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USO DE PRODUTOS FITOFARMACÊUTICOS NA AGRICULTURA

USE OF PLANT PROTECTION PRODUCTS IN AGRICULTURE

USO DE PRODUCTOS FITOSANITARIOS EN LA AGRICULTURA

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RESUMO

Introdução: A agricultura é uma atividade praticada há milhares de anos por seres humanos para a produção de alimentos que representam riscos para a saúde dos trabalhadores. Estes riscos estão presentes, principalmente, devido à utilização de produtos fitofarmacêuticos (PPP) que apesar de ter benefícios na obtenção de alimentos também apresentar inconvenientes para os seus manipuladores e também para o meio ambiente.

Objetivos: Avaliar os conhecimentos sobre a utilização e aplicação de produtos fitofarmacêuticos na agricultura.

Métodos: Estudo exploratório realizado em várias empresas no sector agrícola no norte e centro de Portugal e teve como população-alvo todos os trabalhadores que usaram PPP em suas funções de trabalho para um total de 46 funcionários a quem foram aplicados questionários para recolher informação sobre as práticas adotadas pelos trabalhadores no que diz respeito à utilização de trabalho de PPP. A investigação durou oito meses, com início em outubro de 2015 e terminou em maio de 2016.

Resultados: A aplicação desta pesquisa mostrou as boas práticas adotadas pelos trabalhadores que foram questionados, designadamente: leitura dos rótulos; uso de equipamentos para a segurança individual e alocação/triagem correta dos resíduos de embalagens vazias de PPP. No entanto apurou-se existirem aspectos em que os trabalhadores poderão melhorar, tais como: nível de consciência sobre o risco a que estão expostos ao manusear PPP já que nem todos os trabalhadores adotaram boas práticas agrícolas.

Conclusões: Os resultados sugerem a necessidade de novas acções pelos órgãos de supervisão para garantir que os aplicadores de PPP adquirem as certificações e formação exigidas por lei. Também devem ser criadas mais campanhas de sensibilização sobre as questões de segurança salientando-se a importância da leitura dos rótulos, uso de equipamento adequado para a segurança individual face à exposição para cada tipo de produto e assegurar a devida rota para o pacote de resíduos.

Palavras-chave: Produtos fitofarmacêuticos, Exposição, Saúde, Risco,

ABSTRACT

Introduction: Agriculture is an activity practiced for thousands of years by humans for food production representing risks to the workers' health. These risks are present mainly due to the use of Plant Protection Products (PPP) that despite having benefits in getting food also entail disadvantages for their handlers, to consumers of food produced and also for the environment me to carry out an empirical evaluation of the use of PPP in agriculture.

Objectives: Assess knowledge about the use and application of plant protection products in agriculture.

Methods: Study exploratory was conducted in several companies in the agricultural sector in the north and centre of Portugal. As the target population were considered all workers who used PF in their work duties for a total of 46 employees to whom questionnaires were administered to collect information on the practices adopted by the workers as regards the labour use of PPP. The investigation lasted eight months, starting in October 2015 and ending in May 2016.

Results: The application of this research has shown the good practices adopted by the workers who were questioned and which are reading the labels, use of equipment for individual safety and proceed the correct disposal of waste of empty containers of PPP. However it can be noted that there are still aspects that the workers have to improve awareness level about the risk they are exposed to when handling PPP since not all employees were careful to adopt these good agricultural practices.

Conclusions: The results also demonstrate the need for further action by the supervisory bodies to ensure that the PPP applicators have all the required training certificate by law. It should also be created more awareness campaigns about the safety issues when these products are used like the importance of reading labels, use of appropriate equipment for individual safety for each product type and exposure, and properly route for the waste package.

Keywords: *Plant Protection Products; Exposure; Health Risk; Equipment for individual safet; Residues;*

RESUMEN

Introducción: La agricultura es una actividad practicada desde hace miles de años por los seres humanos para la producción de alimentos que representan riesgos para la salud de los trabajadores. Estos riesgos están presente debido principalmente a la utilización de los productos fitosanitarios (PPP) que apesar de tener beneficios en la obtención de alimentos también implica desventajas para sus manipuladores y también para el medio ambiente.

Objetivos: Avaliar los conocimientos sobre la aplicación y los productos fitofarmacêuticos en la agricultura.

