SCT Proceedings in Interdisciplinary Insights and Innovations. 2025; 3:407
doi: 10.56294/piii2025407

Category: Applied Research in Health and Medicine

REVIEW

Occupational Safety and Health in Floriculture: Analysis of Pesticide Effects

Seguridad y Salud Laboral en la Floricultura: Análisis de los Efectos de los Plaguicidas

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Cite as: Villegas Narvaez LM. Occupational Safety and Health in Floriculture: Analysis of Pesticide Effects. SCT Proceedings in Interdisciplinary Insights and Innovations. 2025 Jan. 1; 3:407. DOI: https://doi.org/10.56294/piii2025407

Submitted: 12-09-2025 **Reviewed:** 27-11-2024 **Accepted:** 03-01-2025 **Published:** 05-01-2025

Editor: Emanuel Maldonado

ABSTRACT

The article reviewed the importance of occupational health and safety in the Ecuadorian flower sector, especially in relation to exposure to pesticides. These chemicals, essential for crop protection, have raised concerns due to their adverse effects on workers' health. Previous research that demonstrated significant risks and highlighted the need to improve labor practices and regulation of pesticide use was addressed.

Development

The daily exposure of workers to phytosanitary products and its consequences on health was analyzed. The studies evaluated showed a high prevalence of neurological, respiratory, skin and, to a lesser extent, renal problems. Factors such as lack of personal protective equipment, poor working conditions and prolonged exposure to highly toxic chemicals were also identified. In addition, the acute and chronic effects of these substances were reviewed, as well as the preventive measures proposed in previous studies. Strategies included training, monitoring of working conditions and adoption of sustainable agricultural practices.

Conclusions

The article concluded that pesticide exposure represents a significant risk for flower workers in Ecuador. The implementation of safety measures and strict regulation of the use of these products are essential to protect their health. In addition, the need for further research on long-term effects and the promotion of a safer work culture was highlighted.

Keywords: pesticides; floriculture; occupational health; occupational hazards; safety.

RESUMEN

Introducción
El artículo revisó la importancia de la seguridad y salud en el trabajo dentro del sector florícola ecuatoriano, especialmente en relación con la exposición a plaguicidas. Estos químicos, esenciales para la protección de los cultivos, han generado preocupaciones debido a sus efectos adversos en la salud de los trabajadores. Se abordaron investigaciones previas que evidenciaron riesgos significativos y destacaron la necesidad de mejorar las prácticas laborales y la regulación del uso de plaguicidas.
Desarrollo
Se analizó la exposición diaria de los trabajadores a productos fitosanitarios y sus consecuencias en la salud. Los estudios evaluados mostraron una alta prevalencia de problemas neurológicos, respiratorios, cutáneos y, en menor medida, renales. También se identificaron factores como la falta de equipos de protección personal, las deficientes condiciones laborales y la exposición prolongada a químicos altamente tóxicos. Además, se revisaron los efectos agudos y crónicos de estas sustancias, así como las medidas preventivas propuestas en estudios anteriores. Las estrategias incluyeron capacitación, monitoreo de las condiciones laborales y adopción de prácticas agrícolas sostenibles.
Conclusiones
El artículo concluyó que la exposición a plaguicidas representa un riesgo significativo para los trabajadores florícolas en Ecuador. La implementación de medidas de seguridad y la regulación estricta del uso de estos productos son esenciales para proteger su salud. Además, se destacó la necesidad de continuar investigando los efectos a largo plazo y promover una cultura laboral más segura.

Palabras clave: plaguicidas; floricultura; salud ocupacional; riesgos laborales; seguridad.

INTRODUCTION

Health and safety at work are current issues in Ecuadorian government policy, especially in the last decade, aimed at ensuring that workers carry out their activities in a healthier way. However, as expected, the regulations were not applied in floriculture in this case.

Phytosanitary products are chemical substances used worldwide in agriculture, horticulture, and public health to prevent diseases that attack crops and pests that affect human health, such as dengue. Floriculture in Ecuador has evolved over decades and has produced an increasingly important resource. In terms of employment, workers are increasingly committed to this type of business, many of whom have been working since they were teenagers.

