Applied Studies in Agribusiness and Commerce – APSTRACT
Center-Print Publishing House, Debrecen
DOI: 10.19041/APSTRACT/2017/1-2/2

SCIENTIFIC PAPER

THE ANALYSIS OF AGRO-ECONOMIC EFFECTS OF HOUSEHOLD FOOD WASTAGE THROUGH THE EXAMPLE OF BREAD

Klára Hubert – István Szűcs
University of Debrecen, Faculty of Economic Sciences, Institute of Business and Management Sciences
H-4032 Debrecen, Böszörményi Str. 138.
hubert.klara@econ.unideb.hu
szucs.istvan@econ.unideb.hu

Abstract: *In our busy world, where numerous people starve and where the resources are restricted, it is a key issue to pay particular attention to the topic of prevention and decrease of food loss as well as food wastage.Wastage of food produced and delivered to the end user (customer) is an issue arising globally and nationally as well, which results in efficiency loss at economic level in any case. While the FAO study mentions food waste of the order of 1.3 billion tonnes on a world scale, then the annual quantity of food waste in Hungary is estimated at about 1.8 million tonnes, which contains the waste of every member of the chain from production to consumption. On the basis of the data published by the Hungarian Food Bank (2015), the amount of food waste caused by the population is 400 000 tonnes.*

In compliance with our objectives, inputs – expressed by non-financial and financial indicators – emerge during production are assigned to the quantity of wasted food. Applying the aforementioned method we would like to make customers realize how many resources (land, water, artificial fertilizer, pesticide, seed and gasoil) are utilized needlessly in food verticum by the end products – at present by different breads they throw out.

As our calculations prove by 10% waste of breads the utilization of 5 300 hectares of wheat land and 660 hectares of rye land can be considered unnecessary. By 10% waste of breads the financial value of the utilized resources is altogether 3.25 million EUR. Out of this the financial value of utilized artificial fertilizer is 1.10 million EUR (34%), of utilized pesticide is 1.15 million EUR (35%), of utilized gasoil is 0.70 million EUR (22%) and of utilized seed is 0.30 million EUR (9%).

Among different breads, white bread is purchased in the greatest volume by the Hungarian households, from which 121 900 tonnes are bought annually on an average. This quantity is equal to almost the 40% of the annual bread sell. If 10% of purchased white bread is thrown out, it results in useless utilization of 2 676 hectares of wheat land in food verticum. The quantity of utilized water arising form wastage is 15.8 million m3. Further losses emerge as regards material inputs: artificial fertilizer- to the value of 0.50 million EUR, pesticide- to the value of 0.58 million EUR, seed to the value of 0.15 million EUR and gasoil-loss to the value of circa 0.35 million EUR. Totally, material input to the value of 1.58 million EUR is owing to the Hungarian households in case of 10% white bread wastage.

Keywords: *food wastage, household, food waste, resources* (JEL code: *Q53*)

INTRODUCTION

It is well-known that waste of food products is a matter that appears throughout the food chain from production through harvesting and processing to trade and final consumer (Schneider, 2008).

While in developed countries greater amount of waste is typically generated by consumers in the food chain, in developing countries post-harvest waste is more defining (Parfitt et al., 2010a; Császár, 2014a; Borbély, 2014).

In the less-developed countries the greatest problem evolves from the lack of cold chain being essential to perishable products, from the underdeveloped producing- and harvesting techniques as well as from the lack of appropriate means of transport (Parfitt et al., 2010b). Losses in households particularly derive from the changed lifestyle and consumption patterns of consumers (Bánáti, 2006).

It is estimated that processing industry provides the greatest amount of food waste (62%), while households are responsible for „not more than" 21% of it. As regards the order of wastage, trade and catering services are represented by 6 and 11% (Zentai, 2013).

Three categories of household losses are distinguished by Parfitt et al., (2010c). Consumable food thrown out are considered preventable losses (e.g. leavings, do not use in time); food or food parts, which are consumed by each one

and are not by others, are mentioned as possibly preventable losses (e.g. bread-crust, potato peel); while inedible parts are treated as unavoidable losses (e.g. bone, eggshell, coffee-grounds, vegetable peels, apple-core).

In Hungary two-thirds of food waste belong to the latter mentioned group, apart from this households are important intervention points.

The following objectives are defined in present study:
- How does the extent of utilized land change by the waste of one unit bread?
- How much water is utilized needlessly by the waste of one unit bread?
- How do needlessly utilized material inputs (water, artificial fertilizer, pesticide, seed, gasoil) change by the wastage of one unit bread?

MATERIAL AND METHOD

On behalf of reviewing the above-mentioned issue a calculation for the product chain of cereals is carried out – especially for bread in the food subgroup of cereals as a food product with the highest costs.

