

DYNAMICS OF OCCUPATIONAL RISKS IN AGRICULTURAL ACTIVITIES BRAZIL

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ABSTRACT

Work accidents for the rural man involving agricultural tractors and agrochemicals are among the main causes of work withdrawal in rural areas. Thus, the objective of this work was to demonstrate the real situation of the dynamics of accidents work for the use of machines, agricultural implements and pesticides during rural activities in Brazil. A review of the literature on the theme "work accidents by rural activities in Brazil" was carried out through researches in academic works, articles and scientific journals specific to this theme. It is observed that there is a dynamic of occupational hazards throughout the agricultural activity, among them, poisoning by pesticides due to the inappropriate use and the risk of accidents in agricultural machines and implements. In addition, the results showed that the main factors associated with these risks are: lack of training of farmers on the correct use of pesticides, lack of reading of the package leaflet and instruction manual of the machines and implements, low self-security, popular beliefs and customs in the control and prevention of occupational hazards. We conclude that the use of technology in the field allowed the rise in agricultural and livestock production, but the lack of training of farmers when using these technologies favored a significant increase in occupational hazards during the work activities of farmers. Physical and chemical risks are those that cause the most damage to rural workers.

Keywords: Rural technology, rural activity, safety, work risks.

1. INTRODUCTION

Technological and intensive agriculture is among the main economic activities in Brazil and is responsible for the generation of employment and income for millions of Brazilians. This sector is responsible for a third of the Brazilian Gross Domestic Product (GDP), with positive balances in the trade balance, providing a consolidation of the stabilization of the national economy (AMBROSI & MAGGI, 2013). Advances in agricultural modernization occurred in the 1970s, with increased use of improved seeds, fertilizers and chemical pesticides, as well as the use of machinery and agricultural implements. This modernization made it possible to expand cultivated areas, but also significantly increased the risk of accidents and intoxication on farmers' activities (JESUS & BRITO, 2009). It is highlighted as the main risks, physical agents, chemical, biological, ergonomic, accidents with machines, implements, handle tools, ectoparasitocides, domestic animals, poisoning animals and pesticide intoxication (ALMEIDA, 1995).

Most of these accidents are associated with a lack of training in the correct use of pesticides, agricultural machinery and implements, and low level of education of users, which makes it difficult to read labels and instructional manuals and the low safety culture implanted within the organization of work, where many are limited to the application of popular customs and beliefs acquired from generation to generation (ZORZETTI, 2014). One way of reducing these risks of accidents is based on the application of regulation 31 (NR 31), which deals with preventive measures in rural activities, but the lack of technical monitoring and the need of the use of the technologies by the farmers, end up favoring the misuse of these tools and an increase in environmental risks (ALVES & GUIMARÃES, 2012).

In this sense the aim of this article is to present the real situation of the dynamics of industrial accidents by the use of machines, agricultural implements and pesticides during rural activities in Brazil.

2. MATERIAL AND METHODS

2.1. SOURCE OF RESEARCH

The methodology applied in this article was of the dialectical type (DUFF & LAZARATON, 2000), in order to analyze the articles, monographs, dissertations and theses related to occupational hazards in agricultural activities. Data were collected in the literature between May and August of 2017. The researches were investigated from bibliographic research available in electronic databases such as scientific electronic library online (SCIELO), Google Scholar, Science Direct and CAPES periodicals, as well as publications listed on the website of Graduate Programs and other organizations active in the health and safety of work. For the search of the

articles, the following keywords were used: rural technology, rural activity, occupational hazards, Standard Regulate - 31 (Norma Regulamentadora (NR) in Brazil for for unhealthy activity and operations).

3. RESULTS

3.1. Occupational risks in agriculture

According to the International Labor Organization (ILO) (2004), agricultural activities are among the three with the highest rate of accidents in the world, many of them fatal, and for every three accidents in the countryside, one causes permanent incapacitation of the worker. Occupational hazards already existed in rural areas, but were intensified and aggravated from the 1940s due to technological changes in the rural work environment, resulting in an increase in the occurrence of accidents (DREBES *et al.*, 2014). The main occupational risks to the health and safety of rural workers are: physical, chemical, mechanical, biological, ergonomic and psychosocial (SILVEIRA *et al.*, 2005). According to Rivero *et al.*, (2007), the main occupational risk factors are: fall of structures, fall at ground level, winding by moving objects, entrapment, trampling, overturning of tractors and machines, projection of particles and fragments during use of agricultural tools, perforations and blows, cuts and blows during tool use, electric fits, burns, and product handling intoxications.

