  iii. On the clean water tank, it must be fill with clean water warning label (43).
- On the Pomp
  i. Name and address of the manufacturer (44),
  ii. Serial number (45),
  iii. Max pomp output (46),
  iv. Max pomp pressure (47),
  v. At max pressure max pomp output (48),
  vi. Nominal and max number of rotation (49).
- Hoses should be marked with max allowed pressure (50).
These main requirements have been classified for evaluating the data. The classification is given as follows:
• General safety requirements (1-2),
• Protection against moving power transmission parts (3-4),
• Stability (5-6),
• Spraying boom (7-14),
• Tank (15-21),
• Pressure indicator (22-25),
• Safety valve (26),
• Fan (27),
• Hoses (28),
• Spraying manual control (29),
• Clean water tank (30),
• Manually control spraying unit (31),
• Instruction handbook (32),
• General spraying machine marking (33-40),
• Warning (41-43),
• Pomp marking (44-49),
• Hoses marking (50).

After verifying the machines, the data were analyzed according to these criteria and classification.

RESEARCH RESULTS
Table 1 shows the percentage of the verified health and safety requirements for the spraying machines generally and grouped spraying machines.

Table 1. The percentage of the verified health and safety requirements for the spraying machines.

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<th>Health and Safety Requirements</th>
<th>Percentage of Verified (%)</th>
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<td>General</td>
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<td>General safety requirements</td>
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<td>Protection against moving power transmission parts</td>
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<td>Stability</td>
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<td>Spraying boom</td>
<td>61,1</td>
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<tr>
<td>Tank</td>
<td>72,7</td>
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<td>Pressure indicator</td>
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<td>Safety valve</td>
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<td>Hoses</td>
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<td>Hoses marking</td>
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*NR: Not relevant
As seen in Table 1 there are just two completely verified requirement groups. The other criterions can not verify totally. Measurement and controls indicated that there are not sufficient warning labels on the spraying machines. Also instruction handbooks are not qualified according to the relevant standard. There is no enough protection against moving power transmission parts for mistblowers. After the most insufficient requirements, the following requirements can be declared that the other most insufficient requirements; protection against moving power transmission parts, hoses placement and their marking, manually control spraying unit, spraying manual control and clean water tank. According to percentage of verifying for group of the spraying machine in Table 1, there are two clear differences on the requirements. These are manually control spraying unit and clear water tank. Numbers of verified-not verified requirements are given in Figure 1, 2 and 3. Figure 2 indicate that the number of not verified conditions for manually control for spraying unit is height for field-orchard sprayers. But it is not valid for mistblower sprayers. Because generally manually control spraying unit like spraying gun are not given by the manufacturer with these machines. Therefore the requirements can not been checked in this study. Table 1 show that percentage of verified clean water tank requirements is height for mistblower sprayers.

Figure 1, 2 and 3 indicate that generally tank requirements and general spraying machine marking requirements covered by manufacturers.
Manufacturers should take into consideration that all these health and safety requirements completely meet by them for declaration of conformity to 98/37/EC Machinery Directive. In this study it is summarised the general verified and not verified aspects of the sprayers for the manufacturers. The application of standards on spraying systems is an important contribution to the availability of well performing sprayers which minimise hazards for operators and bystanders. This is of very high value whereas the importance of consumer protection is increasing.

Standardisation yields the most benefit if there are national regulations which entail the application of a standard, as is the case for 98/37/EC Machinery Directive. So one imaginable scenario for the future could be to allow the application of plant protection products only with sprayers designed following appropriate EU safety and environmental standards.

**REFERENCES**

