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„SILENT HUNGER" IN THE CONTEXT OF SOME CHEMICAL PRODUCTS OF INDUSTRY

Currently more and more people are suffering from lifestyle diseases and various nutritional intolerances. Living in a constant haste and stress often causes them to pay little attention to rational nutrition, which results in shortages of necessary nutrients. Plants and, more specifically, cereals are the main source of food in the world. The purpose of this paper is to demonstrate that mineral fertilisers and food additives are necessary and have a positive impact on the quality of selected crops used as the basic raw material in the production of consumer goods. Chemical industry products such as mineral fertilisers and food additives, when used in the appropriate doses, in the correct situations and in the right time, constitute a prerequisite for correct agricultural production as they shape the appropriate standard of cereal raw materials, despite rather sparse and constantly exploited agricultural sites. Using the term *"silent hunger".* Ziegler[3] prefers to call it *"invisible hunger"*, as it is not easy to detect at first sight by a lay person and a medical professional alike. The effects of qualitative malnutrition are not easily noticeable. People affected by it may have a normal body weight and still suffer from the effects of qualitative malnutrition, which can lead to serious health issues.
Keywords: qualitative hunger, mineral fertilizers, food additives, quality indicators of cereals, agricultural development.

1. THE ISSUE OF QUALITATIVE HUNGER

Every human being's right to food is specified in Article 11 of the International Covenant on Economic, Social and Cultural Rights[4]. The right to food is undoubtedly one of the most frequently and commonly violated human rights. Hunger may be even classified as the result of organised crime. According to the FAO[5] estimates, the number of people suffering from chronic and severe malnutrition in 2010 reached 925 million (for comparison, in 2009 it was 1023 million). Almost one billion people (of the world population of seven billion) suffers from chronic hunger[6].

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[3] J. Ziegler, *Geopolityka głodu*, Inst. Wyd. Książka i Prasa, Warszawa 2013.
[4] ONZ, *Międzynarodowy Pakt Praw Gospodarczych*, 1966.
[5] FAO, *Report on Food insecurity in the world*, Rzym 2011.
[6] J. Ziegler, *Geopolityka*…, op. cit.

Food of either plant or animal origin (sometimes also mineral) is consumed in order to provide the body with energy and nutrients. The basic unit of energy understood in this sense is kilocalorie. Such a measurement system makes it possible to estimate the amount of energy needed by the human body to regenerate itself. An insufficient amount of energy and a low intake of calories lead to hunger and subsequently to death. The daily number of calories required by a person depends on age, sex, body weight, type of work performed and climate[7]. The World Health Organisation (WHO) has established that an adult person requires a minimum of 2200 calories per day to survive. Calorie intake below this threshold does not allow the human body to sufficiently regenerate itself. Malnutrition often leads to the development of so called hunger diseases. Furthermore, hunger dangerously compromises the immune system of the people afflicted by it[8].

The areas affected by hunger are unevenly distributed across the globe[9]. Nearly three-quarters of starving people live in Asia, the Pacific Region and Africa. In comparison to the 1969-1971 period, the estimated percentage of the malnourished people in the world went down to 13% in the years 2005-2007, due to abundant crops[10]. Regardless of the fact that the majority of the starving people live in the developing countries, the industrialised countries are not entirely free of this problem. In May of 2012, UNICEF published a report on child malnutrition in Spain – 2.2 million Spanish children under ten are chronically malnourished. The political situation and crisis in the Eastern European and former Soviet Union countries is not very good either. As early as February 2011, FAO announced that 80 countries are threatened by food shortage. According to the statistics, one in seven inhabitants of our planet is affected by hunger[11].

Aside from people suffering from the devastating effects of malnutrition and hunger, there is also a third category – people suffering from qualitative malnutrition. The FAO is also concerned with those people; however, they are treated as belonging to a separate group from the former two. The term quantitative malnutrition refers to an insufficient intake of calories, while qualitative malnutrition means micronutrients, vitamin and mineral salts deficiency. Due to acute and severe qualitative malnutrition millions of children under the age of ten die every year[12].

The effects of qualitative malnutrition are not easily noticeable. People affected by it may have a normal body weight and still suffer from the effects of qualitative malnutrition. Vitamin and mineral salts deficiency can lead to serious health issues, such as significantly greater susceptibility to infectious diseases, loss of vision, anaemia, coma, reduced knowledge acquisition skills, intellectual development disorder, various forms of physical deformities, and finally death. The most common deficiencies involve the following three elements: vitamin A, iron and iodine[13].

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[7] F. Delpeuch, B. Maire, [w:] *Alimentation, environment et sante. Pour un droit al.`alimentation*, pod red. A. Blue i F. Piet, Editions Ellipses, Paryż.

[8] J. Ziegler, *Geopolityka*…, op. cit.

[9] FAO, *Rapport sur L!insecurite alimentaire dans le monde*, Rzym 2010.

[10] FAO, *Rapport*…, op. cit.; J. Ziegler, *Geopolityka*…, op. cit.

[11] Departament Rolnictwa USA, 2010, *Raport Wydziału Analiz Gospodarczych*; J. Ziegler, *Geopolityka*…, op. cit.

[12] Biesalski H.K., *Micronutriments, wound healing and prevention of pressure ulcers*, Nutrition 2010.