3.1.1. Chemical hazards

According to the “Ministério do Trabalho e Emprego” (Ministry of Labor and Employment (MTE), is a ministry of the Brazilian government), chemical hazards can be caused by dust, mists, gases, vapors, fumes and chemicals in general. In agricultural activities, the main risks are dust and toxic gases through the use of agrochemicals (DONHAM *et al.*, 2000). It is estimated that in Brazil there are more than four hundred thousand people contaminated by agrochemicals annually, with four thousand deaths per year (MOREIRA *et al.*, 2010).

Neto *et al* (2009) studying the use of pesticides and the use of individual protection equipment by producers, found that 100% of farmers use chemicals in their crops and 100% do not use any type of personal protective equipment (PPE) at the time of application of the chemical. A study by Sherwood *et al.*, (2005) in Ecuador, using markers on volunteer workers at the time of application of pesticides, found that contamination occurred in the hands, arms and faces of the applicators, as well as in the clothes, beds, kitchen table and children's clothing.

The effects of pesticides on human health are separated into two types: 1) Acute Effects, where the result of exposure to the pesticide is capable of causing in up to 24 hours, apparent effective damage; 2) Chronic Effects, which is characterized by contact over the noxious agent for several

days, months or years and its harmful effects are presented over time (PERES, 2003). It is estimated that at least 7 million acute and chronic nonfatal diseases are caused by the use of pesticides (ILO, 2005). In addition, pesticides can cause harm to the mental health of rural workers, such as mental disorders and depression. According to Marinho & Mendonça (2005), in the years 1992 to 2002 pesticides were among the main causes of suicide attempt and suicide in Brazil.

Bedor (2008) assessing the potential health damage of rural workers in fruit production pairs, found that the main symptoms reported by farmers were headaches, followed by skin irritation, dizziness, sneezing, and itching. Intoxication cases are often aggravated by a number of factors, such as the lack of inspection at the agrochemical sales offices, the neglect of basic safety standards, the lack of technical assistance as well as the cultural problems encountered in rural areas, (TAVELLA *et al.*, 2012). Information that few rural workers take into account is reported by Vieira *et al.* (2016) who, when analyzing the characterization of the scientific production on exogenous intoxications, verified that the high intoxication index besides the absence of the use of the EPI are often associated to the consumption of alcoholic beverages by the rural workers at the moment of the application of the chemical defensive.

3.1.2. Physical risks

The physical risks come from agents that act on the transfer of energy over the organism and the damages caused are equivalent to the speed and amount of energy transferred (BARBOSA FILHO, 2011). These energy transfers come from noise, vibration, ionizing and non-ionizing radiation, cold or heat, as well as moisture and hyperbaric pressures (BRASIL, 2011). In the rural work environment, farmers are constantly exposed to physical agents. Exposure to sunlight during work activities is considered a physical risk, since in the absence of sun protection, farmers' skin is affected by non-ionizing radiation (solar) causing burns that cause discomfort and fatigue, as well as the appearance of diseases such as skin cancer (ARAÚJO *et al.*, 2015).

For those who work with agricultural machines, the working environment of the agricultural operator becomes unhealthy and the noise emitted by the machines and the vibrations stand out as physical risks (MONTEIRO, 2010). To mitigate high noise levels, the tractors are equipped with a protective cab which the operator is "isolated" from external noise. Baesso *et al.* (2015), evaluating the noise level in agricultural tractors, concluded that in the cabins of the tractors studied, the internal noise values were below 85 decibels, that according to NR-15 is considered an adequate level for a daily exposure of eight o'clock. Already Cunha *et al.* (2012), evaluating the noise levels in two agricultural tractors, concluded that both tractors had noise levels above the tolerance limit of 85 decibels and that maintenance would be recommended, as well as the use of the ear protector operators. In a study by Cunha *et al.* (2009), evaluating the vibration and

noise levels emitted by an agricultural tractor in soil preparation, obtained high results in the greater accelerations of the tractor and at the moment of the tractor displacement on the soil preparation.

