

TIME OF FARMERS' EXPOSURE TO BIOLOGICAL FACTORS IN AGRICULTURAL WORKING ENVIRONMENT

Anna Mołocznik

Institute of Agricultural Medicine, Lublin, Poland

Mołocznik A: Time of farmers' exposure to biological factors in agricultural working environment. *Ann Agric Environ Med* 2004, **11**, 85–89.

Abstract: Working time in conditions of exposure to hazardous factors is an important element indispensable for the evaluation of human exposure in the working environment. Agricultural work is accompanied by co-occurrence of many risk factors threatening farmers' health, e.g. dust, elements of the thermal environment, noise, vibration, chemical and biological agents. Biological factors cause diseases with contagious, allergic or immuno-toxic backgrounds which constitute the majority of farmers' occupational diseases registered in Poland. Exposure to hazardous factors in agricultural working environment is due to contact with plants, animals and organic wastes, more precisely - with microbes, plant and animal particles present in aerogenic agricultural dust, as well as pathogens of contagious and invasive diseases present in contaminated soil, water and plants. Data concerning the duration of farmers' exposure to biological and other factors of the working environment were obtained with the use of the Private Farmer Work Chart. Time-schedule observations concerned an annual work cycle. The study covered 30 farms with the following production profiles: plant (Group A), animal (Group B) and mixed production (Group C). The total working time was: in Group A - from 106–163% of the legal working time; in Group B - from 75–147%; in Group C - from 136–167%. Among 48 work activities contributing to the full working cycle among the farmers examined, 15 activities were accompanied by 5 factors. These were mainly field activities which covered plant harvesting and fertilizing, chemical plant protection, as well as cultivation activities. Agricultural dust and elements of the thermal environment were the environmental factors most frequently accompanying agricultural work, followed by contact with biological factors, noise, vibration, and chemical agents. Biological factors are a specific element associated with 19 work activities, mainly the spreading of manure, animal breeding and plant harvesting. Farmers' working time in conditions of exposure to these factors in the group of plant producers was 51% of the total working time on average, among animal breeders - 80% and in the case of mixed production - 77%.

Address for correspondence: Dr Anna Mołocznik, Department of Occupational Physical Hazards, Institute of Agricultural Medicine, Jaczewskiego 2, P.O. Box 185, 20-950 Lublin, Poland.

Key words: farmer, exposure time, biological factors, agricultural dust, elements of the thermal environment, noise, vibration, chemical agents, agricultural environment.

INTRODUCTION

Safe occupational conditions are determined by standard allowable values. The required safety measure for factors

of both long-term and instant action is the mean weighted allowable value. This value refers to the whole work cycle and contains an element of exposure time [2, 9, 11, 20, 25, 26].

Received: 2 December 2003

Accepted: 20 April 2004

Presented at the 1st International Scientific-Training Congress *Organic Dust Induced Pulmonary Diseases*, 10-12 Oct. 2003, Kazimierz Dolny, Poland

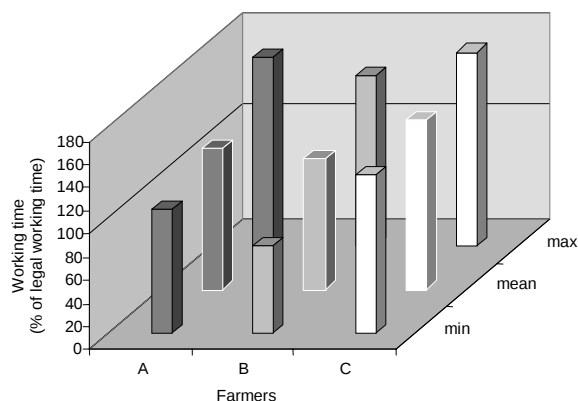


Figure 1. Total annual time of performing all activities in the group of farmers engaged in plant production (A), in animal production (B) and in mixed production (C).

