

## ADAPTATION OF EXISTING LIVESTOCK BUILDINGS TO ECOLOGICAL REQUIREMENTS OF SELECTED ORGANIC FARMS IN THE LUBLIN VOIVODESHIP

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### ABSTRACT

The article presents the results of direct research on livestock buildings and their modernization in selected ecological farms in the Lublin region. The following counties of the Lublin Voivodeship were selected as the research area: Radzyń and Łuków. A total of livestock buildings in 16 farms were examined. The research was conducted based on a site visit and discussions with the owners. An attempt was made to find a relationship between ecological livestock farming and a building substance (livestock buildings).

**Key words:** livestock building, organic farm, material and constructive solutions

### INTRODUCTION

The agricultural building construction encompasses three main sections. The first one encompasses buildings for animal production, i.e. livestock buildings, as well as for plant production, i.e. stores or silos. The second section encompasses buildings related to the agro-food industry, i.e. food processing plants, stores, refrigeration plants. The third section covers service and dwelling buildings (Pawłowski & Pawłowski, 1987). The livestock building construction covers mainly individual buildings based on building patterns from local architecture. Materials used for construction of livestock buildings are commonly applied and generally accessible, sometimes they are small prefabricates which do not require application of heavy equipment. The constructive solutions base on objects of general construction.

They refer to the solutions of roof constructions, roof coverings and external walls as well as carpentry (Lenard, 1983; Herbut & Nawalny, 2014). The livestock buildings for animal production should above all provide appropriate environmental conditions for animals and people working with them (Fornalczyk, Wiśniewski & Pawłat-Zawrzykraj, 2016). The ecological building construction strives to make the constructed buildings environmentally friendly, light and durable for ca. 25 years because they become obsolete after this period (Mikoś, 2002; Kibert, 2016). The livestock buildings as well as rooms separated within their space and devoted for a determined animal species are designed to ensure the best possible environmental conditions for development of expected usable features of the animals (Janowski, 1977; Łuszczynski et al., 2017). The animal breeding in organic farms serves

not only for the income growth but also conditions proper function of agro-ecosystems, i.e. farmstead as a whole (Siebeneicher, 1999). There is a close connection in the organic agriculture between the animal breeding and the soil – the natural animal manure excellently enriches the soil fertility and its lack is related to big environmental problems. The animals in eco-farmsteads should be healthy and productive because the good health status ensures the good quality of animal products. To keep the animals healthy, one should ensure appropriate nutritional conditions and well-being for them (Szymona, 2007; Sozańska, 2008). The organic breeding system satisfies basic needs of animals, above all in terms of: nutrition, water access, required life space, company of other animals, healthcare, hygiene of maintenance, microclimate of rooms, light conditions. At the same time, it protects animals from injuries and provides shelter against bad climate conditions. It also encompasses the animal transport conditions and humane ways of killing (Commission Regulation (EC) 889/2008).

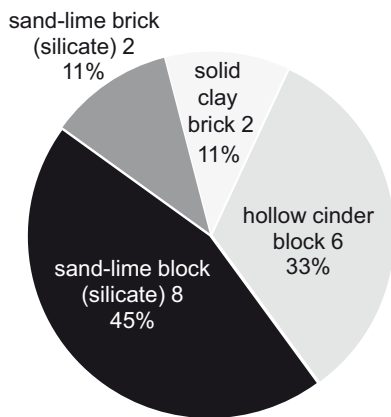
## MATERIAL AND METHODS

It seems clearly natural that these problems should be of significant meaning in places where the ecology is in the fore, i.e. in organic farms. The main objective of the work was to investigate whether a connection exists between the organic farming (certified organic farm) and the building substance existing there (livestock buildings), whether the material and constructive structure of the building is a result of conscious (ecological) action or perhaps of a previous years' practice. The research area was narrowed to two counties of the Lublin Voivodeship: Łuków and Radzyń. Two farms are placed in the Łuków County, fourteen – in the Radzyń County. Following elements of livestock objects were analyzed: foundations, walls, ceilings, rafter framings and roof coverings. Identification of the used materials was carried out in own observations, elements imperceptible to the human eye were consulted with the farms' owners. Through personal conversation with farmers, exact construction and history of buildings, possible reconstruction or expansion plans in future were examined.