3.1.3. Biological risks

The biological risks to farmers can be bacteria, fungi, mites and viruses, which are often transmitted by domestic animals such as fleas and ticks. The main diseases of rural workers from animals, insects, fungi and bacteria are: Brucellosis (*Brucella melitensis*, from sheep and goat they are disease transmitter for man), Leptospirose (*Leptospira interrogans*, from rats), Carbuncle (*Bacillus anthracis*, from bacteria), Tetanus (*Clostridium tetani*, from bacteria), Birdwatching Disease (*Chlamydia psittaci*, from birds), Dermatophytosis (*Microsporum canis*, from pets), Paracoccidioidomycosis (*Paracoccidioides brasiliensis*, from fungi) and Malaria (*Plasmodium* sp., from insect) (FERNANDES & FULARNETO, 2004).

Oliveira *et al.* (2016) evaluating the internal environment conditions in four Soybean Seed Processing Units (BHU), which operate with air and sieve machine, gravity table and with or without spiral separator, have found several microorganisms that can cause occupational diseases, including: *Rhizopus* spp., *Penicillium* spp., *Cladosporium* sp., *Mucor* sp., *Aspergillus* sp., *Alternaria* sp., *Torula* sp., *Epicoccum* sp., *Nigrospora* sp., *Fusarium* sp., *Trichoderma* sp.

3.1.4. Ergonomic risks

Ergonomic risks are those introduced into the workplace by agents (machines, environment, lighting and others) inadequate to users. Emphasis is placed on ergonomic risks, weight lifting above the physical capacity of the worker, inadequate posture during the performance of the work activity, inadequate work station, repetitive work activities, night work, poor or surplus lighting, high working hours and the environmental conditions (noise, humidity, temperature) (MATTOS & MÁSCULO, 2011).

In agricultural activities, we have as examples of ergonomic risks pruning; milking; planting; harvest and weeding, which stand out among the most relevant provocateurs of Repetitive Strain Injuries - LER (MARTINS & FERREIRA, 2015). In a study carried out by Azevedo *et al.*, (2014) evaluating the ergonomic conditions of the work environment in the activity of the agricultural operator, 33% of the workers had neck pain, 20% had spinal pain and 13% had pain in the legs.

In this way, Iida (2005) emphasizes that anthropometric adaptation, movement compatibility and other items of comfort and safety are fundamental in the application of agricultural machinery and equipment. For this reason, knowing the human factors and working conditions, helps in the

search for punctual solutions to ensure a better quality of life and safety at work, as well as greater productive efficiency (QUEIROZ & SOUZA, 2012).

3.1.5 Accidental hazards

It is notorious that accidents are considered to be one of the most relevant risks among the others in rural activities, as they often cause serious injuries such as cuts, amputations or fatal accidents. According to Debiassi *et al.* (2004), most of the accidents with tractors are caused by unsafe behavior, the main one being the loss of slope or slope control in the handling of machines and equipment, followed by the operation of the tractor under extreme conditions. The most important risk factors identified in the use of tractors are: operation under extreme conditions; loss of tractor control in sloping areas; consumption of alcohol; transportation of other workers; lack of protection structure; lack of adequate training; non-use of restraint system; safety systems and non-compliance with the main safety rules due to time pressure (PAPADOPOULOS *et al.*, 2010).

In a study carried out by Ambrosi & Maggi, (2013), evaluating the work accidents related to agricultural activities, it was verified that 76% of the cases of rural accidents, the tractor is not enclosed and has no protective cover on the cardan shaft, do not use belt and 21% use the tractor to carry more than one person. A total of 55% of the serious accidents occurred in the countryside were with agricultural machinery and among these the tractor was the one that caused 65% of serious accidents (MONTEIRO *et al.*, 2010). In a study by Santos & Felix (2016), who analyzed rural work accidents during the period from January/2013 to December/2015, they concluded that most of the accidents at work in sugarcane plants occurred falls, machinery and electric shocks.

In a study carried out for Fernandes *et al.* (2014), characterizing the accidents with agricultural tractors, observed that the agricultural tractor was involved in 153 accidents (67.11%), followed by the sugarcane/grass chopper with 32 occurrences (14,03%) and brush cutter with 18 occurrences (7.90%). Specifically, these accidents occurred due to the worker's lack of attention (26.31%) and the fatigue due to the long period of work (24.52%), which are considered by the operators as the main causes of agricultural tractor accidents. follow the causes caused by tractor operation in extreme conditions (12.94%) and recklessness (9.47).