Hence, the recognition of the time of exposure of farmers to each hazardous factor present in their working environment is extremely significant. The duration of exposure to a health risk factor is particularly important with respect to changeable exposure in agriculture where the work cycle is prolonged to one year, and the daily working time in conditions of exposure to hazardous factors changes irregularly from one day to the next [3, 4, 7, 15].

Agricultural work is accompanied by co-occurrence of many risk factors threatening farmers' health, e.g. dust, elements of the thermal environment, noise, vibration, chemical and biological agents. Biological factors cause diseases of contagious, allergic or immunotoxic background which constitute the majority of farmers' occupational diseases registered in Poland [1, 2, 27]. Exposure to these factors in the agricultural working environment is due to contact with plants, animals and organic wastes, more precisely - with microbes, plant and animal particles present in aerogenic agricultural dust, as well as

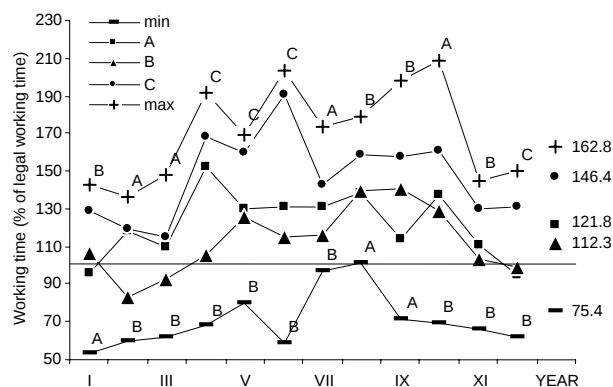


Figure 2. Distribution of working time in annual work cycle among farmers (A - plant production, B - animal production, C - mixed production).

pathogens of contagious and invasive diseases present in soil, water and plants [10, 13, 17, 18, 24]. Pioneer studies in this area are being conducted by the Institute of Agricultural Medicine [5, 6, 8, 12, 14, 16, 19, 21, 22, 23].

The aim of the present study was the recognition of farmers' time exposure to biological factors on the background of other hazards present in agricultural working environment.

MATERIAL

The study covered 30 farms in the Lublin region with the following production profiles: plant - wheat, sugar beet, vegetables (Group A), animal - dairy cattle (40 on average), swine (90 on average) (Group B) and mixed production (Group C). The size of the farms in the study was 30–66 ha (Group A), 18–41 ha (Group B) and 10–20 ha (Group C). The age of farmers was 22–53 years. They ran farms together with adult family members - wife, parents and children.

Table 1. Farmers' potential exposure to hazardous factors accompanying individual groups of work activities on private farms.

Groups of work activities on farm	Hazardous factors of working environment					
	dust	thermal environment	biological hazards	noise	vibration	chemical hazards
Cultivation and crop care:						
- mechanical	•	•		•	•	
- manual	•	•				
Fertilization	•	•	•	•	•	•
Sowing, planting	•	•		•	•	•
Plant protection	•	•		•	•	•
Plant harvesting:						
- mechanical	•	•	•	•	•	
- manual	•	•	•			
Household activities	•	•	•	•	•	
Other work activities	•	•	•	•	•	•

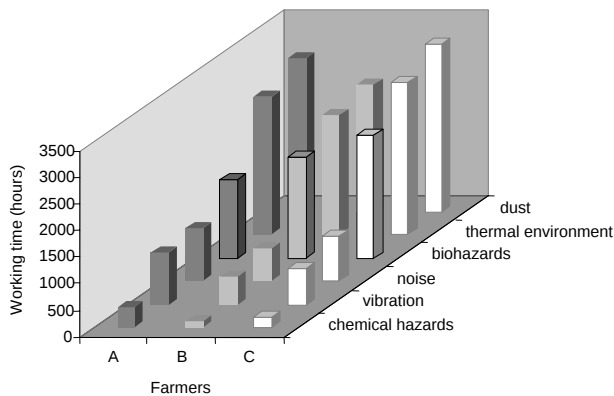


Figure 3. Farmers' exposure time to hazardous factors on 3 types of farms A, B, C (hours).