Annually 304 758 tonnes of bread are sold on the national market (KSH, 2013), which shows the following distribution in Hungary on the basis of the product scale published by the Hungarian Baker Association *(1. table)*.

Table 1.: Evolution of bread structure

Title	Distribution *(%)*	Quantity *(tonnes)*
White, semi-brown bread	**65**	**198 093**
out of this white bread	40	121 903
out of this semi-brow bread	25	76 190
Farmhouse bread	**15**	**45 714**
Other bread	**20**	**60 952**
out of this rye-bread	6	18 285
out of this packed bread	4	12 190
Sum total	**100**	**304 758**

Source: own calculation based on the data of Hungarian Baker Association (2009)

According to a statement of the Hungarian News Agency (MTI) (2017), the average annual bread consumption in Hungary is 37 kilograms per capita while the European average is up to 50 kilograms. Annual bread consumption in Hungary is 370 thousand tones calculated on the total population which triggers a land use of 86 000 thousand ha, regarding an average yield of 4.3 tones/ha. Supposing 10% of bread purchased is wasted (Császár's assumption), the use of 8 600 ha proves unnecessary.

Bread consumption habits in Hungary have changed significantly over the last 15 years: the population consumed mainly white bread around 2 000 while there has been greater demand for brown and wholemeal products recently.

Last year's research of GfK Kft. suggests that the rate of white bread consumers, who eat white bread on a daily basis or more times a week, decreased from 76% (2007) to 61% while the rate of brown bread consumers increased from 34% to 50%.

Based on a report of the Hungarian Central Statistical Office this year, it also entailed significantly less purchase for bread among the Hungarian population: annual bread consumption per capita was 63 kilograms in 2002 while it is only 37 kilograms per capita these days.

According to EU surveys, the German and Austrian consume 80 kilograms while it is 60 kilograms for the Spanish and Italian population annually.

To illustrate how much land is used needlessly by the wastage of different breads in food chain, the ratio of wheat- and rye flour necessary for producing different breads had to be taken into consideration (*Table 2.*), as well as the average yields of wheat and rye. The average yield of wheat was 4.3, while the average yield of rye was 2.7 tonnes per hectare in the light of averages in the past years (KSH, 2012-2014).

Furthermore in the course of bread production the proportion of other additives is taken into account over the flour-ratios, which is determined in the ratio of 80 to 20 in each bread. In addition losses arise from grinding process are not ignored, the ratio of them are estimated 20% (Lakatos, 2013).

Beyond the land use the utilization of other resources during rye production are not taken into consideration.

Table 2.: The quantity of wheat- and rye flour in the production of different breads

Title	Wheat flour ratio *(dkg)*	Rye flour ratio *(dkg)*
White bread	80	-
Semi-brown bread	68	12
Farmhouse bread	65	-
Rye-bread	48	32
Packed bread	45	-

Source: based on own calculation (PAPNÉ SZABÓ, 2008)

Water footprint defined by Hoekstra (2010) is applied to present the average water footprint of the wasted breads by non-financial indicators, which is 1300 litre per one kilogram bread.

An average wheat production technology is supposed to demonstrate the further material inputs (artificial fertilizer, pesticides, seed) used needlessly, which is prepared by the following inputs defined by non-financial indicators and expressed by financial values (*Table 3.*). The total material inputs of wheat production indicate the intensity of technology, which is due to mill quality wheat production.

Table 3.: Material inputs of the average wheat production

Title	Quantity	Measurement unit	Material inputs (EUR/ha)
NPK* 8-24-24	200	kg/ha	81.94
27% nitrogen content "Pétisó"	200	kg/ha	46.75
Nitrosol	100	l/ha	21.75
Trimmer Max	35	g/ha	17,09
Tomigan	0.3	l/ha	
Zamir	2x1.5	l/ha	79.74
Pyrinex	2x1.5	l/ha	27.57
Amalgerol	3	l/ha	28.67
Yaravita gramitrel	2	l/ha	9.89
Mirador Forte	2	l/ha	52.47
Aperon/Athos	20	g/ha	41.18
Mv Magdaléna	200	kg/ha	58.44
Total	-	-	465.49

Source: own calculation
**: Nitrogen phosphorous potassium*

The unnecessary gasoil consumption is illustrated by the consideration of the gasoil prices of the past three years, which was 1.38 EUR/litre in 2013, 1.37 EUR/litre in 2014 and 1.19 EUR/litre in 2015 (NAV, 2014-2016). The quantity of utilized gasoil by intensive technology is 100 litre per hectare.

Every calculation performed was carried out relating to 5%, 10%, 15%, 20%, 25% and 30% extent of wastage, taking the most recent official MNB (2017) exchange rate into account.

RESULTS

Financial loss

Food wastage generates considerable financial losses in any sector of food chain. As regards household sector the food expenditures of consumers are described to demonstrate the aforementioned issue.