The debate on the subject of work accidents in rural areas is fundamental, since in rural areas there have also been intense technological changes that have changed the lives of workers, but the studies and the availability of data on the subject in Brazil and elsewhere are precarious developing countries (TEIXEIRA & FREITAS, 2003).

3.2. Perception of farmers about the work accident

As already mentioned in this article, the lack of study of workers makes it an aggravating factor for accidents at work, since many cases occur due to a lack of knowledge of the risks or simply to think that accidents are commonplace in the workplace. Peres *et al.* (2001), point out that the negative health problems of farmers by the use of pesticides are directly related to socioeconomic factors, such as educational level, reading and writing ability and family income.

Studies have reported that farmers' low level of schooling is considered a problem, since reading safety recommendations, labeling (or possibly Agronomic Reciprocity) is fundamental to avoid problems of intoxication and contamination (FARIA *et al.*, 2004; PERES (1998), and others (Edwards *et al.*, 2002). This was verified by Bohner *et al.*, (2013), where he evaluated the use of pesticides in thirty farmers and concluded that only 30% of them read the package leaflets and understand.

The degree of schooling in many cases is directly linked to the social class in which the farmer is inserted, where many are not able to study, because they are working in the field and have a monthly income that provides them with conditions to survive economically. According to Silva (2007), illiteracy rates are located in rural communities and this makes it an aggravating factor, since it restricts the opportunity to read pesticide labels, machinery and equipment manuals, as well as training and training courses. This perception corroborates the results obtained by Drebes *et al.* (2014), where they assessed the profile of injured rural workers and concluded that 79% of the injured are in the incomplete elementary schooling. This aggravation becomes more pronounced when, within the rural community, a culture of empirical security passed between generations is established.

3.3. Preventive measures applied to rural activity (NR 31)

Established in 2005 (by the Ministry of Labor and Employment) the NR-31 for Occupational Safety and Health in Agriculture, Livestock, Forestry and Aquaculture, addresses the technical guidelines as preventive measures in the health and safety of the rural worker (COUTO, 2007). The NR-31 consists of 23 items. In the item 1.1, the purpose is to establish instructions to be observed in the organization and in the work environment, so as to make compatible the planning and the development of the activities of agriculture, livestock, forestry and aquaculture with the safety and health and work environment (BRAZIL, 2013). The actions aimed at improving environmental conditions are highlighted in item 31.5.1.2 through aspects related to:

- a) chemical, physical, mechanical and biological risks;
- b) investigation and analysis of accidents and work situations that generated them;

c) work organization.

3.3.1 Agrotoxic

In detail, in the item 31.20.2 of NR-31, emphasizes that only the equipment that is used when the worker is exposed to chemical agents (pesticides), such as: protection of the head, eyes and face: impermeable and resistant protectors for jobs with chemicals; respiratory protection: respirators with chemical filters, for working with chemicals; respirators with combined filters, chemical and mechanical, for activities in which gases and toxic dust emanate; protection of upper limbs: protective gloves and sleeves against toxic, irritant, allergenic, corrosive, caustic or solvent chemicals; protection of lower limbs: waterproof and non-slip boots; boots with reinforced soles, where there is risk of perforation; waterproof and resistant shoes in jobs with chemicals; closed shoes for other activities and; protection of the whole body in the work where there is danger of chemical agents: aprons; jackets and caps; and overalls. However, it is worth mentioning that the Individual Protection Equipment needs to have ergonomically comfortable conditions for workers in the course of daily work activities (MENEGUCCI, 2012).

3.3.2. Agricultural machines and implements

Agricultural machinery and implements when operated erroneously and without proper safety measures, are high sources of work accidents. Thus, to establish preventive measures, in the item 31.12.1 of NR-31 details the minimum requirements that the machines must have: be used according to the manufacturer's technical specifications and within the operating limits and restrictions indicated by it; and operated by skilled workers. In addition, the use of safety devices and systems should be mandatory items on all machines. In this NR-31, it is still prohibited to transport people on self-propelled machines and their implements, since work accidents frequently occur because of such irregular transportation.