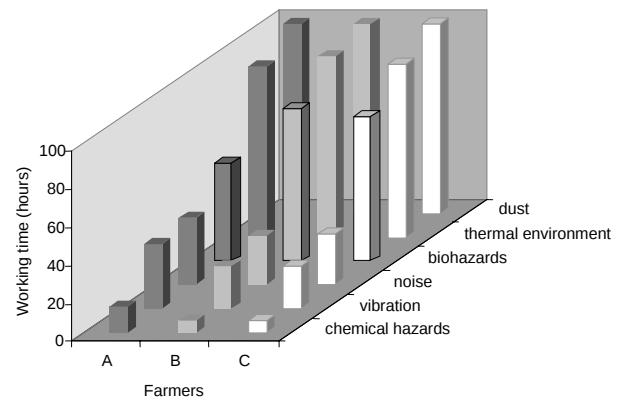


Figure 4. Farmers' exposure time to hazardous factors on 3 types of farms A, B, C (% of the total working time on a farm).

METHODS

The 'Private Farmer's Labour Charter' was applied in order to obtain data concerning time exposure of a farmer to biological and other factors of the working environment during the work cycle. The Charter was designed for a farmer to register his everyday work activities, and contained questions concerning: duration of work, labourers, the equipment applied, as well as subjectively perceived environmental factors accompanying work, such as dust, elements of the thermal environment, noise, vibration, chemical agents including pesticides, mineral fertilizers and biological factors. Time-schedule observations concerned an annual work cycle.

RESULTS

Total working time. Based on the time-schedule documentation, 48 types of work activities were distinguished associated with crop and soil cultivation, fertilization, sowing, planting, plant protection, crop harvesting, as well as household activities, such as care of animals, grain threshing, cleaning and crushing, mixing of fodder, and other work activities - repair, transportation and re-

loading (Tab. 1). The total time of performing all activities registered in annual time-schedule documentation was: in the group of farmers engaged in plant production (Group A) - from 2,260–3,464 hours, in the group of farmers engaged in animal production (Group B) - from 1,605–3,132 hours, and in the group of farmers engaged in mixed production (Group C) - from 2,904–3,373 hours. These values were expressed in the percentage of legal working time and were: in Group A - from 106–163%, 122% on average; in Group B - from 75–147%, 112% on average; and in Group C - from 136–167%, 146% on average. Mixed production occurred to be most time consuming, while swine breeding based on concentrated feeding staff was the least time consuming (Fig. 1).

The greatest amount of time is devoted to the care of animals - the main component of working time during the whole year on animal production and mixed production farms.

The analysis of monthly data shows a great inequality in working time load among the farmers in the study during the annual work cycle, especially among those engaged in mixed production (Fig. 2). It also indicates a high monthly working time schedule of farmers, most frequently exceeding the legal working time, especially

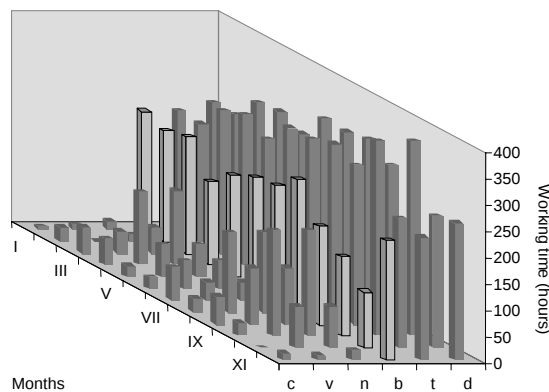


Figure 5. Working time distribution in conditions of exposure to hazardous factors (c - chemical hazards, v - vibration, n - noise, b - biological, t - thermal environment, d - dust) in a selected farmer of Group A (plant production).