[13] Biesalski H.K., *Micronutriments*…, op. cit.; Kristof N.D., *Badanie New York Times*, 24 listopada 2010; J. Ziegler, *Geopolityka*…, op. cit.

The ONZ[3] describes qualitative malnutrition using the term *"silent hunger".* Ziegler[14] prefers to call it *"invisible hunger"*, as it is not easy to detect at first sight by a lay person and a medical professional alike. This condition can even lead to death, the same way as calorie deficiency. However, demises caused by it are not taken into account for the FAO statistics purposes, as the statistics mainly concern calorie intake. Since 2004 the United Nations Children's Fund (UNICEF) and the Micronutrient Initiative, a non-profit organisation dealing with the problem of micronutrients deficiency – have been conducting regular research studies, whose results are published in the reports entitled *"Vitamin and mineral deficiencies. The global situation"*[15].

Anaemia caused by iron deficiency is one of the most common negative effects of qualitative malnutrition. The disease's symptoms include a reduction in blood haemoglobin level, and a weakening of the immune system. This condition is especially dangerous for children under five, as iron deficiency in children leads to irreversible damage in the form of intellectual disorders. Every four minutes a person loses his/her eyesight in the world, and in most cases, the loss is connected with malnutrition. Vitamin A deficiency affects 40 million children in the world, and 13 million of them lose their eyesight. A long-term vitamin B deficiency, on the other hand, causes beriberi – a disease that devastates the human nervous system. Vitamin C deficiency causes scurvy, and, in the case of small children – rickets. Folic acid, for instance, is necessary during pregnancy. According to the World Health Organisation (WHO) estimates, every year 200,000 intellectually challenged children are born, which is due to the lack of this nutrient in the diet of their mothers during pregnancy. Iodine is an essential element needed for the proper functioning of the body. Nonetheless, a billion people suffer from its deficiency. It cannot be naturally acquired in the mountainous regions and inundation areas, in which soil is subject to water erosion, and in the southern hemisphere. If left unsupplemented, iodine deficiency leads to thyroid disease (goiter), stunted growth, and mental retardation (cretinism). Iodine deficiency in pregnant women, and by association the foetus, can also have serious and far-reaching consequences. According to The Economist [2011], zinc deficiency causes about 400,000 deaths a year. Its deficiency in small children causes severe diarrhoea, often resulting in death. Zinc deficiency also impairs the motor skills and mental abilities.

It is important to know that half the people suffering from micronutrient deficiency are usually afflicted by cumulative deficiencies of elements, i.e. they are simultaneously lacking several vitamins and minerals in their diet. Qualitative malnutrition is a direct or indirect cause of half of deaths among children under five in the world. The great majority of its victims live in South Asia and Sub-Saharan Africa. In a document of 2008, published by an organisation called *Action contre la Faim*, the following information can be found: *"The issue of qualitative malnutrition in children is not hard to solve".* It only needs to be made a priority. Unfortunately many countries of the world are lacking in goodwill[16]. It is also important to bear in mind that qualitative malnutrition devastates not only the body but also the human psyche. Macro and micronutrient deficiency cause various diseases, which in turn lead to fear, humiliation, nervous breakdown and apprehension about the future. A family without secure access to adequate supplies of good food is a broken fam-

[14] J. Ziegler, *Geopolityka*…, op. cit.

[15] Haen H., *Das Menschenrecht auf Nahrung*, Konferencja z dnia 28 stycznia 2011, Einbeck Northeim 2011; J. Ziegler, *Geopolityka*…, op. cit.

[16] *Action contre la Faim*, En finir avec la malnutrition, une question de priorite, Paryż 2008.

ily. As noted by Ziegler[17], this fact is sadly illustrated by the situation in India, where thousands of farmers have committed suicide in recent years.

In the light of this chapter devoted to the issue of qualitative hunger, the need for new food sources rich in macro- and micronutrients and vitamins becomes more understandable.

2. SOME ASPECTS OF AGRICULTURE

Agriculture is an area of the economy that greatly utilises mineral and organic fertilisers. The quality and quantity of cereal yields is determined by many factors, including especially fertilisation. Mineral fertilisers, also referred to as artificial fertilisers, are substances extracted from the ground and subsequently processed, or manufactured chemically. Their aim is to enrich the soil with minerals necessary for plants to develop and improve the soil structure and alter its acidity.

The main physicochemical soil properties that influence the quality and quantity of cereal yields are the granulometric compositions and its variability in the soil profile, the hydrographic conditions, the pH value and the soil bacteria level (fertility). Over the last 20 years, the area allocated for crop cultivated for grain, including wheat, triticale and maize has increased; however, the area allocated to the cultivation of rye, barley, oat, buckwheat and millet, and also of leguminous plants for grain, potatoes, economic plants, fodder plants and vegetables, has decreased considerably[18].