Regarding safety protections on machines, the item 31.12.15 provides that: a) perform its functions properly during the life of the machine or enable the replacement of damaged or damaged parts; b) To consist of materials resistant and suitable for containment of projection of parts, materials and particles; c) to firm and guarantee of stability and mechanical resistance compatible with the required efforts; d) does not create crushing or grasping points with machine parts or other protections; e) does not have sharp edges and other dangerous protrusions; f) to resist the environmental conditions of the place where they are installed; g) provide hygiene and cleaning conditions; h) prevent access to the danger zone; i) have their interlocking devices used to block the dangerous functions of machinery properly protected against dirt, dust and corrosion, if necessary; j) to have positive action, that is, to act positively; l) does not entail additional risks; and m) have dimensions as set forth in Item A of Annex II of NR-31.

The power transmission systems of the machines, often when not used correctly, are sources of work accidents capable of causing limb and even fatal amputation. With this in mind, item 31.12.20 provides that: power transmissions and their movable components, accessible or exposed, shall be protected by means of fixed or movable guards with interlocking devices which prevent access by all the sides, except for the provisions of sub-item 31.12.11.1 and other exceptions provided for in NR-31.

Regarding protections in harvesters, item 31.12.20.1 states that: a) they must be designed taking into account the risk to the operator and the generation of other hazards, such as avoiding the accumulation of debris and fire risk; b) reach the maximum extent, considering the functionality of the harvester; c) be signaled for risk; d) have information on the risks contained in the instruction manual.

For the lawn mowers, the measures are established in item 31.12.23.1 which says that the mowers must have protection devices against the throwing of solid materials. For the cutters, choppers, grinders, grinders, defibrillators, item 31.12.24 determines that they must have safety systems that make it impossible for the operator or others to contact their danger zones.

Chainsaws, due to the high potential of risks to the safety of the rural worker, must have: manual or automatic chain brake; pin-chain; right hand protector; left hand protector; and throttle safety catch. For all agricultural machinery and equipment, item 31.12.39 states that: employers or similar entities shall promote, for all chainsaw, motorcycle and similar operators, training for the safe use of the machine, with a minimum working load of eight hours and conforming instructions on how to use this manual.

3.4. Ergonomics in rural areas

To avoid that environmental risks compromise agricultural activities, it is recommended to adjust the work environment in a way that provides physical and psychic comfort, emphasizing the use of modern machines and equipment, adequate posture among others (VIEIRA, 2012). In this way, the use of ergonomically correct machines increases the quality and efficiency of the work, as well as, the employee who will have a healthier and more comfortable work activity (OLIVEIRA, 2012).

NR-31, item 31.10.1 to item 31.10.9, describes the ergonomic measures that employers must take during agricultural work activities, where: the rural or similar employer must adopt ergonomic principles that aim to adapt working conditions to psychophysiological characteristics of workers in order to provide improvements in the conditions of comfort and safety at work; the lifting and manual transport of cargo with a weight that is likely to compromise the health of the worker is prohibited; every worker designated for the regular manual transport of loads shall be

trained or instructed in the methods of work to be used in order to safeguard his health and prevent accidents; transport and unloading of materials made by pushing or pulling wagons on rails, hand carts or any other mechanical device shall be performed in such a way that the physical effort performed by the worker is compatible with his/her health, safety and capacity of force; all machinery, equipment, implements, furniture and tools must provide the worker with conditions of good posture, visualization, movement and operation; in operations that also require the use of the feet, the pedals and other controls must have positioning and dimensions that allow easy reach and adequate angles between the various parts of the worker's body, depending on the characteristics and peculiarities of the work to be performed; for activities that are necessarily carried out standing, rest breaks must be guaranteed; the organization of work must be adequate to the psychophysiological characteristics of the workers and the nature of the work to be performed; activities that require static or dynamic muscle overload should be included rest breaks and other measures that preserve worker health.

4. CONCLUSIONS

- The use of technology in the field allowed the rise in agricultural and livestock production, but the lack of capacity of farmers when using these technologies (machinery, implements and pesticides), favored a significant increase in occupational risks during the activities of farmers .
- The main environmental risks observed throughout this review were the physical ones, as a consequence of the noise and vibrations of the agricultural machines, as well as the non-ionizing radiation, due to the direct exposure to the solar rays; and chemical risks, in which pesticides were the most prominent, since many farmers still neglect the use of PPE at the time of application, because many consider it uncomfortable and unnecessary for the application of agrochemicals.

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