Métodos: Estudio exploratorio desarrollado en varias empresas en el sector agrícola en el norte y centro de Portugal. A medida que la población objetivo se consideraron todos los trabajadores que utilizan PF en sus tareas de trabajo para un total de 46 empleados a los cuales se administraron cuestionarios para recopilar información sobre las prácticas adoptadas por los trabajadores en cuanto a la utilización del trabajo de PPP. La investigación duró ocho meses, a partir de octubre 2015 y finalizó en mayo de 2016.

Resultados: La aplicación de esta investigación ha puesto de manifiesto las buenas prácticas adoptadas por los trabajadores que fueron interrogados, y que están leyendo las etiquetas, el uso de equipos de protección individual y proceder a la eliminación correcta de los residuos de envases vacíos de productos fitosanitarios. Sin embargo cabe señalar que todavía hay aspectos que los trabajadores tienen que mejorar como el nivel de conciencia sobre el riesgo que están expuestos a la manipulación de PPP ya que no todos los empleados fueron muy cuidadosos para adoptar estas buenas prácticas agrícolas.

Conclusiones: Los resultados también demuestran la necesidad de nuevas medidas por los órganos de control para garantizar que los aplicadores de APP tienen todo el certificado de formación requerida por la ley. También se debe crear más campañas de concienciación sobre los problemas de seguridad cuando estos productos se utilizan como la importancia de las etiquetas de lectura, uso de equipo adecuado para la seguridad individual para cada tipo de producto y la exposición, y encaminar adecuadamente para el paquete de residuos

Palabras Clave: Protección de Plantas y Productos, Exposición, Salud, Riesgos,

INTRODUCTION

Agriculture is an activity that has been practiced for thousands of years by humans for food production (Paiva, 2010). Today, it rises up with the need to increase production in order to suppress the growing demand for food (Rico, 2013) resulting from a population increase (Paiva, 2010) challenging the workers of this sector to do so with the same area agricultural (European Landowner's Organization & European Crop Protection, 2015). The production of food products is realized by agricultural enterprises (Medina, s.d.) by using a monoculture agriculture (Costa & Teixeira, 2012). observe their crops being threatened by enemies as pests, diseases and weeds that compromise the crops (Medina, s.d.); (Costa & Teixeira, 2012). So these companies generally use processes that protect the seed and harvesting through treatments in cultures performed especially by the application of PPP (Rico, 2013) finding its use necessary to obtain large yields of food (Medina, s.d.) thereby practicing intensive farming with goal of increased productivity (Paiva, 2010) and improving the quality of agricultural products (Barbosa, 2012).

The use of such products has been found throughout the history of agriculture, but the first milestone of its use was discovered in the mid-30s of the nineteenth century during the development of new chemicals (Barbosa, 2012) having its use increased progressively over the years (Guerra, 2012). The name given to these products change through the years, PPP is the name given by the national legislation (Guerra, 2012); (Lei n.º 26/2013, de 11 de abril). PPP are substances or mixtures of substances designed to combat, control and prevent harmful organisms of agricultural crops such as weeds, diseases and pests (European Landowner's Organization European Crop Protection [ELOECP], 2015); (Rico, 2013); (Rodrigues, Sá, & Moura, s.d.); (Garrido, 2000); (Instituto Nacional de Estatística [INE], 2014); (Direção-Geral de Alimentação e Veterinária [DGAV], 2013a); (Silva, 2012) that can interfere in the production, storage, transport, distribution and processing of agricultural products (Barbosa, 2012). These are characterized by being more or less toxic and in a short and long term can be harmful when introduced into the environment (Garrido, 2000); (Guerra, 2012). PPP enable the production of large quantities of food in order to fulfill the needs of the world population (Medina, s.d.), and have other benefits such as destroying or preventing the action of pests on food products (Teixeira, 2014) avoiding or minimizing losses of crops, helping plantations to develop their full potential, improving the quality of agricultural products (Guerra, 2012) and preserving food after harvesting (Teixeira, 2014). Consequently, these benefits lead to other positive effects as it maintains regularized productions (Guerra, 2012); (Teixeira, 2014) ensuring a continuous supply to the sales areas, allowing the minimization of hand labor requirements over the plantation growth and allowing employability in various sectors that are associated with the production of these products such as pharmaceuticals, transportation companies, among others (Guerra, 2012). However, associated with the use of PPP are also disadvantages as its use raises risks (Medina, s.d.); (Guerra, 2012) dependent on the product toxicity causing acute disease (Costa & Teixeira, 2012), and chronic, production of PPP waste on the environment, persistence and bioaccumulation on the food chain and resistance to PPP in some organisms (Guerra, 2012). With the wide use of PPP it began to emerge alarm signals regarding its toxic nature (Costa & Teixeira, 2012). having thus been initiated efforts to develop new less aggressive compounds to humans and the environment (Barbosa, 2012). The risk that such products have for the environment depend on various factors such as their physical and chemical properties, amount of product applied, method and time of application and the degree of toxicity (Garrido, 2000). The negligent use, the fact that such products degrade slowly and