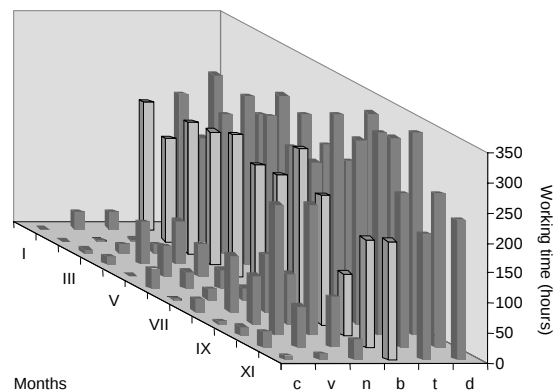


Figure 6. Working time distribution in conditions of exposure to hazardous factors (c - chemical hazards, v - vibration, n - noise, b - biological, t - thermal environment, d - dust) in a selected farmer of Group B (animal production).

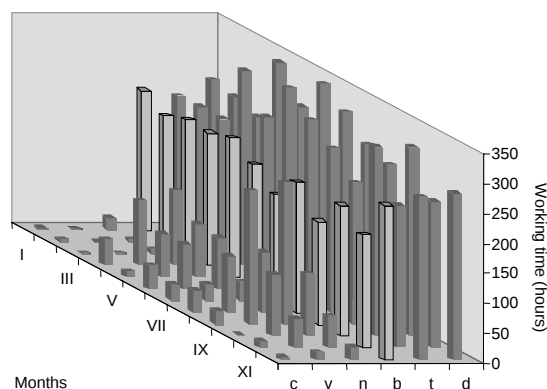


Figure 7. Working time distribution in conditions of exposure to hazardous factors (c - chemical hazards, v - vibration, n - noise, b - biological, t - thermal environment, d - dust) in a selected farmer of Group C (mixed production).

with plant and mixed production, maximum over 200% of the legal time in case of a farmer engaged in plant production (October) and a farmer engaged in mixed production (June).

Working time in conditions of exposure to hazardous factors of the working environment. Among 48 activities contributing to the whole work cycle of farmers in the study, 15 were accompanied by 5 hazards, and the following 16 - by 4 risk factors. These were mainly field work activities associated with plant harvesting and fertilization, chemical plant treatment, as well as cultivation activities (Tab. 1). Figure 3 presents the mean working time of farmers on 3 types of farms in conditions of exposure to hazardous factors of the working environment. The environmental factor most frequently accompanying agricultural work is dust and elements of the thermal environment, followed by contact with biological factors of plant and animal origin, noise and vibration; chemical agents create risk within the shortest working time schedule.

Work in the agricultural environment creates risk to hazardous biological agents through contact with plants, animals and organic wastes (manure, dung) precisely, with microbes and plant and animal particles present in aerogenic agricultural dust produced and inhaled by a farmer while performing various work activities in the field and within the household, as well as pathogens of contagious and invasive diseases present in contaminated soil, water and plants. Biological agents are a specific element accompanying agricultural work. These factors were associated with 27 work activities, mainly during application of fertilizers, harvesting and animal breeding. The farmers exposure time to these factors was about 51% of the total working time on a farm, on average, in the group of plant producers; 80% - among animal breeders; and 77% - among farmers engaged in mixed production (Fig. 4).

The working time of a farmer changes during the annual cycle, each of the hazards registered also has its typical distribution: changeable, with clear maximum values.