For many years cereals have played a vital role in the food economy of every country. Their seeds are characterised by their chemical composition and nutritional value valuable to both humans and animals. They have a positive ratio of carbohydrate and fat content to protein, along with a high starch content, a low fat content, and a high content of fibre and many minerals, vitamins and other biologically active compounds. Correct human nutrition consists of providing the body with all the nutrients necessary for its normal development. Crops resulting from vegetable production, following the meeting of specific qualitative criteria, can be used in the production of specific products. The modern manufacture of raw materials must meet a range of criteria. As indicated by numerous studies, the quality of raw materials is determined by the whole process of vegetation in the field. The appropriate quality depends on the growth conditions available in the production field, including the use of mineral fertilisers.

3. SELECTED PRODUCTS OF CHEMICAL INDUSTRY

3.1. Mineral fertilizers and selected crop-quality indicators

Fertilisation is a factor that has a particularly strong impact on the yield and quality of grain crops. It stands for the supply of minerals to vegetables which feed on them, to the

[17] J. Ziegler, *Geopolityka*…, op. cit.

[18] Rozbicki J., *Kształtowanie wielkości i jakości plonu zbóż*, [w:] Rozbicki J. (ed.), *Produkcja i rynek zbóż*, Wydawnictwo Wieś Jutra, Warszawa 2002, 141-159; Podolska G., Krasowicz S., Sułek A., *Ocena ekonomiczna i jakościowa uprawy pszenicy ozimej przy różnym poziomie nawożenia azotem*. Pam. Puł., 2005, 139, 175-188; Stanko S., *Interwencja na rynku zbóż*, Wieś Jutra, 2005, 4, 4-6; Roczniki Statystyczne GUS 2010; Badora A., Kołodyńska D., Hubicki Z., Kozłowska-Strawska J., *New chemical substances in natural environment and mobility of some metals*. Przem. Chem., 2013, 92, 6, 72-79.

soil or as leaf sprays in the form of chemical agents (mineral fertilisers) or organic substances (natural and organic fertilisers). Fertilisation aims not only to achieve optimal cereal yields, but also to improve the specific qualitative characteristics of seeds. In Poland, mineral fertilisers (nitrogen, phosphorus, potassium, magnesium, calcium, mixed and micro fertilisers) are used, along with natural and organic fertilisers (manure, fermented and unfermented liquid manure, straw, compost, green manure and crop residue). Nevertheless, mineral fertilisation, especially with nitrogen, is of the greatest importance when it comes to crop yielding[19].

It is claimed that for the proper vegetable growth and yielding, and the preservation of the "vegetable-soil" balance, smaller doses of mineral fertilisers should be used in better growing conditions (beneficial nutrient content in the soil, warm weather with moderate precipitation), with bigger doses otherwise. Both nitrogen excess and deficiency have an unfavourable impact on yields and their quality. Nitrogen deficiency causes the yellowing and drying of the oldest leaves, a decrease in stomatal conductance, and the retarded growth and development of vegetables[20].

The utilisation of high doses of nitrogen facilitates rich cereal yields, but it does not always have a positive impact on their quality. Excessive nitrogen content in the soil is conducive to delayed sprouting and early entry into the developmental phases of cereals, and leads to a higher number of flowers per plant at the expense of seed/grain filling, particularly in buckwheat. By increasing nitrogen fertiliser doses (up to 30 kg N ha^{-1}), we can observe a higher yield of buckwheat hulled grain and an increase in protein content, especially in defatted buckwheat hulled grain and pericarps. Higher nitrogen doses (60 kg N ha^{-1}) are conducive to a decrease in both the crop yield of this plant and the content of valuable flavonoids (rutin, isoorientin, orientin, isoquestin) in pericarps. Buckwheat grain yields in the dose of 30 kg N ha^{-1} are considerably lower and this plant yields better when exposed to higher nitrogen doses (60 and 90 kg N ha^{-1}) and lower nitrogen-phosphorus fertilisation, which is proved by the highest vegetative mass and full hulled grain mass. Higher nitrogen fertilisation causes an increase in MTN, raw protein content in grain and crop yield per hectare[21].

High nitrogen doses, in the case of malting barley (up to 60 kg N ha^{-1}), result in an increase in yields and protein content in seeds, soluble proteins, free amino nitrogen, the

[19] Badora A., *Chemistry of organic compounds in soil and their significance for the environment*, Przem. Chem., 2011, 90, 19-36; Stanko S., *Interwencja na rynku zbóż.* Wieś Jutra, 2005, 4, 4-6; Stanko S., *Interwencja*…, op. cit., 4-6; Dietrych-Szóstak D., Podolska G., *Wpływ nawożenia azotem na plon oraz zawartość białka i flawonoidów w orzeszkach gryki*, Fragm. Agronom., maj 1, 2008, 101-109; Pecio A., Kubsik K., *Zróżnicowanie plonu i zawartości białka jęczmienia jarego w obrębie pola produkcyjnego*, Pam. Puławski, 2006, z. 142, pp. 348-362.

[20] Badora A., *Bioaccumulation of Al, Mn, Zn and Cd in Pea Plants (Pisum sativum L.) Against a Background of Unconventional Binding Agents*. Polish Journal of Environmental Studies, 2002, vol. 11, no. 2, 109-116; Badora A., *Chemistry of organic compounds in soil and their signifycance for the environment*, 2011, Przem. Chem., 90, 19-36.