their mean of dispersion which lead them to be considered as a problem for public health and the environment because of its waste being responsible for adverse effects (Barbosa, 2012); DGAV, 2013b), and often identified in water, soil and food products (Garrido, 2000); (Guerra, 2012); (Medina, s.d.), causing serious health problems in humans when acting on vital system (Costa & Teixeira, 2012); (Barbosa, 2012). So during the use and application of these products the risks should be considered (Calado, 2006). In order to have a production, marketing and responsible use of PPP exists legislation regulating the various stages in the life cycle of such products (Cruz, 2006). The use of PPP is subject to approved legislation after running several tests to these compounds (Rico, 2013) carried out by experts with the aim of finding effective products which are not harmful to humans or the environment (Medina, s.d.), also confirming that any waste remain in the environment and agricultural products after use, do not represent risks to consumers (European Crop Protection [ECP], 2014). The European Union therefore stipulates increasingly stricter legislation (Guerra, 2012) designed to ensure that PPP are effective, safe and suitable for use not causing harmful effects (ELOECP, 2015). Towards the high consumption of PPP, exists in Portugal, the concern to limit the use of these products (Garrido, 2000) thereby using other means of control as the cultural, biological, genetic and biotechnical (Barbosa, 2012) continuing to optimize its benefits and reducing the negative effects through legislation that is continuously adjusted (Garrido, 2000). A measure to reduce the incorrect use of PPP in Portugal, it is the obligation for all applicators of these products having a training certificate (Guerra, 2012) from 26 November 2015 (Lei n.º 26/2013, de 11 de abril, 2013).

In Portugal, the number of deaths due to intoxication with PPP is considerable. The intoxications by PPP, are thereby recognized as a significant public health problem (Rodrigues et al., s.d.). The risk of intoxication by a PPP, depends on characteristics such as the toxicity of the active substance, exposure time, the way this product enters the body (Teixeira, 2014) and handling and application use in case its incorrect and careless (Guerra, 2012). This type of intoxication can be acute when they occur immediately after the absorption of substances in an amount sufficient to induce symptoms, chronic when expressed after a more or less prolonged period of exposure to the product (Teixeira, 2014); (Guerra, 2012), or allergenic reactions which can produce symptoms of pathologies such as nausea, headache, seizures and skin irritation for example (Teixeira, 2014).

Although PPP have been modified to make them less aggressive, none is harmless (Guerra, 2012). The PPP, as previously mentioned, have substances that can be harmful to human health, animal health and the environment (Rico, 2013), it is important the fulfil and develop strategies to a better use of these substances and to minimize the risks for the environment and public health (Garrido, 2000) as well as to workers who use these products or manipulate during transport and storage (Teixeira, 2014). Various workers who manipulate these products may be exposed in various ways (Rodrigues et al., s.d.). The entry of the PPP in the body can be made in oral, inhalation or dermal route (Teixeira, 2014); (Garrido, 2000) being the last one the most common entry path (Costa & Teixeira, 2012); (Guerra, 2012).

In agriculture as in any other sector of activity, workers must receive the necessary information so that, based on it, they can make decisions about how to act (Costa & Teixeira, 2012); (Guerra, 2012). For a correct use of these products, the worker must correctly identify the problem to combat so that it can select the best PPP to apply and the application form, dosage and frequency (Teixeira, 2014); (Guerra, 2012); (Garrido, 2000).

The label is an important element for the characterization of a PPP this, in it are presented the results of investigations carried out to verify the efficiency and dangerousness of these products (Guerra, 2012). So the labels instruct PPP users by describing the following procedures for a safe use and the risks inherent in their incorrect use both for health and for the environment so therefore is crucial to compliance with the points expressed in it to promote the production but also to satisfy the criteria of safety and food quality (Guerra, 2012); (ANIPLA, Crop Protection. s.d.) being mandatory to follow his direcciones (Associação Nacional da Indústria para a Protecção de Plantas, 2005).