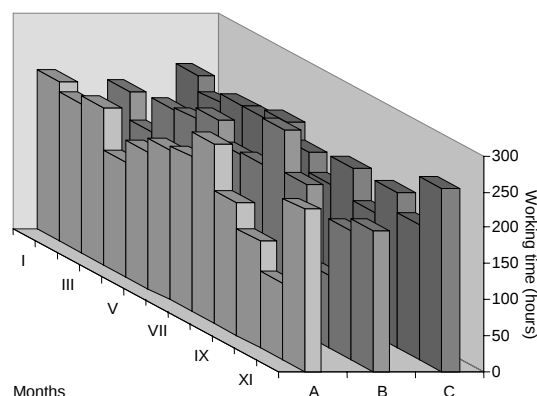


Figure 8. Working time of farmers (A, B, C) in conditions of exposure to biological hazards

Figures 5, 6 and 7 present examples of working time distributions in conditions of exposure to hazardous factors in 3 farmers of the Groups A, B and C.

The exposure time of farmers to biological hazards remained on a high and slightly changeable level throughout the whole year, except for November in the group of plant producers and October among animal breeders (Fig. 8).

CONCLUSIONS

- Working time of farmers on private farms generally exceeds the legal working time, irrespective of the type of production.
- Agricultural work is most often accompanied by several hazards at the same time, which may determine the type and intensity of the body reaction among workers exposed.
- Dust, elements of the thermal environment and biological agents, occur most frequently and create risk for farmers.
- Biological agents accompany nearly 60% of farm activities.
- Working time in conditions of exposure to biological hazards was: in the group of plant producers - 51% of the total working time on a farm; in the group of animal breeders - 80%; and in the group of farmers carrying out mixed production - 77%.
- Time schedule and the distribution of farmers' exposure to hazardous factors during an annual work cycle were specific for each farm and dependent primarily on production profile.
- Data concerning the time of exposure to the hazards of agricultural working environment constitute a basis for biasing prophylactic actions; this is especially important with respect to biological factors, farmers generally not being aware of their presence.

REFERENCES

1. Dutkiewicz J: Bacteria and fungi in organic dust as potential health hazard. *Ann Agric Environ Med* 1997, **4**, 11-16.
2. Dutkiewicz J, Mołocznik A: *Pyły organiczne pochodzenia roślinnego i zwierzęcego. Podstawy i Metody Oceny Środowiska Pracy*. Międzyresortowa Komisja do spraw Najwyższych Dopuszczalnych Stężeń i Natężeń

Czynników Szkodliwych dla Zdrowia w Środowisku Pracy, Warszawa 1998, **18**, 151-185.

3. Mołocznik A: Ocena narażenia na działanie pyłu w warunkach ekspozycji nieustalonej. *Bezpieczeństwo Pracy* 1990, **7-8**, 8-11.

4. Mołocznik A: Ocena ekspozycji pracowników na pyły rolnicze - stan aktualny i potrzeby. *Bezpieczeństwo Pracy* 1993, **5**, 7-11.

5. Mołocznik A: Exposure to agricultural dust in Poland. *Ann Agric Environ Med* 1994, **1**, 115.

6. Mołocznik A: Problem zagrożenia pyłowego w rolnym środowisku pracy. *Zastosowania Ergonomii* 1996, **22-23**, 189-197.

7. Mołocznik A: Czas pracy rolnika w narażeniu na pył jako element oceny higienicznej. *Higiena Pracy* 1996, **3**, 25-31.

8. Mołocznik A: Exposure to dust on farms. **In: 25th International Congress on Occupational Health, Stockholm, Sweden, 15-20 September 1996. Book of Abstracts**, **1**, 265.

9. Mołocznik A: Higiena pracy w indywidualnym gospodarstwie rolnym - potrzeby i możliwości. *Higiena Pracy* 1997, **3**, 23-36.

10. Mołocznik A: Środowisko pracy rolnika indywidualnego - czynniki zagrażające jego zdrowiu i życiu. *Zastosowania Ergonomii* 1998, **1/2/3**, 115-123.

11. Mołocznik A: Problematyka zapylenia w rolniczym środowisku pracy. **In: Dutkiewicz J (Ed): Zagrożenia Biologiczne w Rolnictwie**, 24-32. Institute of Agricultural Medicine, Lublin 1998.