While in the United Kingdom one-third of purchased food is thrown trash, then this ratio in the Hungarian households is 10% according to Császár (2015).

As the report of the European Commission (2011) shows 25% of food bought by the households in the European Union is wasted.

In Great-Britain 6.7 million tonnes food are thrown out annually. It is equal to the dumping of 420 GBP value food per household annually, i.e. it is greater than 10 billion GBP calculating with 25 million households (WRAP, 2008).

Food wastage is annually estimated to 1.8 million tonnes in Hungary, which value can access 0.64 billion EUR (Császár, 2014b). In our view this value contains the replacement cost value of food, since it is well known that the food value is the highest in the moment of production and then it decreases.

In the middle of '90s the food expenditures gave more than one-third of households' budget. By 2005 this indicator has moved to 20% as a positive trend. It is well known that the greater purchasing power a country and its consumers have, the lower value this indicator represents, since consumers spend their income for services with higher added value (Kozák, 2009).

In Hungary families spend 18-23% of their average income on food. As a recent EU estimation from 2006 claims food to the value of 0.12 thousand EUR per households is thrown out annually. Hereby Hungary is one of the moderately wasting societies. Simultaneously, as the per capita income grows the quantity of wasted food increases as well.

On the basis of the data by KSH (2010-2012a), nowadays per capita average food expenditure (without refreshing- and alcoholic drinks) is more than 519.48 EUR/capita/year. As regards the ratio of food expenditures the greatest expenses occur in case of meat and meat products, milk and milk products, egg as well as cereals food subgroups. Expenses on meat and meat products give the 30% of total food expenditure (0.16 thousand EUR), while expenses on cereals, milk, milk products and egg represent equally 17-17% (0.09-0.09 thousand EUR). These together contribute to food expenditure by 65%. 11% (0.06 thousand EUR) of our food expenditures apply for purchasing vegetable and potato; 7-7% of them (0.03-0.03 thousand EUR) is spent on fruit-, sugar- and sweets purchasing, and nearly the same amount of money is spent on buying oils and fats (0.02 thousand EUR). The less money is spent on other food products, e.g. sauces, spices, baby- and dietary meals (0.02 thousand EUR), as well as on purchasing fish and fruits of the see (0.006 thousand EUR). These together contribute to our food expenditures by 5% (*Table 4.*).

Table 4.: Evolution of annual per capita food expenditures (2010-2011-2012) M.U.:EUR/capita/year

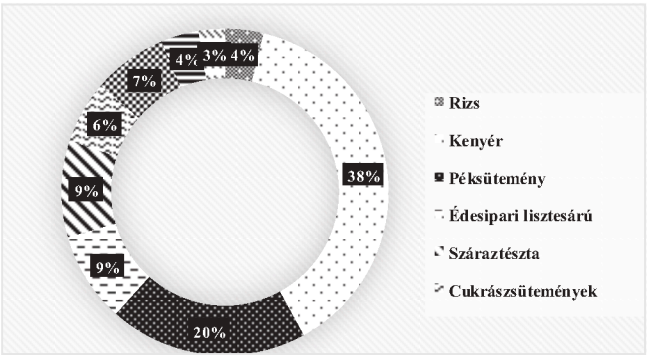
Food subgroups	Food expenditure
Cereals	**91.14**
Meat and meat products	163.23
Fish and fruit of the see	5.84
Milk, milk product, egg	94.52
Oils, fats	29.73
Fruit	36.07
Vegetable, potato	60.92
Sugar, sweets	37.14
Other food	21.40
Total food expenditures	**539.99**

Source: own calculation, based on KSH (2010-2012a) data

By the survey of expenses on cereals in the years of 2010-2011-2012 it can be proved that expenses on bread are the most significant (38%), which contribute to our food expenditures by circa 0.03 thousand EUR annually. Further significant items of expenditure within cereals are the proportion of

bakery products (20%), on which approximately 0.01 thousand EUR is spent. The ratio of noodles and confectionary flour products is also noteworthy (9-9%), which almost contribute to expenditures on cereals by nearly 0.008-0.008 thousand EUR. Purchasing pastry goods (6%), as well as flour and grits (7%) increases food expenditure by not more than 0.006-0.006 thousand EUR. Rice (4%), other cereals (4%) as well as preserved rice- and pasty food (3%) give the least expenses on cereals, on which 0.003 thousand EUR per food subgroups is spent on an average (*Figure 1.*).

Figure 1.: Composition of the expenditures on cereals (2010-2011-2012)



/Rice, Bread, Bakery products, Confectionary flour products, Noodle, Pastry goods, Flour, grits/
Source: own calculation, based on KSH (2010-2012b) data

Furthermore, solely bread wastage within food subgroups of cereals is analysed in present study. White bread (121 903 tons), semi-brown bread (76 190 tons) and farmhouse bread (45 714 tons) are the three breads sold in the greatest quantity calculating by the average of the years of 2012-2013-2014.

