

## **A Survey of Safety Aspects Concerning Horticultural Farm Machinery**

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### **Abstract**

In Italy, one farm machine out every three is obsolete under some points of view and certainly as concerning safety aspects. In the south – east of Sicily carrots and potatoes are the most spread cultivations. To cultivate them are used some machines and some of them are used only for these crops. Here we show the results of a survey concerning machineries used in a representative sample of farms under aspects connected with safety and with the correspondence to the currents regulations.

The survey has involved a sample made up from representative farm sited in the south east of Sicily. We visit them with the aim to enhance the machinery that made up the fleet, the age, their characteristics, the maintenance, the characteristics of the shelter or of the garage, and finally to identify modification carried out to the machines.

Many of the examined machines are without bonnets and or chain guard, or they are not in good conditions. It appears that workers and often the employers and consequently the management are not greatly involved in safety aspects. To make adjustment to machineries and to form and to motivate workers are all activities that employers often consider as additional costs. A news survey is in progress with the aim to update the here shown results (that refers to 2005-2006), because we believe that a great awareness is spreading rapidly among the farmers concerning safety aspects.

### **Key words**

D.P.R. 459/96, safety regulation, carrot, potato

## **1. Objectives**

In Italy the agricultural sector is in second place as regards accidents, just after the building industry. There are many reasons for this but it can be said that human error is often the cause. Carelessness, non-observance of safety regulations, progressive aging of the operators, poor technical training of employers and operators and lack of maintenance of safety devices are the main causes of accidents in agriculture. To these can be added the fact that many of the machines used daily in the fields were designed for completely different purposes or are now obsolete.

In fact in agriculture many accidents involve agricultural machinery. Of about one million, seven hundred and eighty thousand registered machines, at least five hundred thousand do not have the requisites to be in circulation and thus endanger the safety of the operators and others. This data is quite shocking in that it means that about one machine out of three of those used daily in the fields is obsolete and, no longer having the necessary requisites for use, should be taken out of circulation.

In the province of Ragusa the most widespread crops grown in open field are carrots and potatoes and both these crops are cultivated with machines generally used also for other

crops, machines that can be considered typical (such as the banking machines) and specific machines like those used for harvesting.

This work presents the results of a survey carried out of the machines used on highly specialised farms cultivating carrots and potatoes and assesses the state of the machines also with regard to current safety regulations.

## **2. Methodology**

Farms with a significant area and specialised in the cultivation of potatoes and carrots were identified. Where possible farms also marketing their products were chosen. With the assistance of technical personnel the machinery was inspected on the spot in order to identify the machines present and their condition as regards safety regulations.

For each operating machine data was collected relating to the make, model and date of appearance on the market. The data collected also included the presence of an identification label and safety pictograms, the condition of the hydraulic ducts and the general condition of the machines with regard to the varnishing of the body, the trailer hook and the three point attachment hook structure. The state of wear and any evident crack and/or deformation were noted.

In the case of mechanical transmission, the survey also considered the condition of the PTO protection and the presence or absence of protection casing and any modifications. As regards operating machines marketed for the first time after D.P.R. 459/96 came into force, the presence or absence of the EC labels and instruction and maintenance manuals required by said D.P.R. was recorded.

The machines considered were divided into those “activated” and “not activated” from the Power Takeoff (PTO). Finally, the double cardan joints connected to the machines were examined.

## **3. Results e discussion**

### *3.1 Sample Composition*

The survey was carried out on a sample of ten farms in the province of Ragusa (Tab. 1), with a surface area of between 14 and 1200 ha.

**Table 1. Sample farms**

| <b>Farm</b> | <b>Farm area<br/>(ha)</b> | <b>Carrots<br/>(ha)</b> | <b>Potatoes<br/>(ha)</b> | <b>Garage<br/>or Shelter</b> | <b>Farm<br/>Service<br/>department</b> | <b>Packing<br/>House</b> |
|-------------|---------------------------|-------------------------|--------------------------|------------------------------|----------------------------------------|--------------------------|
| A           | 500                       | 150                     | 270                      | Yes                          | Yes                                    | Yes                      |
| B           | 400                       | 50                      | 35                       | Yes                          | Yes                                    | No                       |
| C           | 15                        | 4                       | 9                        | Yes                          | No                                     | No                       |
| D           | 100                       | 25                      | 25                       | No                           | No                                     | Yes                      |
| E           | 65                        | 10                      | 10                       | Yes                          | No                                     | Yes                      |
| F           | 1200                      | 120                     | 250                      | Yes                          | Yes                                    | Yes                      |
| G           | 14                        | -                       | 14                       | No                           | No                                     | No                       |
| H           | 150                       | 50                      | 50                       | No                           | Yes                                    | Yes                      |
| I           | 56                        | 10                      | 15                       | Yes                          | Yes                                    | Yes                      |
| L           | 320                       | 110                     | 10                       | Yes                          | No                                     | Yes                      |

In all 87 operating machines (56 of which were activated from the PTO) habitually used in the cultivation of potatoes and carrots were examined.