Exposure to chemicals such as the plant protection products widely used in floriculture to prevent plant pests and diseases means that workers are exposed to these substances daily. This exposure can be direct for those who handle these substances and indirect for the treated greenhouse workers. Research studies are of significant interest in the effects of pesticides on health, especially pesticides of chronic origin and at the nervous system level of workers. Low doses or the long-term effects of low doses are largely unknown and have not been studied.

The working conditions in which workers carry out their activities can be a significant source of health risks. Exposure to chemicals, the length of time spent exposed, the availability and use of personal protective equipment, and hygiene practices at work can significantly influence the appearance of occupational illnesses.

DEVELOPMENT

Vázquez-Venegas CE, León-Cortez SG, González-Balthazar R, Preciado-Serrano ML 2018; Determination of the effects on workers' health due to exposure to pesticides used in floriculture. Methods of a cross-sectional study on 114 employees A sensory questionnaire was identified. The results showed

that the average age of the employees was between 28.89 and less than 7.09 18-48 years, 55% were men and women, 56% worked 40 hours a week, and FL-TS worked on average. 6.28 5.3 Less than the direct effect category of 33%, still exposed to the indirect effects of organic pesticides, neuropsychiatric and neuropsychiatric, among other behaviors that cause respiratory and nervous system problems 19% and 14%, respectively, of the 5-item questionnaire on psychiatric symptoms. 32-50% of the staff present symptoms (headaches, dementia), memory and concentration problems, insomnia, irritability). CONCLUSIONS: Exposure to pesticides of different toxicity classes among florists can cause serious problems and specific neurological health issues. We should start taking measures to reduce or eliminate the health effects.

Suárez Chérrez, Freddy and Alexander 2021. In recent decades, a type of kidney disease that is not associated with traditional risk factors and is commonly detected in agricultural workers exposed to pesticides has been identified. The problem is a global occupational health issue, with some reports in Ecuador. The objective was to determine the association between pesticide exposure and chronic kidney disease in florists in the parish of Yambo in 2018-2019. METHODS: A non-experimental cross-sectional correlation study was conducted with 218 employees who met the inclusion and exclusion criteria. A survey was conducted to determine sociodemographic variables, pesticide exposure, glomerular filtration rate calculated using the MDRD-4 equation, and kidney disease defined as <60 mL/min/1.73 m2. As a result, 52.8% were men, 32.6% were between 25 and 30 years old, and 100% recognized them as native speakers.

Meanwhile, 45.4% were exposed to pesticides for more than four years, 99.5% used these chemicals for 9 to 12 months in annual shifts, 100% worked 7 days a week, and 88.1% worked less than 6 hours—one day. The prevalence of kidney disease was 2.3% and was significantly related to sex (p = 0.032) and age group (p = 0.019). For workers with kidney failure who were exposed for more than 4 years and did not wear masks, the association was not significant. The conclusion was that the incidence of kidney disease in floriculture was low and not significantly associated with pesticide exposure.

Daniela Alejandra Chacón Cobos, Marilyn Alejandra Gómez Rocero, Valeria Alexandra Vargas Ortiz 2022. This study aims to address the need to monitor workers' occupational exposures to glyphosate at various stages of the substance's life cycle and to develop procedures for monitoring them: working conditions and environment for monitoring workers' health. Research based on various academic journals and articles, book chapters, websites, laws, and other existing compliance processes provides the most accurate information for creating processes for the public. In addition, official information is available from organizations such as the US Government's Conference of Occupational Hygienists (ACGIH), the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA), and the World Health Organization (WHO). (OSHA) and the World Health Organization. (I A). It consists of four parts: identifying worker exposures and working conditions to existing hazards, developing processes to monitor environmental conditions and worker health, and identifying interventions to reduce hazards.

The scientific name is Hypericum perforatum, belonging to the Hypericum family. Commonly known as Hypericum, Hypericon, Little Heart, or St. John's Wort, piercing and coiled, it is one of the most abundant Guttiferae or Hypericaceae family species. Its name, St. Hypericum, alludes to the fact that its flowers are collected on this day (late June).

It is easily found in mountains with limestone exposed to the sun and rocky terrain up to 2,000 meters above sea level in Spain. These lands are usually covered with bushes, pastures, wooded areas, and even clearings by the side of the road.