The average consumer price of breads was the following in the last three years: white bread 0.88 EUR/kg, semi-brown bread 0.75 EUR/kg, farmhouse bread 1.00 EUR/kg (KSH, 2016a).

The Hungarian households at the same time with the wastage of 10% of the purchased white bread throw away 1.11 million EUR. By wasting semi-brown bread the aforementioned value is equal to 5.80 million EUR, in case of farmhouse bread it is 4.58 million HUF.

If households waste 10% of the three breads purchased in the greatest quantity, they waste simultaneously 21.19 million EUR absolutely needlessly (*Table 5.*)

Table 5.: Financial loss owing to the waste of different breads
M.U.: million EUR

Title	5%	10%	15%	20%	25%	30%
White bread	5.42	10.85	16.28	21.71	27.14	32.57
Semi-brown bread	2.88	5.77	8.65	11.54	14.42	17.31
Farmhouse bread	2.28	4.56	6.85	9.13	11.41	13.69
Total	10.58	21.18	31.78	42.38	52.97	63.57

Source: own calculation

Within the scope of the social activity of the Hungarian Red Cross (2014) donations were distributed to approximately 253 539 persons to the value of 2 449 395 EUR. Donation per capita was about 9,74 EUR/capita.

Utilizing the wasted money 2 176 000 pieces parcels could be distributed containing such basic food that includes 3 kg flour, 3 kg granulated sugar, 3 kg potato, 3 kg onion and 3 kg rice (*Table 6.*).

Table 6.: Average consumer price of basic food
M.U.: EUR/kg

Title	2013	2014	2015	Átlag
Flour	0.54	0.45	0.43	0.47
Granulated sugar	0.89	0.72	0.63	0.75
Potato	0.56	0.47	0.46	0.50
Onion	0.57	0.58	0.57	0.57
Rice	0.95	0.93	0.98	0.95
Total	-	-	-	**3.24**

Source: own calculation based on KSH (2016b) data

Resource loss
The evolution of the extent of needlessly used land

In our view the wastage of food in the end consumer sector points beyond the fact that if food is thrown trash money is wasted as well. In economic approach this problem is generated not only by wasting food products. Since those huge amount of resources are also wasted by wasted food that are necessary for the production of the base material of our food. The following tables present the extent of needlessly used land by wasting different breads in different quantities.

The quantity of breads sold annually demonstrates the average quantity of breads sold in the year of 2012-2013-2014.

On an average 121 900 tonnes white bread are sold annually, which are accompanied by 26 760 hectares of wheat land utilization. Assuming 10% food wastage in Hungarian households, the wasted white bread needlessly utilizes 2 676 hectares of wheat land in food verticum (*Table 7.*).

Table 7.: The extent of utilized land by wasting white bread
M.U.: kg

White bread	5%	10%	15%	20%	25%	30%
Bread	6 095 160	12 190 320	18 285 480	24 380 640	30 475 800	36 570 960
Wheat flour used for bread	4 876 128	9 752 256	14 628 384	19 504 512	24 380 640	29 256 768
Wheat used for wheat flour	5 851 354	11 702 707	17 554 061	23 405 414	29 256 768	35 108 122
Wheat used land (ha)	1 338	2 676	4 014	5 352	6 690	8 028

Source: own calculation

Table 8.: The extent of utilized land by wasting semi-brown bread
M.U.: kg

Semi-brown bread	5%	10%	15%	20%	25%	30%
Bread	**3 809 475**	**7 618 950**	**11 428 425**	**15 237 900**	**19 047 375**	**22 856 850**
Wheat flour used for bread	**2 590 443**	**5 180 886**	**7 771 329**	**10 361 772**	**12 952 215**	**15 542 658**
Wheat used for bread	**3 108 532**	**6 217 063**	**9 325 595**	**12 434 126**	**15 542 658**	**18 651 190**
Rye flour used for bread	**457 1327**	**914 274**	**1 371 411**	**1 828 548**	**2 285 685**	**2 742 822**
Rye used for bread	**548 564**	**1 097 129**	**1 645 693**	**2 194 258**	**2 742 822**	**3 291 386**
Wheat utilized land (ha)	**711**	**1 422**	**2 132**	**2 843**	**3 554**	**4 265**
Rye utilized land (ha)	**201**	**403**	**604**	**806**	**1 007**	**1 209**

Source: own calculation

Table 9.: The extent of utilized land by wasting farmhouse bread
M.U.: kg

Farmhouse bread	5%	10%	15%	20%	25%	30%
Bread	**2 285 685**	**4 571 370**	**6 857 055**	**9 142 740**	**11 428 425**	**13 714 110**
Wheat flour used for bread	**1 485 695**	**2 971 391**	**4 457 086**	**5 942 781**	**7 428 476**	**8 914 172**
Wheat used for bread	**1 782 834**	**3 565 669**	**5 348 503**	**7 131 337**	**8 914 172**	**10 697 006**
Wheat utilized land (ha)	**408**	**815**	**1 223**	**1 631**	**2 038**	**2 446**

Source: own calculation

Annually 76 190 tonnes of semi-brown bread are sold on an average, which generate the utilization of approximately 18 245 hectares land. The extent of utilized land consists of 14 215 hectares of utilized wheat land and 4 030 hectares of utilized rye land. By wasting the 10% of purchased semi-brown bread the utilization of 1 420 hectares of wheat land and 400 hectares of rye land is unnecessary in food verticum (*Table. 8.*).