[21] Klockiewicz-Kamińska E., *Metoda oceny wartości browarnej i klasyfikcja jakościowa odmian jęczmienia*, Wydawn. COBORU, 2000, z. 80, 1-9; Noworolnik K., *Plonowanie wybranych zbóż jarych w zależności od pH gleby*, Bibiotheca Fragm. Agronom., 2006, t. 10, 59-67; Golia E.E., Dimirkou A.I., Mitsios K., *Influence of some soil paraters on heavy metals accumulation by vegetables grown in agricultural soils of dif ferent soil orders*, Bull Environ Contam Toxicol, 2000, 81, 80-84.

activity of b- and a-amylase and diastatic power, at the expense of lower grain plumpness and malt extractivity, which, in consequence, leads to worse grain quality for brewing purposes. In some research into spring barley, it was observed that the most beneficial yields of good fodder and consumption quality can be obtained when nitrogen fertilisation in the amount up to 60 kg N ha^{-1} is carried out in the period from full tillering to the beginning of earing. Higher amounts of this constituent (up to 120 kg N ha^{-1}) do not influence crop growth, but cause changes to the amino-acid makeup of protein (a lower content of exogenous amino acids, especially lysine, methionine and isoleucine), which leads to a reduced use value of the plant's seeds[22].

For malting barley, nitrogen doses of 40 kg N ha^{-1} should only be used before sowing, which will ensure the optimal nutrition of the plant with nitrogen, as assessed according to the brewing standard of protein content in grain (10.5-11.5%). Nitrogen fertilisation coupled with overhead irrigation has a positive impact on the yield and quality of both malting and forage barley. The seeds of overhead-irrigated and abundantly fertilised malting barley meet the requirements of suitability for brewing purposes, and the seeds of forage barley originating from overhead-irrigated fields, fertilised with high doses of NPK, exhibit good qualitative parameters. Thanks to complementary overhead irrigation, coupled with high doses of mineral fertiliser, it is possible to obtain high barley yield and increase soil productivity[23].

Fertilising with other macroelements (P, K, Mg, Ca) is of lesser significance to crop quality than nitrogen fertilisation. However, the presence of these elements, and especially Mg in small quantities, is crucial for the correct growth, development and yield of plants, buckwheat in particular. The influence of potassium and phosphorus fertilisation on buckwheat yielding is insignificant, and excessive doses can even cause a decrease in yield. The elements in question must be supplied to the plant in small quantities, since potassium and phosphorus increase the content of monosaccharides in flower nectar, which causes increased foraging by pollinators, and can indirectly contribute to better seed setting. Organic and natural fertilisers have a lower impact on the quantity and quality of cereal yields than mineral fertilisers, as crops for consumer purposes are sown in the second year after the use of manure or other organic fertiliser in the field. This facilitates good supply of nutrients and prevents the emergence of many crop diseases[24].

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[22] Przybulewska K., Stolarska A., *Wpływ stężenia metali (Hg, Pb, Cu) w glebie na wzrost i rozwój siewek jęczmienia*, J. Elementom., 2004, no. 9 (3), pp. 469-475; Kot A., Zaręba S., *Produkty zbożowe źródłem żelaza i manganu*, Roczn. PZH, 2005, 56, nr 1, 91-96; Tyburcy A., *Znaczenie zbóż w żywieniu człowieka*, Przegląd Zbożowo Młynarski, 2007, s. 9-10.

[23] Norvell A.W., *Inorganic Reaction of Manganese in Soils*, [in:] Graham R.D., Hannam R.J., Uren E.C. (eds.), Manganese in Soils and Plants, Kluver Academic Publishers, Dordrecht, 1988, 37-58; Comin J.J., Barloy J., Bourrie G., Trolard F., *Differential effects of monomeric and polymeric aluminium on root growth and on the biomass production of root and shoot of corn in solution culture*, Europ. J. Agronomy, 1999, 11, 115-122; Toma M., Hiradate S., Saigusa M., *Chemical species of Al in a gypsum treated Kitakami Andosol*, Soil Sci. Plant Nutr., 1999, 45, 279-285; Coultate T.P., *Food. The chemistry of the Components*, RSC Publis Ing, UK, 2002, pp. 432; Sobiech E., Smoczyńska K., Markiewicz K., *Badanie zawartości ni zbędnych składników mineralnych i metali szkodliwych w ziarnie, mące i otrębach pszenicy różnych odmian*, Bromat. Chem. Toksykol. 2003, 36, 23-28.

[24] McBride B.M., *Environmental chemistry of soil*, New York-Oxford, Oxford University Press, 1994, 490, s. 406; Badora A., *Bioaccumulation of Al, Mn, Zn and Cd in Pea Plants (Pisum*

The content of macro- and microelements in the soil influences the qualitative parameters of wheat grain. As regards macroelements, the most important is the appropriate supply of nitrogen. This facilitates an increased content of protein, gluten, sedimentation index and rheological properties of dough. Phosphorus and potassium, as well as microelements (copper, manganese and zinc) contribute to obtaining grains with beneficial qualitative properties. Microelements content in the soil and their availability for plants depend on an array of factors. In some regions of the country we can observe microelements appearing in excess, which has a negative impact on the development and yield of plants. Too high copper content in wheat grain decreases the baking value of flour, while a deficiency of this element leads to a hampered growth and development of the main shoot and inhibited development of the generative organs, which, in consequence, substantially decreases the yield. Manganese deficit impairs the metabolic functions of plants and decreases the sowing value of seeds. Supplementing winter and spring wheat with microelements has a positive impact on the qualitative properties of the grains such as gluten content and sedimentation index[25].

