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ORIGINAL

Professional training as a pillar of preventive culture in the management of chemical substances: A study in the agrochemical sector

La formación profesional como pilar de la cultura preventiva en el manejo de sustancias químicas: Un estudio en el sector agroquímico

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ABSTRACT

Objetive: analyze training as an action strategy for risk prevention in the handling and use of agrochemicals. A quantitative, non-experimental, descriptive case study was conducted. The sample was census-based and comprised 15 workers. A survey was used as the data collection technique and a questionnaire as the instrument. Data analysis was conducted using descriptive statistics.
Results: 40 % of workers stated that they rarely receive training on health risks in their workplace. Furthermore, 60 % of the surveyed workers are unaware of the health risks caused by handling agrochemicals. Sixty percent of the sample considered that their company did not have a training plan for workers and, in turn, stated that they had received little or no training on health and safety risks.
Conclusions: workers recognize the health risks resulting from exposure to chemical agents they encounter in their workplace; however, they ignore compliance with workplace safety standards and procedures, such as failing to use personal protective equipment. They report that the company does not provide ongoing training to its workers, violating current national legislation.

Keywords: Training; Prevention; Risks; Agrochemical.

RESUMEN

Objetivo: analizar la formación como estrategia de acción para la prevención de riesgo en la manipulación y uso de agroquímico. Se realizó un estudio cuantitativo, no experimental, de caso, con nivel descriptivo, la muestra fue de tipo censal y estuvo integrada por 15 trabajadores. Se utilizo la encuesta como técnica de recolección de datos y como instrumento el cuestionario. El análisis de los datos se realizó a través de la estadística descriptiva.
Resultados: 40 % de los trabajadores expresaron que rara vez reciben formación sobre los riesgos a la salud en su lugar de trabajo, asimismo el 60 % de los trabajadores encuestados desconocen los daños provocados a la salud por manipulación de agroquímicos. El 60 % de la muestra considera que en la empresa no existe un plan de formación para los trabajadores y a su vez manifiestan que han recibido poca o escasa formación en materia de riesgos sobre la salud y seguridad.
Conclusiones: los trabajadores reconocen los daños a la salud producto de la exposición a los agentes químicos a los que se enfrenta en su entorno laboral, sin embargo, hacen caso omiso del cumplimiento de las normas y procedimientos de seguridad en el trabajo, como omitiendo el uso de los equipos de protección personal. Ellos expresan que en la empresa no se brinda formación continua a sus trabajadores, incumpliendo la legislación nacional vigente.

Palabras clave: Formación; Prevención; Riesgos; Agroquímica.

INTRODUCTION

The control of agrochemicals is a factor that needs to be addressed urgently to protect human health and the environment, which must be closely linked to national and international agricultural policies, due to the indiscriminate use of pesticides and herbicides by agribusinesses. This problem highlights the absence of a solid preventive culture, understood as the set of proactive attitudes and shared beliefs by all members of an organization regarding preventive measures, health, occupational risks, accidents, and occupational diseases,[1] which exacerbates exposure to permanent damage from the prolonged and residual action of these chemicals. This reality, documented in Latin American countries such as Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela, keeps international organizations on alert, given the risk faced by workers exposed to the improper handling of agrochemicals, whose short-, medium-, and long-term health effects are underestimated.[2]

In the last five years, numerous studies have addressed this issue and its repercussions on occupational health, revealing a common denominator: serious deficiencies in the training and practical skills of workers in the safe handling of agrochemicals. This research highlights how training gaps not only increase exposure to chemical risks but also perpetuate dangerous practices during the use, storage, and transport of these substances.

Given this scenario, there is an urgent need to design comprehensive educational strategies that go beyond the mere transmission of information. A transformative approach is necessary to establish a genuine culture of prevention, where changing attitudes and internalizing safe protocols become deeply ingrained organizational values.[1] Only through this cultural change, complemented by continuous training and active monitoring systems, will it be possible to ensure the permanent adoption of safe behaviors aligned with international standards for the secure handling of agrochemicals.