By the sell of 45 710 tonnes farmhouse bread on an average approximately 8 150 hectares of wheat land is utilized. If households do not consume 10% of the purchased farmhouse bread, 815 hectares of wheat land is needlessly utilized in food verticum (*Table 9.*).

Annually 18 285 tonnes of rye bread are sold on an average, which generate the utilization of approximately 4 990 hectares of land. The extent of utilized land consists of 2 410 hectares of utilized wheat land and 2 580 hectares of utilized rye land. Calculating by wasting the 10% of purchased rye bread the utilization of 240 hectares of wheat land and 260 hectares of rye land is unnecessary in food verticum (*Table 10.*).

Table 10.: The extent of utilized land by wasting rye bread
M.U.: kg

Rye bread	5%	10%	15%	20%	25%	30%
Bread	**914 274**	**1 828 548**	**2 742 822**	**3 657 096**	**4 571 370**	**5 485 644**
Wheat flour used for bread	**438 852**	**877 703**	**1 316 555**	**1 755 406**	**2 194 258**	**2 633 109**
Wheat used for bread	**526 622**	**1 053 244**	**1 579 865**	**2 106 487**	**2 633 109**	**3 159 731**
Rye flour used for bread	**292 568**	**585 135**	**877 703**	**1 170 271**	**1 462 838**	**1 755 406**
Rye used for bread	**351 081**	**702 162**	**1 053 244**	**1 404 325**	**1 755 406**	**2 106 487**
Utilized land by wheat (ha)	**120**	**241**	**361**	**482**	**602**	**722**
Utilized land by rye (ha)	**129**	**258**	**387**	**516**	**645**	**773**

Source: own calculation

Table 12.: The quantity of utilized water by wasting breads M.U.: m3

Utilized water	5%	10%	15%	20%	25%	30%
White bread	7 923 708	15 847 416	23 771 124	31 694 832	39 618 540	47 542 248
Semi-brown bread	4 952 318	9 904 635	14 856 953	19 809 270	24 761 588	29 713 905
Farmhouse bread	2 971 391	5 942 781	8 914 172	11 885 562	14 856 953	17 828 343
Rye bread	1 188 556	2 377 112	3 565 669	4 754 225	5 942 781	7 131 337
Packed bread	792 371	1 584 742	2 377 112	3 169 483	3 961 854	4 754 225
Total	17 828 343	35 656 686	53 485 029	71 313 372	89 141 715	106 970 058

Source: own calculation

By the sell of 12 090 tonnes packed bread on an average approximately 1 500 hectares of wheat land is utilized. If households do not consume 10% of the purchased packed bread, 815 hectares of wheat land is needlessly utilized in food verticum (*Table 11.*).

Table 11.: The extent of utilized land by wasting packed bread M.U.: kg

Packed bread	5%	10%	15%	20%	25%	30%
Bread	609 516	1 219 032	1 828 548	2 438 064	3 047 580	3 657 096
Wheat flour used for bread	274 282	548 564	822 847	1 097 129	1 371 411	1 645 693
Wheat used for bread	329 139	658 277	987 416	1 316 555	1 645 693	1 974 832
Utilized land by wheat (ha)	75	151	226	301	376	452

Source: own calculation

The evolution of the quantity of needlessly utilized water

Assuming 10% food wastage in Hungarian households, the utilized quantity of water by wasting breads is the following: in case of white bread 15.8 million m^3, in case of semi-brown bread 9.9 million m^3, in case of farmhouse bread approximately 5.9 million m^3, in case of rye bread about 2.3 million m^3, while in case of packed bread 1.5 million m^3. The quantity of utilized water by breads is nearly 35.6 million m^3 (*Table 12.*).

The evolution of the quantity of needlessly utilized artificial fertilizer

In the course of wheat production, as the most important base material of bread, the following artificial fertilizers are assumed during the applied nutrient management: NPK (Nitrogen phosphorous potassium) 8-24-24, a 27% nitrogen fertilizer called "Pétisó", as well as liquid Nitrosol. On behalf of soil-amelioration Amalgerol as a foliar fertilizer and Yaravita gramitrel are applied (*Table 13.*).