Barley and buckwheat yield quality indicators sometimes depend more on the content of available forms of P, K, Ca and N, and especially Mg, than on other properties of the soil. Higher cereal and protein yields of spring barley and buckwheat are observed in soils with Mg content exceeding 60 mg kg^{-1} of soil, P content exceeding 48 mg kg^{-1} of soil and K content exceeding 130 mg kg^{-1} of soil. A positive impact of an increased content of these elements on the specific yield structure elements and on over ground parts of crops was also recorded. On the other hand, an increased protein content was observed in grains originating from soils with lower content of minerals (Mg below 2 mg $100g^{-1}$ of soil). The impact of Mg on buckwheat and barley yielding was greater under Mg deficiency conditions in plants and was conditioned by the specific requirements of every crop. Barley yields harvested from soils richer in nutrients are usually characterised by better brewing

sativum L.) Against a Background of Unconventional Binding Agents, Polish Journal of Environmental Studies, 2002, vol. 11, no. 2, 109-116; Dietrych-Szóstak D., Podolska G., *Wpływ nawożenia azotem naplon oraz zawartość białka i flawonoidów w orzeszkach gryki*. Fragm. Agronom., maj 1, 2008, 101-109; Pecio A., Kubsik K., *Zróżnicowanie plonu…*, op. cit.; Hasim M.A., Mukhopahyyay S., Sahu J.N., Sengupta B., *Remediationtechnologies for heavy metal contaminated ground water*, J. Environ. Managem., 2011, 92, 2355-2388.

[25] Laurie H.S., Tancock P.N., McGrath P.S., Sandres R.J., *Influence of EDTA Complexation on Plant Uptake of Manganese(II)*. Plant Sci., 1995, 109, 231-235; Bashan Y., *Inoculants of plant growth-promoting bacteria for use in agriculture*, Biotechnol. Adv., 1998, 16, 729-770; Naidu R., Harter D.R., *Effect of different organic ligands on cadmium sorption by and extractability from soils*, Soil Sci. Soc. Am. J., 1998, 62, 644-650; Shuman M.L., *Effect of organic waste amendments on zinc adsorption by two soils*, Soil Sci., 1999, 164, 197-205; Evangelou P.V., Marsi M., Vandiviere M.M., *Stability of Ca^{2+}-, Cd^{2+}, Cu^{2+} [ilite humic] complexes and pH influence*, Plant Soil, 1999, 213, 63-74; Almas R.A., McBride B.M., Singh R.B., *Solubility and liability of cadmium and zinc in twos treated with organic matter*, Soil Science, 2000, 165, 205-259; Sumathi K.M.S., Mahimairaja S., Naidu R., *Use of low – cost biological wastes and vermiculite from removal of chromium from tannery effluent*, Bioresource Technol., 2005, 96, 309-316; Chen A.H., Liu S.Ch., Chen Ch.Y., Chen Ch.Y., *Comparative adsortion of Cu(II), Zn(II), and Pb(II) ion in aqueous solution on the crosslinked chitosan with epichlorohydrin*, J. Hazard. Mater., 2008, 154, 184-191; Kawka A., *Przetwory zbożowe – aspekty wzbogacania wartości odżywczej*. Przegląd Zbożowo-Młynarski, 2009, nr 10, s. 2-7.

quality indicators, whereas yields harvested from poorer soils (with fewer cultures) can be suitable for fodder or consumer purposes[26].

3.2. Additives as permitted products of the chemical industry

From the technological and health-related perspective, food additives are important factors[27]. These additives include:

- substances that prevent spoilage (preservatives, acids, acidity regulators, antioxidants, chelating agents, stabilisers and gases),
- substances that shape the sensory properties of the product (food colouring, sweetening agents and flavour enhancers),
- substances that give products their texture (emulsifiers, anti-caking agents, modified starches, raising agents, stabilisers, thickeners, mass-increasing agents, humectants and gelling agents),
- processing aids (enzymes, pressurised gases, flour treatment agents, foaming agents, antifoam agents, solvents and glazing agents).

The main purpose of adding these substances during the production process and during the processing of vegetable raw materials and their products is, among other things, to streamline the course of these processes, increase product durability, and provide the product with desirable sensory, organoleptic and functional properties[28]. Additives can be used in food production only when:

- they do not pose a threat to the health of consumers at the proposed use level, based on available scientific evidence,
- there is a justified technological requirement which cannot be met in any other way that would be acceptable from the economic and technological point of view,
- the use of a given substance does not mislead consumers as regards the health-related value of foodstuffs.