As can be seen from the table, in the sample there are farms of various sizes. They have commercial contacts abroad and in seven cases packing facilities. Even the smallest have a lively business: one operates for third parties and this implies even greater attention towards choice, maintenance and efficiency of machinery. Most of the farms have workshops and personnel qualified to carry out maintenance work and often also to make important modifications.

### 3.2 *State of machinery*

The operating machines not powered from the PTO include ploughshares, disc ploughs, tillers. Disc harrows were not found although they are widely used elsewhere. Potato planting machines were included in this group, in which the planting device is powered by a supporting wheel. Of the 31 machines examined, 18 were found to have been marketed for the first time before D.P.R. 459/96 came into force (tab. 2).

All the ploughs, tillers and scarifiers were found to lack instruction and maintenance manuals.

In most cases, where there were broken and worn parts these had been replaced. The oldest machines had been re-varnished and their body structure had been reinforced. Such modifications, combined with the re-varnishing, in general made it impossible to see the make or model of the machine.

As regards the two potato planters marketed for the first time before D.P.R. 459/96 came into force, neither had an EC label, instruction or maintenance manual, identification label, or safety pictograms. In both, the transmission parts were protected and both had been modified with reinforcement of the structure, the addition of microgranulators, an increase in the hopper capacity and posterior footboards to facilitate loading.

**Table 2. Machines not powered from the PTO**

| <b>Machines examined</b> | <b>D.P.R. 459/96<br/>Tot/Before/After</b> | <b>EC<br/>labelling</b> | <b>Manual</b> | <b>Label</b> | <b>Pictograms</b> |
|--------------------------|-------------------------------------------|-------------------------|---------------|--------------|-------------------|
| Ploughs                  | 6/3/3                                     | 6                       | 0             | 2            | 0                 |
| Disc ploughs             | 4/3/1                                     | 1                       | 0             | 1            | 0                 |
| Tillers                  | 9/5/4                                     | 1                       | 0             | 2            | 1                 |
| Heavy tillers            | 4/1/3                                     | 1                       | 0             | 0            | 2                 |
| Potato<br>planters       | 8/6/2                                     | 0                       | 0             | 0            | 0                 |
| Totals                   | 31/18/13                                  | 9                       | 0             | 4            | 3                 |

Of the operating machines powered from the PTO, 57% were found to have been put on the market for the first time after D.P.R. 459/96 came into force. As well as the parameters examined for the previous sample, the protection of the PTO was also considered – the presence or absence of carters or protective covering and the presence of modifications. The results for each type of machine are presented in the following table.

As regards the machines powered from the PTO, the four rototiller marketed after DPR 459/96 all had EC labelling, instruction manuals, identification labels, safety pictograms,

power plug protection and intact cases. None of them had been modified.

**Table 3. Machines powered from the PTO shaft**

| <b>Machines examined</b> | <b>D.P.R. 459/96 Tot/before/After</b> | <b>EC labelling Before/After</b> | <b>Manual</b>        | <b>Label</b>                 |
|--------------------------|---------------------------------------|----------------------------------|----------------------|------------------------------|
| Diggers                  | 10/6/4                                | 1-4                              | 1-4                  | 1-4                          |
| Centrifugal spreaders    | 6/3/3                                 | 0-3                              | 0-3                  | 0-3                          |
| Seeders                  | 5/1/4                                 | 1-4                              | 1-4                  | 1-4                          |
| Spreyers                 | 6/2/4                                 | 0-2                              | 0-2                  | 0-2                          |
| Carrot harvesters        | 10/7/3                                | 0-3                              | 0-3                  | 0-3                          |
| Potato windrower         | 4/2/2                                 | 0-1                              | 0-0                  | 0-0                          |
| Potato harvester         | 2/0/2                                 | 0-2                              | 0-2                  | 0-2                          |
| Totals                   | 43/21/22                              | 2-19                             | 2-18                 | 2-18                         |
| <b>Machines examined</b> | <b>Pictograms</b>                     | <b>Carter</b>                    | <b>Modifications</b> | <b>Power plug protection</b> |
| Diggers                  | 1-4                                   | 6-4                              | 2-0                  | 1-4                          |
| Centrifugal spreaders    | 3-3                                   | -                                | 3-0                  | 3-0                          |
| Seeders                  | 0-4                                   | -                                | 0-1                  | 0-2                          |
| Spreyers                 | 0-2                                   | -                                | 2-2                  | 1-3                          |
| Carrot harvesters        | 0-3                                   | 0-2                              | 7-3                  | -                            |
| Potato windrower         | 0-1                                   | 0-0                              | 2-2                  | 0-0                          |
| Potato harvester         | 0-2                                   | 0-2                              | 0-2                  | 0-2                          |
| Totals                   | 4-19                                  | 6-10                             | 16-10                | 5-11                         |