It can be proved that the largest demand on artificial fertilizer emerges on wheat production, which is the base material of 12 190 tonnes white bread produced on needlessly utilized 2 680 hectares of land. In quantitative approaching it results in the unnecessary application of more than 535 tonnes NPK 8-24-24, 535 tonnes 27% nitrogen content "Pétisó" and 268 tonnes Nitrosol. The wasted quantity of foliar fertilizer is 13.3 hl, which consists of the quantity of applied Amalgerol and Yaravita gramitrel.

During wheat production being necessary for the wasted 7 620 tonnes semi-brown bread the utilization of a bit more than 284 tonnes NPK 8-24-24, 284 tons 27% nitrogen content "Pétisó" and 142 tonnes Nitrosol seems to be unnecessary. The quantity of wasted foliar fertilizer is 5.2 hl, which is owing to the applied quantity of Amalgerol and Yaravita gramitrel.

In case of the wasted 4 570 tonnes farmhouse bread in the course of nutrient management the utilization of 163 tonnes NPK 8-24-24 and the same amount of 27% nitrogen content "Pétisó" as well as 81.5 tonnes Nitrosol is unrequired. The quantity of wasted foliar fertilizer is 4 hl, which is owing to the applied quantity of Amalgerol and Yaravita gramitrel.

The utilized wheat for the 1 830 tonnes uneaten rye bread requires less artificial fertilizer inputs, however it still results in the unnecessary utilization of 48 tonnes NPK 8-24-24, 48 tonnes 27% nitrogen content "Pétisó" as well as 24 tonnes Nitrosol The quantity of wasted foliar fertilizer is 1.2 hl, which contains the applied quantity of Amalgerol and Yaravita gramitrel.

The packed bread is the bread with the smallest demand on artificial fertilizer. With its 1220 tonnes wastage 30 tonnes NPK 8-24-24, the same amount of 27% nitrogen content "Pétisó" and approximately 15 tonnes Nitrosol artificial fertilizer get lost. The quantity of wasted artificial fertilizer is 0.75 hl, which refers to the applied quantity of Amalgerol and Yaravita gramitrel.

Table 13.: Artificial fertilizer inputs in case of different breads

Title	Measurement unit	Quantity	Material inputs (Thousand EUR)
White bread			
NPK 8-24-24	kg	535 200	219.29
27% nitrogen content "Pétisó"	kg	535 200	125.11
Nitrosol	l	267 600	58.21
Amalgerol	l	8 028	76.73
Yaravita gramitrel	l	5 352	26.48
Total	-	-	505.82
Semi-brown bread			
NPK 8-24-24	kg	284 317	219.29
27% nitrogen content "Pétisó"	kg	284 317	66.46
Nitrosol	l	142 158	30.92
Amalgerol	l	2 446	40.76
Yaravita gramitrel	l	2 843	14.06
Total	-	-	371.49
Farmhouse bread			
NPK 8-24-24	kg	163 064	66.81
27% nitrogen content "Pétisó"	kg	163 064	38.12
Nitrosol	l	81 532	17.73
Amalgerol	l	2 446	23.37
Yaravita gramitrel	l	1 631	8.06
Total	-	-	154.09
Rye bread			
NPK 8-24-24	kg	48 167	19.73
27% nitrogen content "Pétisó"	kg	48 167	11.25
Nitrosol	l	24 083	5.24
Amalgerol	l	722	6.90
Yaravita gramitrel	l	482	2.38
Total	-	-	45.50
Packed bread			
NPK 8-24-24	kg	30 104	12.33
27% nitrogen content "Pétisó"	kg	30 104	7.03
Nitrosol	l	15 052	3.27
Amalgerol	l	452	4.31
Yaravita gramitrel	l	301	1.49
Total	-	-	28.43

Source: own calculation

Calculating with 10% wastage of purchased breads the wastage of artificial fertilizer in financial value is the following: in case of white bread 0.50 million EUR, in case of semi-brown bread 0.37 million EUR, in case of farmhouse bread 0.15 million EUR, in case of rye bread 0.04 million EUR, in case of packed bread 0.02 million EUR. The financial value of needlessly utilized artificial fertilizer is 1.08 million EUR in case of 10% wastage of all breads.

The evolution of the quantity of needlessly utilized pesticides

By means of mill quality wheat production technology requires the accomplishment of intensive plant protection operations. Different herbicides (Trimmer Max, Tomigan, Aperon/Athos), fungicides (Zamir, Mirador Forte) as well as insecticides are applied in production technology assumed in present study (*Table 14.*).

The safety of production is threatened by fusarium disease, also known as spike fusariosis by the side of other diseases (e.g. powdery mildew, blights, leaf- and glume blotch). Diseases caused by Fusarium spices, among which F. graminearum and F. culmorum play outstanding role in epidemic years. The risk of infection is not only in direct damage, since in indirect damage unhealthy metabolites (toxins) are formed, which can appear in feed or in bakery products (Anonymus).

