

## HYGIENIC ASSESSMENT OF WORKING CONDITIONS IN GREENHOUSES

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**Abstract.** This article presents an analysis of production factors in greenhouse farms and their impact on greenhouse workers' health.

The study revealed the negative impact of occupational hazards on workers' health. The main occupational hazards in greenhouses include microclimate, chemical agents, air pollution, and pesticides. Furthermore, greenhouse workers' work is very stressful. As a result, an increase in respiratory and musculoskeletal diseases has been observed among female greenhouse workers.

**Keywords:** greenhouse, microclimate, chemical factors, pesticides, diseases.

**Relevance** Over the past decade, the number of enterprises engaged in indoor vegetable cultivation in Uzbekistan has increased, and the number of new technologies for cultivating vegetable crops is constantly growing. Despite the modernization of production, protecting the health of agricultural workers remains a pressing issue. Protecting and improving the health of the working population is a key public health issue. Prevention of occupational and work-related diseases occupies a leading place in the system of treatment and preventive measures. Considering only the isolated impact of individual production factors on workers' health, it is impossible to assess the impact of their combined effects. During periodic medical examinations of workers in the agro-industrial complex, there is a lack of interest in actively identifying risk groups for occupational and work-related pathologies, both on the part of employers and employees (N.F. Izmerov, I.V. Bukhtiyarov, L.V. Prokopenko 2014; T.A. Novikova, V.F. Spirin, N.A. Mikhailova, V.M. Taranova 2012; I.V. Bukhtiyarov 2016).

In recent years, sanitary inspection specialists have paid little attention to enterprises engaged in the production and cultivation of vegetables in greenhouses. Insufficient research has been conducted, and no connection has been established between sanitary, hygienic, epidemiological, and physiological factors of working conditions affecting the body of workers and their morbidity. Somatic pathologies of various etiologies are constantly being reported in greenhouse farms in the Bukhara region, despite ongoing management and preventive measures. The incidence of illness among workers in key greenhouse occupations in the Bukhara region is primarily due to exposure to environmental factors: unfavorable microclimate, dust, and physical strain resulting from significant manual labor.

Therefore, it is necessary to improve oversight during inspections, taking into account the impact of environmental factors on the primary professional group—greenhouse workers. Objective of the study: To conduct a hygienic assessment of working conditions and scientifically substantiate measures to reduce the risk of exposure to adverse work-related factors on the health of female workers in key greenhouse occupations.

**Research Methodology and Methods:** The study was conducted at two greenhouse fresh vegetable and mushroom growing facilities in the region: the Bukhara Agricultural Production Cooperative and the Umurbek Fayz Zamini greenhouse workshop in the Gijduvan District.

The study focused on working conditions (air pollution indicators, microclimate parameters, workload and intensity, etc.), as well as the health status of key occupational groups (greenhouse vegetable growers and greenhouse mushroom growers).

The study was conducted in accordance with current regulatory and methodological documents using a combination of modern hygienic, statistical, laboratory, and instrumental research methods.

The hygienic assessment of working conditions included an analysis of the impact of chemical factors, physical factors (microclimate, noise, vibration, electromagnetic fields, illumination), an assessment of the severity and intensity of the work process, as well as a comprehensive assessment of factors affecting the work environment and the work process of greenhouse workers.

The risk assessment of pesticide exposure on workers was conducted in accordance with the guidelines "Risk Assessment of Pesticide Exposure on Workers" No. 1.2.3017-12.

The hygienic assessment of microclimate, noise, vibration, electromagnetic fields, and illumination parameters was carried out in accordance with SanPiN 1.2.3685-21 "Hygienic Standards and Requirements for Ensuring the Safety and (or) Harmlessness of Environmental Factors for Humans." An assessment of the severity and intensity of the work process, as well as a comprehensive assessment of working conditions, were conducted in accordance with R 2.2.2006-05

"Guidelines for the Hygienic Assessment of Factors in the Work Environment and Work Process. Criteria and Classification of Working Conditions."

To assess the health status of greenhouse vegetable growers and greenhouse mushroom growers, the group was divided into three subgroups by age and four subgroups by length of service.

To ensure the reliability of the results, a control group was studied, consisting of 108 female administrative and management staff (AMS) employees aged 24 to 54 years who had not previously participated in the production process.

Incidence of temporary disability was assessed based on the number of cases and days of disability per 100 workers, the average duration of one case, and the relative risk of morbidity. A quantitative assessment of the relative risk of morbidity leading to temporary disability among greenhouse vegetable and mushroom growers was conducted based on the calculation of odds ratios, relative risk, and etiologic proportions.

MAIN SUMMARY

1,158 workers, including 789 women, are employed in greenhouse farms in the Bukhara region, representing 72.7% of the total workforce. 427 workers work in hazardous conditions, 68% of whom are women. A hygienic assessment of working conditions in greenhouse farms in the Bukhara region revealed that workers are exposed to a range of adverse factors. Based on studies conducted between 2015 and 2019, of the 458 samples analyzed for harmful substances in the air of the working area, 1.3% of the samples exceeded the maximum permissible concentration of controlled pollutants. The proportion of test results showing exceedances of maximum permissible concentrations of harmful substances in the form of dust and aerosols over the same period was slightly higher, at 1.4%. Overall, the assessment of chemical exposure shows that the dynamics of harmful substance levels, such as acetic acid, carbon monoxide, chlorine, ammonia, sulfur dioxide, and suspended solids, in the air of work areas at closed-type enterprises over the past five years has tended to decrease the proportion of samples that do not meet hygiene standards.