Additives cannot be used to conceal defects in foodstuffs resulting, for instance, from poor quality, incorrect production processes and unhygienic production conditions, or to make the product similar to other (better or more nutritious) products. The conditions and

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[26] Sobiech E., Smoczyńska K., Markiewicz K., *Badanie zawartości ni zbędnych składników mineralnych i metali szkodliwych w ziarnie, mące i otrębach pszenicy różnych odmian*. Bromat. Chem. Toksykol. 2003, 36, 23-28; Przybulewska K., Stolarska A., *Wpływ stężenia metali (Hg, Pb, Cu) w glebie na wzrost i rozwój siewek jęczmienia*. J. Elementom., 2004, no. 9(3), pp. 469-475; Babuchowski A., *Żywność i zdrowie*. Bezp. Hig. Żyw. 2005, no. 10, pp. 20-22; Kot A., Zaręba S., *Produkty zbożowe źródłem żelaza i manganu*. Roczn. PZH, 2005, 56, no. 1, pp. 91-96; Dietrych-Szóstak D., Podolska G., *Wpływ nawożenia azotem…*, op. cit.; Pecio A., Kubsik K., *Zróżnicowanie plonu…*, op. cit.; Badora A., Kołodyńska D., Hubicki Z., Kozłowska-Strawska J., *New chemical substances…*, op. cit.; Badora A., Kozłowska-Strawska J., Domańska J., Filipek T., *Cereals – healthor Disease*. Problems of Sustainable Development, 2014, vol. 9, no. 2, pp. 87-98.

[27] Traczyk T., *Potencjalne działanie alergizujące wybranych substancji dodatkowych występujących w żywności i pożywieniu*, Żywienie Człowieka i Metabolizm, 2002, v. XXIX, no. 3, pp. 196-201; Kawka A., *Przetwory zbożowe…*, op. cit.;

[28] Rozporządzenia Komisji (WE) nr 466/2001; Rozporządzenia Komisji (WE) nr 856/2005; Rozporządzenia Komisji (EG) nr 1881/2006; Rozporządzenia Komisji nr 1126/2007; *Rozporządzenie Ministra Zdrowia z dnia 18 września 2008 r. w sprawie dozwolonych substancji dodatkowych* (Dz. U. z dnia 3 października 2008 r., Nr 177, poz. 1094).

doses of additives in the food industry are specified by legal regulations, and in particular by the Directives on:

- sweeteners [Dyrektywa 94/35/WE].
- colours [Dyrektywa 94/36/WE],
- food additives other than colours and sweeteners[29].

The aforementioned Directives specify the conditions regarding the use of additives and foodstuffs in which they can be used. In Poland the currently binding document is the Regulation of the Minister of Health of 18 September 2008 on permitted additives[42)], which is based on EU regulations[30]. The list of permitted food additives has increased in Poland from 154 to 284.

4. SUMMARY

A compromise between civilisation and ecology unites technological advancement and attempts at making our lives easier with health safety and care for the natural environment. Food of either plant or animal origin (sometimes also mineral) is consumed in order to provide the body with energy and nutrients. The basic unit of energy understood in this sense is kilocalorie. Such a measurement system makes it possible to estimate the amount of energy needed by the human body to regenerate itself. An insufficient amount of energy and a low intake of calories lead to hunger and subsequently to death.

It is important to know that half the people suffering from micronutrient deficiency are usually afflicted by cumulative deficiencies of elements, i.e. they are simultaneously lacking several vitamins and minerals in their diet. Qualitative malnutrition is a direct or indirect cause of half of deaths among children under five in the world. The search for new sources of plant protein enriching the diet is extremely important in the light of increasing animal protein deficits and the increasing number of consumers preferring vegetarian food. Plant proteins are important due to their diversity and accessibility of resources needed to obtain them.

On the other hand people living in the modern and busy world want to satisfy their nutritional requirements by spending as little time and money as possible. This is facilitated by modern agricultural science and processing, making food more available and durable, as well as easier to prepare and consume. However, producing such foodstuffs would not be possible without a wide selection of chemical substances, including plant protection products, mineral fertilisers and food additives, used in the food industry (preservatives, antioxidants, stabilisers and flavourings). On the other hand, the "march of chemistry" through fields and tables causes risks to both humans and the environment.

Therefore, rational nutrition means reaching a compromise between consumer convenience and health security, as well as food production intensification and natural environment protection. As highlighted by "longevity researchers" our eating habits are of crucial importance to our health and changes taking place in the human body. Poland's presence in EU structures imposes an obligation on food producers to ensure that human health and consumers' interests are protected through the implementation of food safety strategies.

[29] Dyrektywa 95/2/WE.

[30] Rozporządzenia Komisji (WE) nr 466/2001; Rozporządzenia Komisji (WE) nr 856/2005; Rozporządzenia Komisji (EG) nr 1881/2006; Rozporządzenia Komisji nr 1126/2007.

Chemical industry products, when used in appropriate doses, in the correct situations and in the right time, constitute a prerequisite for the correct agricultural production as they shape the quality of cereal raw materials. They make it possible for producers to maintain appropriate standards and determine the health of society, in particular when production sites are not naturally rich in important nutrients necessary for the growth and development of cereal raw materials.

REFERENCES

[1] *Action contre la Faim.* En finir avec la malnutrition, une question de priorite, Paryż 2008.

[2] Almas R.A., McBride B.M., Singh R.B., *Solubility and liability of cadmium and zinc in twos treated with organic matter*, Soil Science, 2000, 165, 205-259.

[3] Babuchowski A., *Żywność i zdrowie*. Bezp. Hig. Żyw. 2005, nr 10, 20-22.