Table 14.: Pesticide input of breads

Title	Measurement unit	Quantity	Material inputs (thousand EUR)
White bread			
Trimmer Max	g	93 660	45.74
Tomigan	l	245	
Zamir	l	8 028	213.39
Pyrinex	l	8 028	73.78
Mirador Forte	l	5 352	140.42
Aperon/Athos	g	53 520	110.22
Total	-	-	583.55
Semi-brown bread			
Trimmer Max	g	49 755	24.30
Tomigan	l	426	
Zamir	l	4 265	113.36
Pyrinex	l	4 265	39.19
Mirador Forte	l	2 843	74.59
Aperon/Athos	g	28 432	58.55
Total	-	-	309.99
Farmhouse bread			
Trimmer Max	g	28 536	13.93
Tomigan	l	245	
Zamir	l	2 446	65.01
Pyrinex	l	2 446	22.48
Mirador Forte	l	1 631	42.78
Aperon/Athos	g	16 306	33.58
Total	-	-	177.78
Rye bread			
Trimmer Max	g	8 429	4.11
Tomigan	l	72	
Zamir	l	722	19.20
Pyrinex	l	722	6.63
Mirador Forte	l	482	12.63
Aperon/Athos	g	4 817	9.91
Total	-	-	52.48
Packed bread			
Trimmer Max	g	5 268	2.57
Tomigan	l	45	
Zamir	l	452	12.00
Pyrinex	l	452	4.14
Mirador Forte	l	301	7.89
Aperon/Athos	g	3 010	6.20
Total	-	-	32.80

Source: own calculation

Assuming 10% bread wastage in Hungarian households the wastage of pesticides is the following: 0.58 million EUR in case of white bread, 0.30 million EUR in case of semi-brown bread, 0.17 million EUR in case of farmhouse bread, 0.05 million EUR in case of rye bread and 0.03 million HUF in case of packed bread. By 10% wastage of all breads the financial value of needlessly utilized pesticide is 1.13 million EUR.

The evolution of the quantity of needlessly utilized seed

In present study Mv Magdaléna is selected as a seed type in wheat production, since it has been a significant type in Hungarian wheat production for ages. Its quality is suitable for the requirements of baking industry in all respects. Its grains can be properly ground, its flour can absorb 5-6% more water than traditional species. Paste made out of it is well rollable, flexible and it has high bread volume.

Calculating with 10% waste of sold breads, in case of white bread to the value of 535.2 tonnes, of semi-brown bread to the value of 284.3 tonnes, of farmhouse bread to the value of 163 tonnes, of rye bread to the value of 48.1 tonnes and of packed bread to the value of almost 30.1 tonnes seed wastage emerges. The quantity of needlessly utilized seed is 1060.7 tonnes by 10% waste of different breads (*Table 15.*).

Table 15.: Seed input of breads

Title	Measurement unit	Quantity	Material inputs (thousand EUR)
White bread			
Mv Magdaléna	kg	535 200	156.38
Semi-brown bread			
Mv Magdaléna	kg	284 317	83.08
Farmhouse bread			
Mv Magdaléna	kg	163 064	47.64
Rye bread			
Mv Magdaléna	kg	48 167	14.07
Packed bread			
Mv Magdaléna	kg	30 104	8.79

Source: own calculation

As regards the 10% waste in Hungarian households, the seed wastage is the following: it is 0.15 million EUR in case of white bread, 0.08 million EUR in case of semi-brown bread, 0.04 million EUR in case of farmhouse bread, 0.01 million EUR in case of rye bread, and 0.008 million EUR in case of packed bread. The financial value of the needlessly utilized seed beside 10% waste of all breads is 0.28 million EUR.

The evolution of the quantity of needlessly utilized gasoil

The operations of wheat production require 100 litre gasoil per hectare on an average. On the bases of it gas oil loss is 267 590 litre in case of wasted white bread, 142 160 litre in case of wasted semi-brown bread, 81 530 litre in case of wasted farmhouse bread, 24 080 litre in case of wasted rye bread and 15 050 litre in case of wasted packed bread. The quantity of needlessly utilized gasoil is 530 410 litre by 10% wastage of breads (*Table 16.*).

Table 16.: Gasoil input of different breads

Title	Measurement unit	Quantity	Material inputs (thousand EUR)
White bread			
Gasoil	l	267 592	353.62
Semi-brown bread			
Gasoil	l	142 158	187.86
Farmhouse bread			
Gasoil	l	81 532	107.74
Rye bread			
Gasoil	l	24 083	31.82
Packed bread			
Gasoil	l	15 052	19.89

Source: own calculation

Calculating with 10 % wastage of purchased breads by the Hungarian households, the gasoil loss in financial value is 0.35 million EUR in case of white bread, 0.18 million EUR in case of semi-brown bread, 0.10 million EUR in case of farmhouse bread, 0.03 million EUR in case of rye bread and 0.01 million EUR in case of packed bread. By 10% wastage of all breads the financial value of needlessly utilized gasoil is 0.67 million EUR.