Hypericum taxonomy

Hypericum perforatum or HypericumHypericum is a perennial, woody, slightly branched, tawny root.

Stem

The stems are erect, reddish, and 25-90 cm high. They are distributed along the upper part of the plant and give rise to the two vertical branches characteristic of this type of HypericumHypericum.

Leaves

The leaves measure 1.5 and 3 cm, are opposite, sessile, elliptical, generally dark green, and have small transparent glands.

In fact, the Latin name perforatum comes from these tiny holes (actually packets of essential oil) that you can see under the light of each leaf of this plant. In addition, due to the orange sap, it is also characterized by leaving marks on the skin when the leaves are crushed with a finger. From the base of each leaf grow two excellent filaments, generally purple, which join the opposite leaf and completely enclose the stem.

It flowers from April to October. It is asymmetrical, with five petals. The flowers are hermaphroditic and bloom very densely.

Petals

The petals are golden yellow with small black dots on the edges, which are tiny secretory sacs.

After fertilization, an ovoid fruit is produced, divided into three compartments containing numerous seeds. If you crush the flowers, you get a red juice that stains your fingers a purplish-green color, just as you do with the leaves.

Cultivation and Care

Hypericum perforatum is relatively new in cultivation, and it is grown for markets such as herbs, medicines, and liqueurs.

No cultivars have been selected, but there are some populations of European origin because they have morphological characteristics recognized by growers, such as plants with a low stem/leaf ratio. However, these stems are more resistant; the flowering is more significant and even. As for soils, HypericumHypericum has the advantage of adapting to different pH levels, accepting dry soils, and preferably being exposed to the north. For direct sowing, the lighter the soil, the better. When starting to grow Hypericum perforatum, the most common system is from seeds, but it can be done from seeds and rhizomes. In any case, do not leave plants in the same field for more than two years. The longer you leave it there, the greater the risk of phytosanitary problems. For seed cultivation, the seeds of the year should be selected.

Sowing is done very superficially. Other plants, such as basil, need light to germinate. Before sowing, the seeds should be washed thoroughly to remove seed inhibitors. Plasticize for a week. A stratification system involves placing seeds in damp sand and maintaining temperatures between 0° and 5°C. This makes germination faster and more uniform. In this sense, a test was carried out in which 70% germination was achieved after 7 days instead of the 10% germination of unsorted seeds. Remember that seed germination and seedling growth are very slow in the early stages, generally taking an average of 4 to 5 weeks. Ideally, nursery planting is done by transplanting to a container and then directly to the field, although in some European countries, direct sowing is preferred. To achieve this, we recommend proceeding in the fall if possible.

If this is done in the spring, the seeds should first be layered. For autumn sowing, a single harvest is made in the first year of sowing, which is done in the spring.

The seeds of Hypericum perforatum are tiny, with an average size of 1.3 mm and a weight of 7-10 grams, about 1000 seeds. Therefore, mixing fine sand at a rate of 10% is recommended to improve workability when sowing and obtain a homogeneous distribution. The method of transplanting in late fall or early spring and sowing in early fall or late winter is most commonly used, depending on the timing of sowing. About 25 grams of seed should be sown in a bed of about 120 square meters. This allows you to replant 1 hectare of crops later. The final planting density is about 50,000 plants/ha, and the distance between plants is 30-40 cm. The space between rows should match the machines available for sowing and harvesting.

https://doi.org/10.56294/piii2025407

Fertilizing the hedge mustard ensures soil fertility by adding organic matter before sowing. Remember that the crop will be maintained for two years. During the growing season, you can contribute to some extent with granular chemical fertilizer during the beginning of spring.

Weed control is significant as the plants compete for everything from nutrients to moisture and space. It is generally used by mechanized methods to increase yield and avoid contamination of other vegetables during harvesting.

Pests

Although it is a very resistant plant, its growth is affected to some extent during cultivation, and due to the frequent supply of additional nutrients and irrigation, it can be attacked by various types of pests, to name some problems that may arise from time to time.

For pests, there can be many insects and mites, many of which also lend themselves to biological control.