12. Mołocznik A: Exposure to dust on private farms in Poland. **In: International Conference Environmental, Occupational Health and Safety in Agriculture on the Boundry of two Millenia, Kiev, Ukraine, 8-11 September 1998. Abstracts**, 87.

13. Mołocznik A, Zagórski J: Zagrożenia w rolnictwie indywidualnym oraz działania na rzecz poprawy warunków pracy rolników indywidualnych. *Medycyna Ogólna* 1996, **2**, 160-166.

14. Mołocznik A, Zagórski J: Exposure to dust among agricultural workers. *Ann Agric Environ Med* 1998, **5**, 127-130.

15. Mołocznik A: Rozpoznanie czasu pracy rolnika w narażeniu na szkodliwe czynniki środowiska pracy na przykładzie wybranych gospodarstw rodzinnych. *Zastosowania Ergonomii* 1999, **34-35**, 77-87.

16. Mołocznik A: Zapylenie w rolniczym środowisku pracy jako otwarty problem higieniczny. **In: Solecki L (Ed): Zagrożenia Fizyczne w Rolnictwie**, 58-66. Institute of Agricultural Medicine, Lublin 1999.

17. Mołocznik A: Składniki pyłu rolniczego jako potencjalne czynniki patogenne. **In: Zagórski J (Ed): Choroby Zawodowe i Parazawodowe w Rolnictwie**, 61-67. Institute of Agricultural Medicine, Lublin 2000.

18. Mołocznik A: Wieloaspektowy charakter ekspozycji na pył w środowisku rolniczym. *Medycyna Ogólna* 2000, **4**, 347-357.

19. Mołocznik A: Hygienic aspect of dustiness on Polish private farms. **In: ERGON-AXIA 2000. Ergonomics and Safety for Global Business Quality and Productivity. Proceedings of the Second International Conference ERGON-AXIA 2000, Warsaw, Poland, 19-21 May 2000**, 147-150. CIOP, Warsaw 2000.

20. Mołocznik A: Studies of time of farmers' exposure to hazardous factors in the working environment on Polish family farms. **In: Proceedings of the IEA 2000/HFES 2000 Congress, San Diego, California, USA, 29 July-4 August 2000**, **3**, 662-665.

21. Mołocznik A, Zagórski J: Exposure of female farmers to dust on family farms. *Ann Agric Environ Med* 2000, **7**, 43-50.

22. Mołocznik A, Zagórski J: Exposure of farmers to dust on private farms of various production profiles. *Ann Agric Environ Med* 2001, **8**, 151-161.

23. Mołocznik A: Praca w indywidualnym gospodarstwie rolnym - otwarty problem ergonomiczny. **In: Solecki L (Ed): Aktualny stan ergonomii w rolnictwie - potrzeby na przyszłość**, 135-147. Institute of Agricultural Medicine, Lublin 2002.

24. Mołocznik A: Qualitative and quantitative analysis of agricultural dust in working environment. *Ann Agric Environ Med* 2002, **9**, 71-78.

25. Mołocznik A: Farmers' working time in conditions of exposure to hazardous factors of working environment. **In: Conference Proceedings. 8th International Conference on Human Aspects of Advanced Manufacturing: Agility & Hybrid Automation Rome, Italy, 26-30 May 2003**, 567-568.

26. Rozporządzenie Ministra Pracy i Polityki Socjalnej z dnia 29 listopada 2002 r. w sprawie najwyższych dopuszczalnych stężeń i natężeń czynników szkodliwych dla zdrowia w środowisku pracy. Dz.U. 2002, Nr 217, poz. 1833.

32. *Wypadki przy pracy i choroby zawodowe rolników oraz działania prewencyjne KRUS w 2002 roku*. Kasa Rolniczego Ubezpieczenia Społecznego, Warszawa 2003.