Over the past five years, there has been a trend toward an increase in the proportion of workplaces that do not meet hygiene requirements for noise – from 2.8 to 3.8%, primarily among tractor drivers – and for microclimate – from 7.5 to 8.6% among greenhouse workers. The Bukhara Greenhouse Complex greenhouse complex has five workshop divisions, where the bulk of the research was conducted: Workshop 1 – cucumber cultivation, Workshop 2 – tomato cultivation, Workshop 3 – pepper cultivation, Workshop 4 – greens cultivation, and Workshop 5 – mushroom cultivation. The company employs 690 people, 352 of whom are directly involved in vegetable and mushroom cultivation, including 158 women. The new-generation Umurbek Fayz Zamini greenhouse complex, which produces fruit and vegetable products indoors using low-volume hydroponics on mineral wool, has two greenhouses with a total area of 6.2 hectares, where tomatoes and seedlings are grown.

## CONCLUSIONS

1. The working conditions of vegetable growers working in greenhouses cultivating vegetables in soil are characterized by the combined adverse effects of environmental and work process factors: microclimate (high temperatures, relative humidity, especially in summer), and exposure to pesticides (overall working conditions rating: 3.2). Vegetable growers working in greenhouses using low-volume hydroponics have more favorable working conditions (overall working conditions rating: 3.1). The working conditions of mushroom growers are characterized by the combined effects of high humidity and low temperatures, forced work postures, and exposure to pesticides (overall working conditions rating: 3.1).
2. Indoor use of cypermethrin- and bifenthrin-based pesticides, subject to compliance with application regulations and safety requirements, poses an acceptable risk to female greenhouse workers, both in terms of exposure levels of the total safety factor (TSF) of 0.038 and 0.2, and in terms of the absorbed dose of the inhalation and dermal safety factor (SDF) of 0.015 and 0.029, with a permissible value of 1. A safe period of entry into the greenhouse after pesticide treatment for manual work of 1 day has been justified.
3. The incidence rate of temporary disability among female greenhouse workers (per 100 workers) is 1.05 to 1.19 times higher than the average for the agricultural sector in the Voronezh Region; The relative risk of morbidity resulting in temporary disability is greater than 1: 1.38 for

vegetable growers and 1.53 for mushroom growers. The etiological contribution of unfavorable work-related factors to morbidity is 27.72% and 34.44%, respectively (at  $p < 0.05$ ).

4. The leading causes of morbidity among greenhouse vegetable growers are acute respiratory viral infections (62.56%), respiratory diseases (13.66%), cardiovascular diseases (6.61%), musculoskeletal diseases (7.49%), and peripheral nervous system diseases (4.85%). Among greenhouse mushroom growers, the main nosologies remain acute respiratory viral infections (34.38%), respiratory diseases (18.75%), cardiovascular system diseases (9.38%), but the proportion of skin and subcutaneous fat diseases (12.5%), musculoskeletal system diseases (9.38%), and genitourinary system diseases (6.25%) increases in relation to the group of greenhouse vegetable growers.

5. Among greenhouse vegetable growers, the risk interval for developing chronic respiratory diseases and peripheral nervous system diseases is 6-9 years, and for diseases of the musculoskeletal system and cardiovascular system, 10-15 years; In greenhouse mushroom growers: chronic respiratory diseases and diseases of the skin and subcutaneous fat 6-9 years, diseases of the cardiovascular system, musculoskeletal system, genitourinary system - 10-15 years.

6. Evaluation of the functional state of the cardiovascular system of greenhouse workers in the dynamics of the work shift and taking into account the differences in the severity of work at the leading stages of vegetable crop cultivation revealed a reliable increase ( $p < 0.05$ ) in the heart rate by the end of the work shift from  $81.87 \pm 2.78$  to  $88.18 \pm 1.09$  beats / min ( $p = 0.035$ ), a change in systolic from  $120.1 \pm 2.38$  to  $136.13 \pm 5.1$  mm Hg. ( $p = 0.005$ ) and diastolic blood pressure increased, which were more pronounced in older groups with 10 or more years of experience and in older age groups, regardless of the technology used to cultivate vegetable crops in greenhouses.

7. A decrease in right-hand wrist endurance by the end of the work shift during harvesting and removal of plant residues from  $5.22 \pm 0.13$  to  $4.46 \pm 0.19$  sec ( $p = 0.001$ ) indicates the development of muscle fatigue, regardless of the technological features of growing crops in greenhouses.

8. A high prevalence of bad habits was found among the professional group compared to the comparison group ( $p = 0.00004$  for vegetable growers and  $p = 0.008$  for mushroom growers). 81.2% of respondents in the vegetable and mushroom grower groups had incomes below 8,000 rubles per family member. This, combined with unfavorable production factors, contributes to a more rapid deterioration in health.

9. A set of measures to reduce the risk of illness among greenhouse workers was developed and implemented. This measure is based on the results of an analysis of the impact of work-related factors and health assessment methods. This includes organizational, engineering, technical, and preventive measures to ensure compliance with sanitary and hygienic requirements and requirements for the conditions for growing vegetable crops in closed ground. This is aimed at maintaining the health of greenhouse workers and increasing their productivity.

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