Diseases

As for disease, there is a fungus called Verticillium albo atrium, a vascular fungus that first turns the leaves yellow, then the leaves wither and dry out. The disease first attacks the lower parts of the tree and then continues to the upper parts of the tree. Preventive control by crop rotation.

Septoria hypericin is a fungus that causes ash-gray spots with dark edges to appear on the leaves. Although there may be a few at first, they can completely cover the leaves and kill the plant over time.

Gloeosporium sp. The disease affects leaves, branches, and fruits. It is also known as anthrax, and its symptoms appear as more or less circular necrotic patches surrounded by darker halos. Due to its presence, diseased plants become scorched and reddish-yellow.

Erysiphe sp. is a parasitic fungus belonging to the powdery mildew group and produces white deposits on the upper surface of the leaves. Affected plants stop growing and eventually die.

Harvesting

In spring and summer, the HypericumHypericum is harvested with flowers and berries, flowering aerial parts, or whole aerial parts. Depending on the application, health food shops, pharmacies, liquor stores, etc., offer it fresh or dried.

Practically all the aerial parts of the plant, that is, all the flowers and leaves, are harvested for production destined for the herb market. This is usually done in spring when the flowers fully bloom. The trees can be cut by hand or with a machine, and an attempt should be made to cut them at a reasonable distance from the ground to avoid dragging up both the woody parts of the tree and the small remains of weeds found in the garden. With a second crop, if the plants are very healthy, a second mowing can be done in late summer or early fall after the trees have grown, so it is usually a good idea to keep the plantations in place throughout the year, especially in the first year of planting. Harvest only once—late flower.

After harvesting the plants, they are cut green into cutting sizes of approximately 1 cm and dried at temperatures between 35 and 45 °C for the herb market. Once dry, the product is transferred to obtain only the leaves and flowers.

According to reference materials, the medicinal herb hypericum flower yield was about 6 tons/ha after crushing, drying, and plucking in the second year.

Chemicals used in the floriculture area

The situation in floriculture is alarming, with most farms showing serious health and pollution problems due to the use of chemicals in their crops—red and yellow dangerous and cheap labels.

Pesticides are dangerous substances that companies can quickly dispose of and use to kill pests, but their frequent use and long-term human exposure can cause severe damage to workers' health.

According to the WHO, there have been cases of pesticide poisoning, of which 10% resulted in death, with the majority of the pesticides being carbamates, organophosphates, and organochlorines, which correspond to third-world countries.

https://doi.org/10.56294/piii2025407

Table 1. Chemicals.

Chemists	Chemical group	Use	Toxicity level
Fosetyl aluminum	Phosphate	Flowers - Potatoes	Blue
Propamocar hydrochloride	Carbamate	Flowers	Green
Mancozeb	Acetamide	Flowers - Potatoes	Yellow
Methiocarb	Carbamate	Flowers	Yellow

Source: Author's own creation.

Table 2. Effects caused by Chemicals.

EFFECT OF POLLUTION	
Corrosive	It destroys the tissues that are in contact with the toxins.
Irritant	It causes skin irritation
Asphyxiant	It makes breathing difficult
Sensitizing	It causes an allergic reaction
Carcinogenic/mutagenic	It causes or increases the possibility of contracting cancer, malformations, etc.
Systemic	It causes organ damage

Source: Author's own creation.

https://doi.org/10.56294/piii2025407

According to company organizations and employees, florists often use a variety of chemicals to control pests and diseases in flowers, which not only fail to kill pests but also harm workers. The table shows that these chemicals are used not only in floriculture but also in agriculture without considering the risks that this represents.

Florists use pesticides to control pests on flowers. This is due to the prolonged exposure of workers to these substances, which can cause unwanted skin changes and reactions. This can lead to health problems and complications for workers and, consequently, a reduction in productivity.

Safety measures

Collective safeguards protect specific groups of people at risk; they represent the infrastructure of a place, they protect people, measures that protect people, and they apply to the body. This is the last barrier between people and risk.

It is important to know that the florist must get involved in accident prevention work, as risk management depends largely on the florist. Therefore, if a worker suffers the pain of an injury or the consequences of an accident, it is the worker who must apply the safety regulations.

Prevention is a step that must be taken with a good attitude, resulting in perfect health. Everyone must know the benefits of using safety measures to avoid problems. The above issues can be complicated, so management staff must check the premises to ensure proper hygiene measures and the trader's comfort.