With the use of a PPP its harmfulness is always present and it is necessary to reduce the employee exposure level to prevent it from being contaminated (Guerra, 2012). The protection of workers using these products should be thereby ensured by the use of appropriate Personal Protective Equipment (PPE) (Costa & Teixeira, 2012)ⁱ (Teixeira, 2014) not only during the mix to apply but throughout the all handling of the PPP (Guerra, 2012). For a correct use PPE the user should pay attention to the information provided on the product label that will apply as well as the conditions of use and maintenance of these equipment so that they are always in good conditions of use (Teixeira, 2014); (Guerra, 2012).

The protection of crops against their threats is a complex problem considering the diversity of harmful organisms as well as the large amount of PPP available on the market (Guerra, 2012) products that continue to be the resource most used for its effectiveness in eliminating the cultures threats and as a guarantee of obtaining profits in this activity (Costa & Teixeira, 2012). This research study aimed to do an empirical analysis of the use of plant protection products in the agricultural sector the choice of this theme is due to the importance of global production with the use of these products by looking for food at a pace higher than the offer.

1. METHODS

Study exploratory was conducted in several companies in the agricultural sector in the north and centre of Portugal. As the target population were considered all workers who used PF in their work duties for a total of 46 employees to whom questionnaires were administered to collect information on the practices adopted by the workers as regards the labour use of PPP. The investigation lasted eight months, starting in October 2015 and ending in May 2016.

The questionnaires were designed seeking to answer important questions concerning the use of PPP in agriculture being distributed in agriculture companies of North and Centre of Portugal who used these products. The questionnaire initially was focused on the description of the socio-biographic data of the participants, being then developed four pieces that identified whether the PPP applicators obtained or not training on the application of these products, the importance of the label given by the workers who manipulate these products, knowledge of PPE and its use and also the destination of the empty containers of PF. It should also be noted that, with the approval of questionnaires in the agricultural enterprises the data collected showed only purely curricular and academic interest having no economic or commercial interests. All questionnaires were also carried out so that the anonymity of all workers who participated in the study was maintained and the confidentiality of the data collected was assured.

1.1 Sample

This investigation had the duration of 8 months between October 2015 and May 2016. The study was conducted in several companies in the agricultural sector in Northern and Central of Portugal Continental area and had the aim to conduct an empirical assessment of the use of PPP in agriculture. As the target population were considered all workers that used these compounds in their work duties for a total of 46 workers questioned. It was performed an observational study of level II cross-sectional cohort. The data collection was carried out by questionnaires in order to collect information on workers' practices regarding the use of plant protection products in work. In the appendix is presented a copy of the questionnaire used to obtain data and a copy of the application used in the approach to agricultural enterprises.

1.2 Data Collection Instruments

For the analysis of data obtained in the development of this research it was used the data processing and statistical analysis software identified by name IBMSPPS statistics version 23.0. For data processing it was used the nonparametric tests: Fisher's exact test and chi-square test of independence. For statistical inference it was used a 95% confidence level for a random error less than or equal to 5%.

2. RESULTS

After the application of the questionnaires in the companies of agricultural sector in the North and Centre of the country it was preceded the analysis of the responses obtained in the same obtaining therefore the results presented below.

As it can be seen in Tables 1 and 2q presented in the appendix out of the 46 questionnaires it was found that only 22 subjects had training on application of PPP being 23 subjects' full-time workers in the agricultural sector and 23 part-time workers in this sector. It was proposed to assess the relationship between the presence or absence of care to read the label of a PPP before an application and if this type of care would be related to the presence of previously received training on the use of this products. Consider the following table1.