The *boom sprayers* examined are used for weeding and for pesticide treatments onto the canopies. In most cases the sprayers did not undergo regular maintenance. In fact maintenance was carried out only on the occurrence of problems during use – problems that interfered with the functioning of the equipment such as blockage of the nozzles, a break in the tubing or filter blockage.

The *fertiliser spreaders* and the precision pneumatic seeders were not found to have been modified and were all in a fairly good or good condition.

The three carrot harvesters bought after D.P.R. 459/96 had come into force all had EC labelling, an instruction and maintenance manual and safety pictograms. Two of them had protection crankcase for moving sections. All the sample machines had undergone modification: the most significant modifications were those regarding digging mechanisms and product transport devices and the addition of a footboard for an operator in charge of checking the regular working of the belt transporting the carrots towards the bin.

During the survey 9 *potato harvesting machines* were examined: 3 were only diggers, 4 digger – windrowers and 2 digger-harvesters. The diggers were made by local manufacturer. They work one row at a time. They did not have EC labels or manuals or even identification labels or safety pictograms. They were, however, in good condition and their use does not represent any type of safety hazard for the operators.

Of the 4 *digger-windrowers*, 2 were bought after D.P.R. 459/96 had come into force. One of these had EC labelling and safety pictograms but neither had an instruction manual or

identification label. Moreover neither had protection for the PTO shaft or protection case. Both had been modified to improve harvesting and avoid breakdowns during the operation. Modifications included the replacement of individual hoes with a single blade, this making it possible to regulate the inclination as well as the depth, and changes in the transmission (the addition of chains other than those installed by the constructor). Such modifications should imply constant and careful maintenance but this is often overlooked. Some of the oldest machines had been re-varnished and undergone reinforcement of the body structure. Both the digger-harvesters, bought in 2001 and 2004, had all the safety requisites required by the laws in force and neither had been modified to an extent that would compromise safety during use.

Finally, the 33 cardan joints connected to the machines under consideration were examined. As many as 17 were found to lack the protection required by law. Of the 16 joints with protection, in 8 the protection was not intact or the joints were only partly protected. Moreover, only 9 had warning and signalling pictograms.



**Figure 1.**



**Figure 2.**

### 3. Conclusions

Of the operating machines not activated from the PTO, more than half were found to have been put on the market before D.P.R. 459/96 came into force. Not even all those marketed after 21/09/1996 had EC labels. None of the ploughs, tillers and scarifiers had instruction or maintenance manuals. Of the machines powered from the PTO, only a little over half (57%) were found to have been put on the market after D.P.R. 459/96 came into force and even some of these did not have EC labels or instruction and maintenance manuals. Most of them did not have protection for the PTO, protection carters for the engine transmission parts or safety pictograms. More than half had been modified. Only 8 cardanic joints out of the 33 examined could be considered safe. The rest either had no protection or else the protection was broken and did not completely protect the shaft.

The safety conditions of most of the agricultural machines examined were found to be poor - either because there were no protection carters or safety devices or because where these were present they were not adequately maintained. The survey showed that most agricultural operators are unaware of the dangers connected with using machinery and unwilling to apply the safety regulations in force. Employers continue to see safety regulations as an extra cost and believe that the risk to workers is already covered by an obligatory insurance policy. The workers themselves, who by law are also responsible for checking safety measures, are generally unprepared for this role and find it difficult. The obsolescence of the machines increases the risk of accidents at work as does the progressive aging of operators in the agricultural sector. There is reason to believe that continual training and an information campaign about safety would significantly reduce accidents and improve productivity.

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