All the safety techniques used have proven to be more effective in avoiding malicious behavior, thus demonstrating two basic forms of safety action.

- Prevention: Impact on the causes of accidents.
- Protection: Measures taken to reduce the effects of an accident on work groups or people at risk.

The safety and protection of florists is paramount, and safety measures, such as company policies, must be followed.

Workers have the right to do a good job if they can perform well.

Safety Equipment

All employees involved in floriculture need an environment. Comprehensive protective equipment to support infrastructure, workers carrying out activities, providing care, and avoiding accidents without occupational hazards in their various fields of work.

Table 3. Protective equipment.

Implementos de aseo	Ropa de protección	
Vestidor	Mandil	Zapatos
Ducha e inodoro	Botas	Gafas
Comedor	Mascarilla	Overol
	Guantes	Mandil
	Gorra	Ropa de protección

Source: Author's own creation.

Occupational health is an interdisciplinary activity aimed at guiding, promoting and protecting the health of workers through the prevention and control of communicable diseases, accidents and conditions that endanger health and safety.

Protective measures are very important. For workers, acceptance is a right for all. The company must always provide and update them to prevent health risks. Health, physical, mental and social.

Types of poisoning due to exposure to pesticides

- Acute poisoning: occurs within a few minutes or hours of exposure.
- Chronic poisoning: can manifest itself even after years of exposure.

Figure 1. Signs and symptoms associated with chemical exposure.

Source: Author's own creation.

https://doi.org/10.56294/piii2025407

Table 4. Diseases associated with exposure to chemicals

Respiratory system diseases	Digestive system diseases	Diseases of the eye system	Skin and tissue diseases	Musculoskeletal system
Rhinitis	Gastric ulcer	Conjunctivitis	Dermatitis Allergic	Arthritis
Chronic pharyngitis	Gastroenteritis	Cataracts due to radiation	Hives	Joint disorders
Sinusitis	Toxic colitis		Back pain	Lower back pain
Chronic obstructive pulmonary disease				
Obstructive asthma				
Asthmatic bronchitis				
Chronic obstructive bronchitis				
Pneumonia				

Source: Author's own creation.

Table 5. Pesticides commonly used in floriculture.

TYPE OF PESTICIDE	CHEMICAL GROUP
INSECTICIDES	• Organophosphates • Chlorinated organics • Pyrethrins and pyrethroids
NEMATICIDES	• Organophosphates
FUNGICIDES	• Dithiocarbamates • Chlorothanil • Organophosphates

https://doi.org/10.56294/piii2025407

FUMIGANTS	• **Dithiocarbamates** • **Chlorothanil** • **Organophosphates**
HERBICIDES	• **Bipyridyls** • **Chlorophenoxy** • **Organophosphates**

Source: Author's own creation.

CONCLUSIONS

Occupational health and safety in Ecuadorian floriculture is a significant and priority challenge, given the prolonged exposure of workers to phytosanitary chemicals. These products, widely used to control pests and diseases in crops, have been shown to have adverse health effects, particularly at the neurological and renal levels, as evidenced by several studies cited. Despite the evolution of this industry and its significant contribution to employment, the working conditions and risks associated with handling pesticides require immediate attention and concrete actions to guarantee the well-being of the workers.

The research carried out shows that flower workers are exposed daily to substances of different levels of toxicity, which can generate both acute and chronic effects on their health. The most common problems include respiratory, skin, and neurological diseases, such as persistent headaches, insomnia, irritability, and difficulty concentrating. In addition, kidney damage has been identified in workers exposed for long periods, although some studies indicate that the relationship between exposure and these diseases is not always statistically significant. These results underline the importance of conducting more extensive research to understand the long-term risks fully.

Working conditions, such as exposure time, lack of adequate personal protective equipment, and poor hygiene practices, aggravate the health risks. This highlights the urgent need for stricter safety and protection measures in the floriculture sector. These measures include training workers in the safe handling of pesticides, providing personal protective equipment, and promoting a culture of prevention within companies. Strict regulation and constant monitoring of the use of chemicals are also essential, prioritizing those with lower toxicity and promoting more sustainable agricultural practices.