Table 1: Relation between Reading the label f PPP and Training on the use of PPP

		Training on the use of PPP		Total (%column)
		Yes	No	
Read the label of PPP	Yes	n	21	19
		% line	52,5%	47,5%
		% column	95,5%	79,2%
	No	n	1	5
		% line	16,7%	83,3%
		% column	4,5%	20,8%
Total	N	22	24	46
	% line	47,8%	52,2%	100,0%
	% column	100,0%	100,0%	100,0%

Fisher's exact test (p=0,114)

According to the table above, it has not been identified a pattern of association between the practice of reading or not the label of a PPP before the application and the presence/absence of training on the use of this type of products ($p>0.05$). Nevertheless, people who indicated having the habit of reading the label of a PPP ($n=40$) the most indicated having received training (52.5%). However, the total number of people who indicated not having the care to read the label of the product before application ($n=6$), most of them never received any training on the use of PPP (83.3%). It can also be added that in the study the prevalence of people with training on application of the products was 47.8% compared to the total study sample ($N=46$).

Afterwards it was proposed to assess the relationship between the presence or absence of knowing what are PPE and if this kind of knowledge would be related to the presence of previously received training on the use of PF. Consider the following table 2.

Table 2: Relation between Information about PPE and Training on the use of PPP

			Training on the use of PPP		Total (%column)
			Yes	No	
Information about PPE	Yes	n	22	19	41
		% line	53,7%	46,3%	
		% column	100,0%	82,6%	91,1%
	No	n	0	4	4
		% line	0,0%	100,0%	
		% column	0,0%	17,4%	8,9%
Total	n	22	24	45	
	% line	48,9%	52,1%	100,0%	
	% column	100,0%	100,0%	100,0%	

Fisher's exact test ($p=0,059$)

According to the table above, it has not been a pattern of association between information of PPE and the presence/absence of training on the use of PPP ($p>0.05$). Nevertheless, people who indicated having the information of PPE ($n=41$) mostly indicated having already received training (53.7%). However, the total number of people who indicated total ignorance about PPE ($n=4$), none had received any training on the use of FP (100%).

Later it was proposed to evaluation the relationship between the presence or absence of information of PPE and knowledge of the various types of PPE in agricultural activities. Consider the following table 3.

Table 3: Relation between Information of PPE and Knowledge of PPE presented in the questionnaire

			Knowledge of PPE		Total (%column)
			Yes	No	
Information about PPE	Yes	n	22	19	41
		% line	53,7%	46,3%	
		% column	100,0%	79,2%	89,1%
	No	n	0	5	5
		% line	0,0%	100,0%	
		% column	0,0%	20,8%	10,9%
Total	n	22	24	46	
	% line	47,8%	52,2%	100,0%	
	% column	100,0%	100,0%	100,0%	

Fisher's exact test ($p=0,031$)

According to the table above, there was a pattern of association between information about PPE and knowing the PPE presented in the questionnaire ($p<0.05$). People who reported having information on EPI ($n=41$) most of them indicated being aware of all PPE presented in the questionnaire (53.7%). Of the total number of people who indicated not knowing what PPE are ($n=5$), none has knowledge of PPE indicated in the questionnaire (100%).

Afterwards it was set out to assess the relationship between the presence or absence of appropriate practices on the use of PPE when using PF, that is, if people use PPE in the three situations presented in the questionnaire and if this type of care would be related the presence of previously received training on the use of such products. Consider the following table 4.

Table 4: Relation between Appropriate practices on the use of PPE and Training on the use of PPP

			Training on the use of PPP		Total (%column)
			Yes	No	
Appropriate practice about PPE	Incorrect	n	11	17	28
		% line	39,3%	60,7%	
		% column	50,0%	70,8%	60,9%
	Appropriate	n	11	7	18
		% line	61,1%	38,9%	
		% column	50,0%	29,2%	39,1%
Total	n	22	24	46	
	% line	47,8%	52,2%	100,0%	
	% column	100,0%	100,0%	100,0%	

Fisher's exact test (p=0,126)

According to the table above, there was not identified a pattern of association between the appropriate practices of PPE and the presence/absence of training on the use of the PPP (p>0.05). Nevertheless, people reported having good practice on PPE (n=18) mostly indicated having already received training (61.1%). However, the total number of people who indicated having incorrect practices of PPE (n=28), mostly had not received any training on the use of PPP (60.7%). It can also be noted that of the 22 people who indicated having the training on the application of PPP, there was a proportional division between good (50%) and bad practices (50%) their use.

At last it was proposed to evaluate the relationship between the presence or absence of appropriate practices related to the destination given to the PPP packaging waste, that is, if the applicators guide such waste to the competent authority in Portugal - Valorfito - and if this type of care is related to the presence of previously received training on the use of PPP. Consider the following table 5.