The International Labor Organization (ILO) similarly establishes international standards, such as the principle of protecting workers from occupational diseases and accidents, given the inadequate and hazardous working conditions experienced by millions of people around the world.[3] In response to this, the same organization developed a global policy for occupational safety and health, aiming to create and implement strategies and solutions for both known occupational hazards and risks, as well as problems that arise from dangers such as biological and psychosocial hazards.[3]

Thus, one of the strategies adopted by organizations in response to legal and moral requirements regarding worker safety and health is the creation of group and individual training processes that seek to ensure that all workers, regardless of their position, have clear and continuous knowledge of prevention and safety systems. These processes are part of Occupational Health plans or programs, which consist of planning, organization, execution, control, and evaluation of all activities aimed at preserving, maintaining, and improving individual and collective health to prevent workplace accidents and occupational diseases.[4,5]

It is essential to emphasize that training enables human beings to shift their life paradigm, resulting in sociocultural change that empowers them to identify the risks to which they are exposed, thereby becoming aware of the risk prevention measures established to safeguard their health and physical integrity, as well as that of their colleagues.[6]

Putting the above words into context, within the Chemical Formulation Plant (B25) of a Venezuelan agrochemical company, there is a multidisciplinary team that makes up the organization's Occupational Health and Safety Service, which has qualified professionals who contribute to the promotion and development of strategies for the prevention of risks in the use and handling of agrochemicals. However, this is not only the responsibility of the Occupational Health and Safety Service, but also a task for the entire organization and its management. Its ultimate goal is to create a culture of prevention through the continuous training of its workers, thereby promoting health and healthy coexistence in the workplace, in compliance with the safety procedures and standards established for this purpose.

In this regard, the objective is to analyze training as a risk prevention strategy in the handling and use of agrochemicals within the production area of the Chemical Formulation Plant (B25) of a Venezuelan agrochemical company.

METHOD

This study was grounded in the quantitative paradigm and conducted as a case study. The study was developed under a non-experimental, descriptive design.

The population consisted of 15 workers who make up the staff of the chemical formulation plant (B25) of the agrochemical company studied. The sample was census-based and consisted of 15 workers, who represent the entire plant's staff.

For this research, a survey was used as the data collection technique and a (01) Likert scale questionnaire, which was validated using the expert judgment technique and calculated the reliability using Cronbach's alpha reliability coefficient, which resulted in a value of 0,88. According to the interpretation scale for this coefficient, this is VERY HIGH, which means that the instrument was reliable for its application.

The information collected through this instrument was analyzed using descriptive statistics, through the Excel 2010 statistical package. It was then sorted, classified, tabulated, and presented in tables and bar charts, which were then analyzed.

RESULTS

Table 1. Receives information on health risks related to the job

Alternative	Frequency (FX)	Percentage
Always	0	0
Frequently	1	6,6
Sometimes	5	3
Rarely	6	40
Never	3	20
Total	15	10

Table 1 shows that 6,67 % reported being frequently informed about health risks related to their job, 33,33 % said they are sometimes advised, 40 % said they are rarely informed, and 20 % said they have never been told. This shows that there are shortcomings in the process of informing workers about the risks they are exposed to in their workplaces.

Table 2. Are you aware of the health hazards associated with handling agrochemicals?

Alternative	Frequency (Fx)	Percentage
Definitely YES	0	0
Probably YES	6	40
Undecided	0	0
Probably NO	0	0
Definitely NO	9	60
Total	15	10

The results obtained in this table show that nine (9) workers, representing 60 %, do not know the harm caused by the chemicals they handle, and six (6) workers, representing 40 % of the sample, stated that they were aware of the harm that the chemicals they handle daily cause to their health.

Table 3. Are you aware of the personal protective equipment that must be used when handling agrochemicals?

Alternative	Frequency (Fx)	Percentage
Definitely YES	15	10
Probably YES	0	0
Undecided	0	0
Probably NO	0	0
Definitely NO	0	0
Total	15	10

100 % of respondents say they are familiar with the personal protective equipment (PPE) used with each of the chemicals they handle in their work area.

Table 4. Do you use personal protective equipment correctly in your work area?

Alternative	Frequency (Fx)	Percentage
Definitely YES	9	6
Probably YES	0	0
Undecided	0	0
Probably NOT	6	40
Definitely NO	0	0
Total	15	10

The results obtained in this table show that nine (9) workers, representing 60 %, use personal protective equipment correctly in their work area, and six (6) workers, representing 40 % of the sample, stated that they probably do not use personal protective equipment (PPE) correctly when handling products in their work area.