[4] Badora A., *Bioaccumulation of Al, Mn, Zn and Cd in Pea Plants (Pisum sativum L.) Against a Background of Unconventional Binding Agents*. Polish Journal of Environmental Studies, 2002, vol. 11, no. 2, 109-116.

[5] Badora A., *Chemistry of organic compounds in soil and their significance for the environment*, Przem. Chem., 2011, 90, 19-36.

[6] Badora A., Kołodyńska D., Hubicki Z., Kozłowska-Strawska J., *New chemical substances in natural environment and mobility of some metals*. Przem. Chem., 2013, 92, 6, 72-79.

[7] Badora A., Kozłowska-Strawska J., Domańska J., Filipek T., *Cereals – healthor Disease*. Problems of Sustainable Development, 2014, vol. 9, no. 2, 87-98.

[8] Bashan Y., *Inoculants of plant growth-promoting bacteria for use in agriculture*, Biotechnol. Adv., 1998, 16, 729-770.

[9] Biesalski H.K., *Micronutriments, wound healing and prevention of pressure ulcers*, Nutrition, 2010.

[10] Comin J.J., Barloy J., Bourrie G., Trolard F., *Differential effects of monomeric and polymeric aluminium on root growth and on the biomass production of root and shoot of corn in solution culture*, Europ. J. Agronomy, 1999, 11, 115-122.

[11] Coultate T.P., *Food. The chemistry of the Components*, RSC Publis ing, UK, 2002, pp. 432.

[12] Chen A.H., Liu S.Ch., Chen Ch.Y., Chen Ch.Y., *Comaprative adsor-tion of Cu(II), Zn(II), and Pb(II) ion in aqueous solution on the crosslinked chitosan with epichlorohydrin*, J. Hazard. Mater., 2008, 154, 184-191.

[13] Dietrych-Szóstak D., Podolska G., *Wpływ nawożenia azotem na plon oraz zawartość białka i flawonoidów w orzeszkach gryki*. Fragm. Agronom., maj 1, 2008, 101-109.

[14] Delpeuch F., Maire B. [w:] *Alimentation, environment et sante. Pour un droit al.`alimentation*, pod red. A. Blue, F. Piet, Editions Ellipses, Paryż.

[15] Departament Rolnictwa USA, 2010, *Raport Wydziału Analiz Gospodarczych*.

[16] Dyrektywa 94/35/WE.

[17] Dyrektywa 94/36/WE.

[18] Dyrektywa 95/2/WE.

[19] Evangelou P.V., Marsi M., Vandiviere M.M., *Stability of Ca^{2+}-, Cd^{2+}, Cu^{2+} [ilite humic] complexes and pH influence*, Plant Soil, 1999, 213, 63-74.

[20] FAO, *Rapport sur L!insecurite alimentaire dans le monde*, Rzym 2010.

[21] FAO, *Report on Food insecurity in the world*, Rzym 2011.

[22] Golia E.E., Dimirkou A.I., Mitsios K., *Influence of some soil paraters on heavy metals accumulation by vegetables grown in agricultural soils of dif ferent soil orders*. Bull Environ Contam Toxicol, 2008, 81, 80-84.

[23] Haen H., *Das Menschenrecht auf Nahrung*, Konferencja z dnia 28 stycznia 2011, Einbeck Northeim, 2011.

[24] Hasim M.A., Mukhopahyyay S., Sahu J.N., Sengupta B., *Remediationtechnologies for heavy metal contaminated ground water*, J. Environ. Managem., 2011, 92, 2355--2388.

[25] Klockiewicz-Kamińska E., *Metoda oceny wartości browarnej i klasyfikacja jakościowa odmian jęczmienia*, Wydawn. COBORU, 2000, z. 80, 1-9.

[26] Kawka A., *Przetwory zbożowe – aspekty wzbogacania wartości odżywczej*. Przegląd Zbożowo-Młynarski, 2009, nr 10, s. 2-7.

[27] Kot A., Zaręba S., *Produkty zbożowe źródłem żelaza i manganu*, Roczn. PZH, 2005, 56, nr 1, 91-96.

[28] Kristof N.D., *Badanie New York Times*, 24 listopada 2010.

[29] Laurie H.S., Tancock P.N., McGrath P.S., Sandres R.J., *Influence of EDTA Complexation on Plant Uptake of Manganese(II)*. Plant Sci., 1995, 109, 231-235.

[30] McBride B.M., *Environmental chemistry of soil*. New York–Oxford, Oxford University Press, 1994, 490, s. 406.

[31] Naidu R., Harter D.R., *Effect of different organic ligands on cadmium sorption by and extractability from soils*, Soil Sci. Soc. Am. J., 1998, 62, 644-650.

[32] Norvell A.W., *Inorganic Reaction of Manganese in Soils*, [in:] Graham R.D., Hannam R.J., Uren E.C. (eds.), Manganese in Soils and Plants, Kluver Academic Publishers, Dordrecht, 1988, 37-58.

[33] Noworolnik K., *Plonowanie wybranych zbóż jarych w zależności od pH gleby*, Bibiotheca Fragm. Agronom., 2006, t. 10, 59-67.

[34] ONZ, *Międzynarodowy Pakt Praw Gospodarczych*, 1966.