On the other hand, the information presented on handling and cultivating species such as Hypericum perforatum reveals that, although this plant has multiple beneficial applications, its cultivation also exposes it to similar phytosanitary risks. This reinforces that sustainability and occupational health should be fundamental pillars in agricultural and floricultural production.

In conclusion, floriculture in Ecuador faces the challenge of balancing its economic growth with protecting its workers' health. It is essential to adopt a comprehensive approach that combines scientific research, regulatory compliance, and safe labor practices to reduce the risks associated with pesticide use and improve the quality of life of those who work in this industry. Occupational health and safety is not only an employee's right but also an ethical and legal responsibility of companies.

REFERENCES

1. Albiano N, Lepori E. Criterios para el monitoreo de la salud de los trabajadores expuestos a sustancias químicas peligrosas [Internet]. 2015 [consultado 1 Sep 2022]. Disponible en: https://www.toxicologia.org.ar/wp-content/uploads/2018/06/Toxicologia_Laboral-2015.pdf.
2. Bejarano P, Estefanía V. Evaluación de inmunoglobulinas en trabajadores expuestos a plaguicidas (carbamatos y organofosforados) en la florícola Rosalquez período 2013 [Internet]. 2014 [consultado 1 Sep 2022]. Disponible en:

https://repositorio.uta.edu.ec/bitstream/123456789/7665/1/Vanessa%20Estefania%20P%c3%a9rez%20Bejarano.pdf.

3. Chérrez S, Alexander F. Relación entre el uso de plaguicidas y enfermedad renal en los agricultores de una florícola en la parroquia Yambo año 2017-2018 [Internet]. 2021 [consultado 1 Sep 2022]. Disponible en: https://repositorio.upch.edu.pe/handle/20.500.12866/11690.
4. Chacón Cobos DA, Gómez Rosero MA, Vargas Ortiz VA. Planteamiento de un protocolo de vigilancia para los trabajadores expuestos al glifosato en Colombia [Internet]. 2022 [consultado 1 Sep 2022]. Disponible en: https://repositorio.unbosque.edu.co/bitstream/handle/20.500.12495/6779/Chac%c3%b3n_Cobos_Daniela_Alejandra_2022.pdf?sequence=1&isAllowed=y.
5. Fernanda J. Evaluación del riesgo ergonómico y trastornos musculoesqueléticos en trabajadores del área de fumigación de la florícola Florecal de Cayambe 2019-2020 [Internet]. 2020 [consultado 1 Sep 2022]. Disponible en: http://repositorio.utn.edu.ec/bitstream/123456789/11021/2/06%20TEF%20350%20TRABAJO%20GRADO.pdf.
6. Flores A. Determinación de la exposición a plaguicidas de los productores hortícolas y florícolas [Internet]. 2020 [consultado 1 Sep 2022]. Disponible en: https://www.ungs.edu.ar/wp-content/uploads/2020/11/Tesis-de-Doctorado_rev_sep-3.pdf.
7. MAGANIZE. Hypericum perforatum [Internet]. 2017 [consultado 1 Sep 2022]. Disponible en: https://www.floresyplantas.net/hypericum-perforatum/.
8. Organización Mundial de la Salud. Prevención de los riesgos para la salud derivados del uso de plaguicidas en la agricultura [Internet]. 2004 [consultado 1 Sep 2022]. Disponible en: https://apps.who.int/iris/bitstream/handle/10665/42799/9243590995.pdf?sequence=1&isAllowed=y.
9. Ramírez JA, Lacasaña M. Plaguicidas: clasificación, uso, toxicología y medición de la exposición [Internet]. 2001 [consultado 1 Sep 2022]. Disponible en: https://archivosdeprevencion.eu/view_document.php?tpd=2&i=1270.
10. Vásquez Venegas CE, León Cortés SG, González Baltazar R, Serrano M. Exposición laboral a plaguicidas y efectos en la salud de trabajadores florícolas de Ecuador. Salud Jalisco [Internet]. 2016;3(3):1-9. Disponible en: https://www.medigraphic.com/pdfs/saljalisco/sj-2016/sj163e.pdf.

FINANCING

None.

CONFLICT OF INTEREST

None.