Table 5. Staff are trained in the use and maintenance of personal protective equipment

Alternative	Frequency (Fx)	Percentage
Definitely YES	0	0
Probably YES	5	3
Undecided	0	0
Probably NO	0	0
Definitely NO	10	67
Total	15	10

The data tabulated in table 5 show that 67 % of the sample have not been trained in the use and maintenance of personal protective equipment, while 33 % say they have received some kind of training.

Table 6. Have you received any training from the company on the use and handling of agrochemicals?

Alternative	Frequency (Fx)	Percentage
Definitely YES	4	2
Probably YES	3	2
Undecided	0	0
Probably NO	0	0
Definitely NO	8	54
Total	15	10

The results obtained show that 54 % of the personnel studied stated they had not received training in occupational health and safety regarding the chemical products they handle in their work areas. In comparison, 26 % reported having received training, and 20 % indicated that they had probably received training in the handling of the product in their work areas.

Table 7. Initial and ongoing training in line with the tasks performed

Alternative	Frequency (FX)	Percentage
Always	0	0
Frequently	0	0
Sometimes	0	0
Rarely	6	40
Never	9	60
Total	15	10

Table 7 shows that 100 % of respondents stated that they rarely (40 %) or never (60 %) received initial or ongoing training in line with the tasks they perform, thus failing to comply with the provisions of the Organic Law on Prevention, Conditions and Environment at Work.

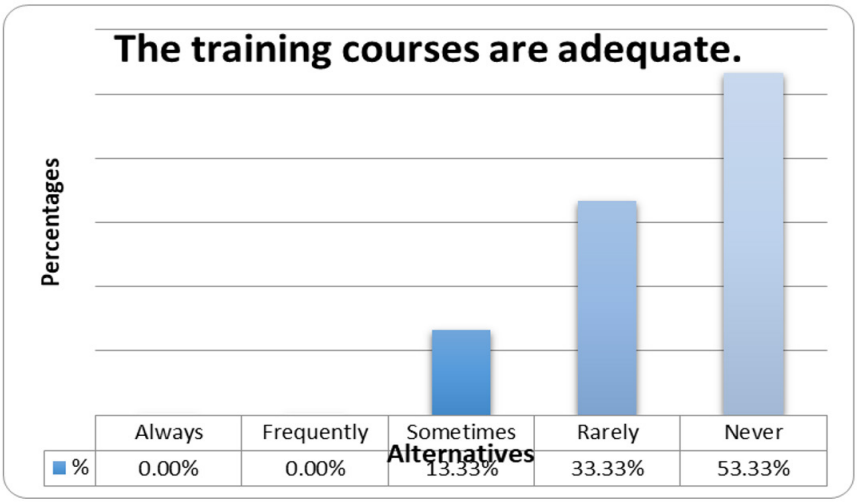

Figure 1. Do you consider the training courses provided by your company to be adequate?

The above graph shows the workers' responses, where it can be seen that 13,33 % responded that the courses provided by the company are sometimes adequate, 33,33 % said rarely, and 53,33 % said that the training they receive is never acceptable.