Table 5: Relation between Appropriate practice of guidance of packaging waste and Training on the use of PPP

			Appropriate practice of guidance of packaging waste		Total (% column)
			Yes	No	
Training on the use of PPP	Yes	n	16	6	22
		% line	72,7%	27,3%	
		% column	61,5%	30,0%	47,8%
	No	n	10	14	24
		% line	41,7%	58,3%	
		% column	38,5%	70,0%	52,2%
Total	n	26	20	46	
	% line	56,5%	43,5%	100,0%	
	% column	100,0%	100,0%	100,0%	

Chi-square test of independence (p=0,034)

According to the table above, there was identified a pattern of association between the variables in the previous table (p<0.05). People who reported guiding the packaging waste to the responsible entity (n=26) mostly indicated having received already training (61.5%). Of the total of people who reported having poor practice (n=20), that is, not send the packaging waste to Valorfito mostly had not received any training on the use of PPP (70%) therefor it can be noted that there is a relationship between having training and properly direct the waste of PPP packaging.

3. DISCUSSION

Because of the toxicity of PPP during their handling, the risks inherent in its use should be taken into account being necessary scientific and technical training in the area to ensure proper identification of the problem and correct decision-making (Calado, 2006). Good training is important for a correct use of PPP fulfilling therefore good agricultural practices, improving the profitability of crops, ensuring safety for the applicators of these products, to consumers of such foods and the environment (Guerra, 2012). Despite the continuous training for farmers (Direcção-Geral de Agricultura e Desenvolvimento Rural, 2014) during this research project it was found that the 46 workers who apply PPP in the various types of crops they produce, only 22 of them had mandatory training by Lei n.º.26/2013, 11 April which requires that

after November 26 of 2015 all PPP applicators must have the necessary training for this purpose (Lei n.º 26/2013, de 11 de abril, 2013). These results are in agreement with other studies already carried out in Portugal who claim that there are PPP applicators that do not have the necessary and appropriate training, therefore missing information about the risks and how to act ensuring the safe handling of a PPP (Calado, 2006); (Carvalho, Araújo & Cunha, 2012) even though the training is mandatory (Guerra, 2012).

Regarding the study of the variables "*read the label of plant protection products*" and "*training on the use of PPP*" was expected that all workers who had the training had the care of reading the label but that was not the case however, most have this correct practice, practice which can also be seen in workers without training. These results were also found in previous investigations that have studied the reading of PPP labels by handlers of these products (Carvalho et al., 2012); (Guerra, 2012) being identified that this practice is present in some workers in Portugal reporting also that only a few mentioned not read the label justifying that they already use these products for a long time and only one said he used the quantities of product that felt right (Guerra, 2012).

Training is an important aspect to take into account in works that use PPP since the applicators have adequate training they know how to act and they proper identify the risks which they are exposed to during the handling of these products and that could lead to better work practices that reduce the risk associated with the various tasks (Costa & Teixeira, 2012) however, studying the results obtained related to the knowledge of all PPE it can be seen that most of the people demonstrated to know the 5 PPE listed in the questionnaires (Guerra, 2012).

The population that often works with PPP in its sector of activity in the production, preparation or application of these products are more exposed than anyone else to these products towards the levels, frequency and variety of PPP that they are occupationally exposed being therefore considered a risk group (Costa & Teixeira, 2012). Although some PPP are characterized with low toxicity they still can cause adverse health problems of applicators (Fernandes, 1990). Some studies show a cause-effect relationship between exposure to PPP and the emergence of diseases in the health of their occupational handlers such as skin diseases, neurological, reproductive and incidence of malignant tumours, these are some examples of pathologies found in employees who work with these products even at low levels. Studies have detected more serious damage at the level of health applicators that apply these products indoors like in greenhouses when compared to workers who performed the same task but outdoor (Costa & Teixeira, 2012). The risk of occupational diseases caused by use of PPP has been studied worldwide over the years and has recently been found epidemiological evidence which affirm that prostate cancer is related to the use of PPP being leukemia another disease that has been connected to the use of these chemicals at work (Alavanja, Ross & Bonner, 2013). Absorption of PPP in the body depends on the physicochemical properties, dosage, frequency, exposure time to these products, the working environment where the application occurs and the route of exposure (Costa & Teixeira, 2012). In order to reduce the risk of diseases such as cancer the exposure levels should be controlled (Alavanja et al., 2013). and decreased being necessary to take some precautions such as the use of PPE which will reduce the contamination of the human body (Fernandes, 1990). Therefore, the use of PPE is essential for safe use of PPP (Monquero, Inácio & Silva, 2009). The use of PPE such as gloves there are resistant to chemical products, protective suits and masks when handling these products reduces significantly the exposure levels (Alavanja et al., 2013), these were some of the PPE that workers have pointed out in the questionnaires mainly individuals who have training for applying PF (Guerra, 2012).