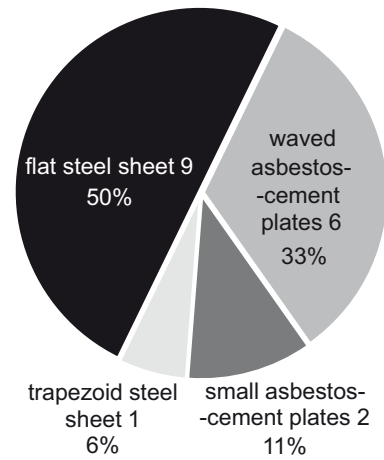
## RESULTS

The investigations were performed in the west part of the Lublin Voivodeship. The investigated organic farms are mostly large. Ten of them exceed the area of 30 ha. The livestock buildings in these farms were mostly erected at the end of 20<sup>th</sup> century (5 – 1970s, 7 – 1980s, 6 – 1990s). Any renovations were made at the end of 20<sup>th</sup> century and beginning of 21<sup>st</sup> century. Strip foundations were applied in all of the livestock buildings. They were made of materials commonly applied in that times – stone, gravel, cement and water; the foundations were usually reinforced. The external and internal walls were made of materials commonly used in rural building. The walls in the older buildings were erected with use of red brick whereas in the newer ones – sand-lime brick or hollow cinder blocks. The prevailing part – 47% – are the sand-lime blocks, so-called silicates (Fig. 1). The ceilings were made of ferroconcrete with use of steel elements. Sometimes the ceiling supporting posts, if applied, were made of steel profiles. The rafter framing was made of wood; usually the spruce or pine wood was applied. Wood is the most popular material used for roof constructions. Small weight, ease of processing and attractive price are the advantages significantly contributing to its wide application. The most often applied material for the roof coverings is steel sheet, then the asbestos-cement plates commonly used in 1970s and 1980s. The majority of the investigated buildings has the steel sheet covering. They were the newest buildings or those where the covering was changed (Fig. 2).

The remaining ones are awaiting the exchange of the asbestos-cement plates. The livestock buildings were renovated: the roof coverings were renewed (3 farms), door carpentry was exchanged into a steel framing (7) and wood framing (4), window carpentry was exchanged into the plastic framing (2). In the investigated farms, mostly, the animal and plant production is being carried out. Taking the species of the bred animals into consideration, pigs are prevailing (53% of farms), then – cows (21%), horses (16%) and sheep (10%). The majority of the livestock objects – over the half – are piggeries, then – cowsheds, stables and sheep sheds (Figs. 3–6).



**Fig. 1.** Types and share of the materials applied in the analyzed buildings; number of farms and percentage of the total number are presented (own preparation)



**Fig. 2.** Types and number of individual roof coverings; number of farms and percentage of the total number are presented (own preparation)



**Fig. 3.** Piggeries in the investigated farms (photo by K. Redzik)



**Fig. 4.** Sheep sheds in the investigated farms (photo by K. Redzik)



**Fig. 5.** Stables in the investigated farms (photo by K. Redzik)



**Fig. 6.** Cowsheds in the investigated farms (photo by K. Redzik)

## DISCUSSION

After the analysis of results for the investigated buildings in organic farms one can state that with regard to the environmental performance of the applied

building materials they have nothing in common with ecological building construction. It is evoked mainly by the fact that, yet under 20 years ago, the farms encompassed by the investigations were regular, conventional farms. The livestock buildings were erected with use of building materials which were common in that time. It corresponds to the publications dealing with the problem of environmental friendliness with regard to dwelling houses placed in organic farms (Dąbkowski & Pędzich, 2015; Dąbkowski, Olszewska & Chalecki, 2018; Dąbkowski, 2021). The problem of covering roofs with asbestos-cement plates occurred in some of the investigated buildings. When the conventional farms were being converted into the organic ones, at first the requirements posed for the plant and animal agricultural production were covered. Possibilities of transformation and adaptation of the existing buildings with use of ecological materials are being taken only currently into consideration. Funds have also a significant impact on the investment planning.

## SUMMARY

Ecological buildings are made of raw materials which are harmless for the environment and for dwellers and do not affect unfavorably the environment during their manufacturing. These materials should be characterized by good thermal insulating properties, humidity exchange between baffles, heat accumulation capacity as well as optimum volumetric density and durability. Livestock buildings in the organic farms should ensure good environmental conditions, appropriate to species of bred animals and production objectives, and also ensure the organization of labor to the highest possible technical level for the applied technologies.

From the point of view of pro-ecological actions, it must be strived that any renovations or modernizations of buildings (not only livestock ones) placed within farms producing food with use of ecological methods are carried out with use of the materials which are nowadays considered as ecological and energy-saving.

## Authors' contributions

Authors contributed to this work as follows: N.D. developed the concept and designed the study, K.R. collected the data, N.D. analyzed and interpreted the

data, N.D. prepared draft of article, N.D. revised the article critically for important intellectual content.

All authors have given approval to the final version of the article.

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## **DOSTOSOWANIE ISTNIEJĄCYCH BUDYNKÓW INWENTARSKICH DO WYMAGAŃ EKOLOGICZNYCH W WYBRANYCH GOSPODARSTWACH EKOLOGICZNYCH WOJEWÓDZTWA LUBELSKIEGO**

### **STRESZCZENIE**

W artykule omówiono badania bezpośrednie budynków inwentarskich i ich modernizacji w wybranych gospodarstwach ekologicznych Lubelszczyzny. Jako obszar badań wybrano powiaty radzyński i łukowski. Łącznie zbadano budynki inwentarskie w 16 gospodarstwach. Badania zrealizowano poprzez wizyty terenowe oraz wywiady bezpośrednie z właścicielami. Podjęto próbę znalezienia związku między ekologiczną hodowlą zwierząt a tkanką budowlaną (budynki inwentarskie).

**Słowa kluczowe:** budynek inwentarski, gospodarstwo ekologiczne, rozwiązania materiałowo-konstrukcyjne