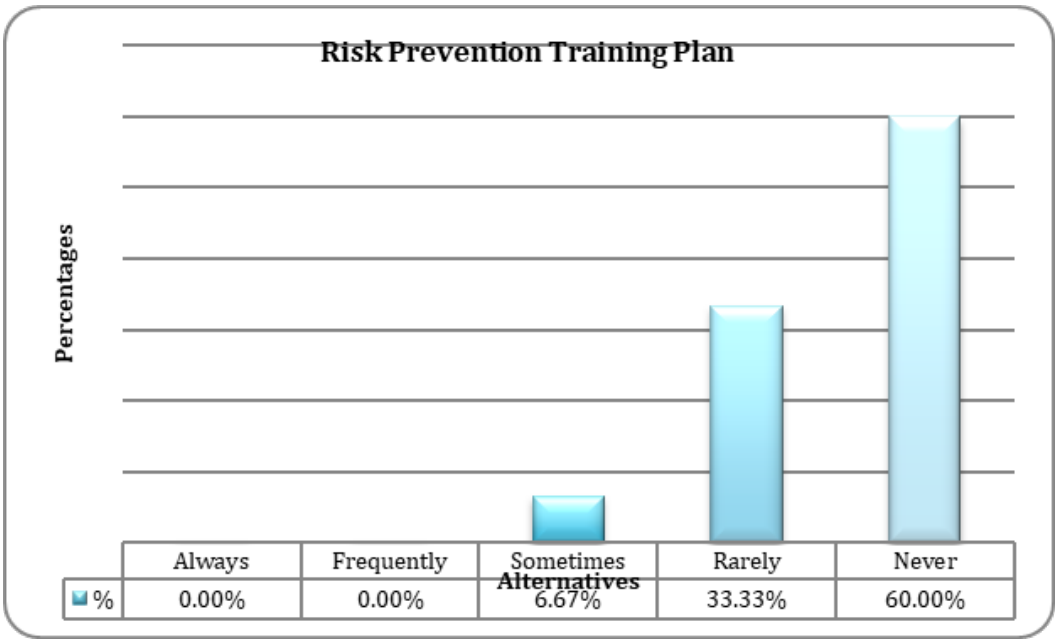

Figure 2. Do you consider the training plan provided by the company to be relevant to the prevention of risks present in the company?

Figure 2 shows that there is a training plan for risk prevention in the handling of agrochemicals, but 6,67 % consider that this training plan is sometimes relevant to the prevention of risks present in the company, while 33,33 % say that it is rarely relevant and 60 % say that it is never relevant to the prevention of risks present in the company.

CONCLUSIONS

The findings reveal a worrying disconnect between theoretical knowledge and actual prevention practices in the handling of agrochemicals, highlighting the absence of a genuine prevention culture. Despite the formal recognition of protective equipment, its inconsistent use and the poor internalization of protocols reflect a reactive model that prioritizes superficial compliance over behavioral change. This paradox, where available

tools coexist with underuse, is exacerbated by the lack of ongoing training tailored to specific risks, as well as the absence of structured plans that extend beyond occasional instruction.

The situation denounces not only operational failures, but also a structural deficit in preventive management: safety is perceived as a formal requirement rather than an organizational value. To reverse this, a systemic approach is proposed that integrates epidemiological surveillance, critical pedagogy (linking "knowing" with "doing"), and mechanisms for the active participation of workers. Only in this way can a culture be built where prevention, in the face of chemical risks, is assumed as a collective responsibility and daily practice, in line with the standards of the Organic Law on Prevention, Conditions and Environment at Work[6] but, above all, with the fundamental right to safe and healthy working environments.

Final note

"Safety is not an expense; it is the pillar that sustains sustainable productivity. Investing in a preventive culture will reduce costs associated with accidents, occupational illnesses, absenteeism, and environmental damage, while strengthening team commitment."

BIBLIOGRAPHIC REFERENCES

1. Runque EH, Blanco MB. Los desechos peligrosos de las industrias agroquímicas en Venezuela: visualizando claves de prevención. Revisión sistemática resumida. Rev Inclusiones. 2021;8(6):169-87. https://dialnet.unirioja.es/servlet/articulo?codigo=7803928.

2. Organización Panamericana de la Salud. Las condiciones de salud de las Américas. Salud y ambiente. Publicación Científica. 1994;(1):549. Disponible en: https://iris.paho.org/handle/10665.2/52720.

3. Organización Internacional del Trabajo. Equipos de protección personal. 1998. https://www.ilo.org/global/topics/labour-administration-inspection/resources-library/publications/guide-for-labour-inspectors/personal-protective-equipment/lang--es/index.htm.

4. Organización Internacional del Trabajo. Directrices sobre los sistemas de gestión de la seguriy salud en el trabajo (SST). 2019. https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/publication/wcms_727196.pdf.

5. Organización Internacional del Trabajo. Seguridad y salud en el uso de productos químicos en el trabajo. 2022. https://www.ilo.org/global/topics/safety-and-health-at-work/lang--es/index.htm.

6. Ley Orgánica de Prevención, Condiciones y Medio Ambiente de Trabajo. Gac Ofic Repúb Bolivar Venezuela. 2005 Jul 26; No. 38.236.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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Visualization: Luilibi Escalona, Estela Hernández-Runque.