Situations of accidental intoxications with these products are frequent however they can be prevented with the reading the PPP labels and with the use of appropriate PPE in accordance with the PPP used (Costa & Teixeira, 2012). The proper care of using PPE throughout all PPP handling was noted by the most individuals with training however, it is important to recognize that still are a large number of subjects who should have this practice. It was also noticed with the analysis of the results that even those with no training have correct practices regarding the use of PPE. This finding has also been reported in studies that indicated that most applicators had this practice and the individuals who do not have it justify it with feeling discomfort while using the PPE as well as heat and difficulty in mobility and breathing (Monquero et al., 2009).

The waste from empty containers of PPP should be treated with the same care as the product itself. These packages after being washed up and considered unusable should be directed to the reception centres in Portugal - Valorfito (Santos, Silva, & Gouveia, 2012). through the study of the results from the questionnaires it was found that most of the applicators with training in the area has a right practice for packaging wastes having this also been discovered in previous investigations (Guerra, 2012).

Increasingly there are strategies that agricultural businesses can use to effectively control pests, diseases and weeds that attack their crops by optimizing the use of PPP. The Integrated Production is a system that ensures the production of food combining different management strategies in order to minimize the use of PPP (ELOECP, 2015) as much as possible

(ECP, 2014). According to its principles, an organism is only considered a pest, disease or weed when it exceeds a certain limit set by area for body type therefor, in order to prevent the emergence of resistance to PPP is not recommended to intervene in the control of that organism when is identified in a low population density. A proper selection of a PPP and fulfil of the instructions given for its use is part of an agriculture that promote good agricultural performance, efficient use of natural resources and achieve environmental protection (ELOECP, 2015).

Organic farming is another method that seeks to enhance agricultural production reducing the use of chemicals ensuring the production of quality food without toxic waste in it allowing profitable the financial costs. Some studies of this type of agriculture lead researchers to claim to be possible by 2020 to produce food without use PPP or genetic modifications. Consequently, with the growing concern of consumers about the food they are eating, with environmental issues and with funding for rural development, this type of food production can be a good replacement for existing agriculture (Paiva, 2010).

CONCLUSIONS

PPP are considered toxic to humans, animals and the environment therefore a good training in the area means that workers on alert to the risks they are exposed to when handling this type of product.

According to the results obtained after the application of the questionnaires in companies of the agricultural sector in the north and centre of Portugal it can be withdraw that the application of PPP is still done by workers who lack the necessary training and required by law being also found that the concern of reading of the labels and the use of PPE are neglected.

These products can enter the body of their handlers by via dermal or if they are inhaled or swallowed. In order to reduce exposure to these products is advised the use of PPE during the handling PPP is also advised to read in full the labels of the products that will be used in order to better choose the means of protection accordingly to the risks which workers are exposed to.

The application of this research project has shown good practices adopted by workers who deal daily with PPP such as reading the labels, use of PPE and correct disposal of waste of empty containers. However it can be noted that there are still aspects to improve the workers' awareness level about the risk they are exposed to when handling these products since not all are careful to adopt good agricultural practices.

The results show the need for further action by the supervisory bodies so that the PPP applicators are only individuals who possess the certificate of compulsory education in the area obligatory by law. It should also be created more awareness campaigns about the safety issues when using these products still raising the importance for reading the labels, use of appropriate PPE for each product type and exposure and direct the waste package correctly to the entity responsible Valorfito.

The lack of studies in the area about the number of people who have the required training, knowledge of what PPE should be use when handling PPP and how to proceed with the empty packaging of PPP product reinforces the need for further research in the agricultural sector. For future studies it is suggested that other variables can be studied and that the exposure levels to which workers are exposed should be measured in the various tasks of handling the PPP like in the preparation of syrup, application and washing the application equipment of product may further studies could be directed to a research for organic farming which is a way of producing food without the use of PPP but who still have occupational risk like any other activity.

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