[35] Pecio A., Kubsik K., *Zróżnicowanie plonu i zawartości białka jęczmienia jarego w obrębie pola produkcyjnego*, Pam. Puławski, 2006, z. 142, s. 348-362.

[36] Podolska G., Krasowicz S., Sułek A., *Ocena ekonomiczna i jakościowa uprawy pszenicy ozimej przy różnym poziomie nawożenia azotem*, Pam. Puł. 2005, 139, 175--188.

[37] Przybulewska K., Stolarska A., *Wpływ stężenia metali (Hg, Pb, Cu) w glebie na wzrost i rozwój siewek jęczmienia*, J. Elementom., 2004, nr 9 (3), s. 469-475.

[38] Rozbicki J., *Kształtowanie wielkości i jakości plonu zbóż*, [w:] Rozbicki J. (red.): Produkcja i Rynek Zbóż., Wyd. Wieś Jutra, Warszawa 2002, 141-159.

[39] Roczniki Statystyczne GUS, 2010.

[40] Rozporządzenia Komisji (WE), nr 466/2001.

[41] Rozporządzenia Komisji (WE), nr 856/2005.

[42] Rozporządzenia Komisji (EG), nr 1881/2006.

[43] Rozporządzenia Komisji, nr 1126/2007.

[44] *Rozporządzenie Ministra Zdrowia z dnia 18 września 2008 r. w sprawie dozwolonych substancji dodatkowych* (Dz. U. z dnia 3 października 2008 r., Nr 177, poz. 1094).

[45] Shuman M.L., *Effect of organic waste amendments on zinc adsorption by two soils*, Soil Sci., 1999, 164, 197-205.

[46] Sobiech E., Smoczyńska K., Markiewicz K., *Badanie zawartości ni zbędnych składników mineralnych i metali szkodliwych w ziarnie, mące i otrębach pszenicy różnych odmian*, Bromat. Chem. Toksykol., 2003, 36, 23-28.

[47] Stanko S., *Interwencja na rynku zbóż*, Wieś Jutra, 2005, 4, 4-6.

[48] Sumathi K.M.S., Mahimairaja S., Naidu R., *Use of low – cost biological wastes and vermiculite from removal of chromium from tannery effluent*, Bioresource Technol., 2005, 96, 309-316.

[49] Toma M., Hiradate S., Saigusa M., *Chemical species of Al in a gypsum treated Kitakami Andosol*, Soil Sci. Plant Nutr., 1999, 45, 279-285.

[50] Traczyk T., *Potencjalne działanie alergizujące wybranych substancji dodatkowych występujących w żywności i pożywieniu*. Żywienie Człowieka i Metabolizm, 2002, t. XXIX, nr 3, s. 196-201.

[51] Tyburcy A., *Znaczenie zbóż w żywieniu człowieka*. Przegląd Zbożowo-Młynarski, 2007, 9-10.

[52] Ziegler J., *Geopolityka głodu*, Inst. Wyd. Książka i Prasa, Warszawa 2013.

„CICHY GŁÓD" W KONTEKŚCIE STOSOWANIA NIEKTÓRYCH PRODUKTÓW PRZEMYSŁU CHEMICZNEGO

W obecnym czasie coraz więcej osób zapada na choroby cywilizacyjne cierpi na nietolerancje pokarmowe i żyjąc w ciągłym biegu i stresie zaniedbuje racjonalne odżywianie, przez co nie dostarcza organizmowi wszystkich potrzebnych składników pokarmowych. Głównym źródłem żywności na całym świecie są rośliny, a dokładniej, zboża. Zajmują one największą powierzchnię upraw. Dlatego celem niniejszej pracy było pokazanie, że nawozy mineralne i dodatki do żywności mogą mieć pozytywny wpływ na jakość surowców roślinnych. Chemiczne produkty jakimi są nawozy i dodatki do żywności, zastosowane w odpowiedniej dawce, w odpowiedniej sytuacji i w odpowiednim czasie, mogą przyczynić się do polepszenia jakości żywności. Ziegler[31] preferuje używać terminu "*niewidzialny głód*" zamiast „*silent hunger*", zwłaszcza, że jest on trudny do wykrycia, nawet przez osobę o kwalifikacjach medycznych. Ludzie cierpiący na ten rodzaj głodu mogą wyglądać normalnie, jeśli chodzi o wagę i posturę ciała, ale skutki tego zjawiska to poważne choroby XXI wieku. Nowoczesne procesy gospodarowania i produkcji żywności

[31] J. Ziegler, *Geopolityka*…, op. cit.

sprzyjają funkcjonalnej konsumpcji, jednak to nie było by możliwe bez racjonalnego używania nawozów, środków ochrony roślin i dodatków oraz konserwantów. Kompromis pomiędzy rozwojem cywilizacyjnym a ekologia wymaga technologii, aby ułatwiać życie i poprawiać bezpieczeństwo żywności oraz środowiska. Żywność bowiem, zarówno roślinna, jak i zwierzęca ma służyć poprawie zdrowia i dobrobytu człowieka.

Słowa kluczowe: jakościowy głód, mineralne nawożenie, dodatki do żywności, wskaźniki jakości zbóż. Zrównoważony rozwój pola produkcyjnego.

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