CONCLUSIONS

In the light of annual per capita food expenditure – which is 519.48 EUR/capita/year – it can be proved that cereals have an important role in our every day meals, since almost 97.40 EUR is spent on their purchasing from the annual per capita food expenditure. Furthermore the proportion of bread is the greatest within the subgroup of cereals, its ratio is approximately 40%. Our annual food expenditure is increased by more than 32.46 EUR by the annual per capita bread expenditure.

Annually 304 760 tonnes bread are sold on an average. By 10% wastage of the three breads purchased in the largest quantity, nearly 0.02 billion EUR financial loss emerges.

This money would be enough donating food parcels contain base food of 9.74 EUR value for more than 2.1 million needy persons.

The total financial value of the utilized resources is 3.25 million EUR beside 10% waste of breads. Out of this the financial value of utilized artificial fertilizer is 1.10 million EUR (34%), of utilized pesticide is 1.15 million HUF (35%), of utilized gasoil is 0.70 million EUR (22%) and of utilized seed is 0.30 million EUR (9%) (*Table 17.*) .

Annually 121 900 tonnes white breads are purchased. If 10% of purchased white bread are thrown out, then 2 676 hectares of wheat land are utilized needlessly in food verticum. The quantity of utilized water arising from wastage is 15.8 million m^3. Further losses are emerges as regards material inputs as well, whereas the loss of 0.50 million EUR artificial fertilizer, of 0.58 million EUR pesticides, of 0.15 million EUR seed and of approximately 0.35 million EUR gasoil is owing to the white bread wastage of the Hungarian household. The financial value of the all material inputs related to the quantity of wasted white bread is equal to 1.58 million EUR (*Table 17.*).

Annually 76 190 tonnes semi-brown bread are sold. Assuming 10% wastage of households the utilization of 1 420 hectares of wheat land and 400 hectares of rye land is unnecessary in food verticum. The quantity of utilized water by wastage is 9.9 million m^3. As regards material inputs by 10% waste of semi-brown bread in households the utilization of artificial fertilizer to the value of 0.37 million EUR, of pesticide to the value of 0.30 million EUR, of seed to the value of 0.08 million EUR as well as of gasoil to the value of 0.18 million EUR is proved to be unnecessary. The financial value of the total material inputs related to the quantity of wasted semi-brown bread is equal to 0.93 million EUR (*Table 17.*).

Annually 45 710 tonnes farmhouse bread are sold. In case of 10% wastage, the extent of the needlessly utilized wheat land is 815 hectares in food verticum. The quantity of utilized water is 5.9 million m^3. Together with the wasted farmhouse bread there is a loss of artificial fertilizer to the value of 0.15 million EUR, of pesticide to the value of 0.17 million EUR, of seed to the value of 0.04 million EUR, of gasoil to the value of 0.10 million EUR, as material losses. The financial value of the total material inputs related to the quantity of wasted farmhouse bread is equal to 0.46 million EUR (*Table 17.*).

Annually 18 285 tonnes rye bread are sold on an average. If 10% of purchased rye bread are not consumed, then 240 hectares of wheat land and 260 hectares of rye land are utilized needlessly in food verticum. The quantity of utilized water is 2.3 million m^3. The following material inputs can be considered money thrown out: the cost of artificial fertilizer – 0.04 million EUR, the cost of pesticide – 0.05 million EUR, the cost of seed – 0.01 million EUR and the cost of gasoil – 0.03 million EUR. The financial value of the total material inputs related to the quantity of wasted rye bread is equal to 0.13 million EUR (*Table 17.*).

Annually 12 190 tonnes packed bread are sold on an average. Assuming 10% wastage the extent of land utilized by wheat is 150 hectares. The quantity of utilized water is 1.5 million m3. The cost of wasted artificial fertilizer is 0.02 million EUR, of pesticide is 0.03 million EUR, of seed is 0.008 million EUR, of gasoil is 0.01 million EUR. The financial value of the total material inputs related to the quantity of wasted packed bread is equal to 0.068 million EUR (*Table 17.*).

Table 17.: Material inputs in case of different breads

Items	Material inputs (million EUR/ha)
White bread	
Artificial fertilizer	0.50
Pesticides	0.58
Seed	0.15
Gasoil	0.35
Water	-
Total	1.58
Semi-brown bread	
Artificial fertilizer	0.37
Pesticides	0.30
Seed	0.08
Gasoil	0.18
Water	-
Total	0.93
Farmhouse bread	
Artificial fertilizer	0.15
Pesticides	0.17
Seed	0.04
Gasoil	0.10
Water	-
Total	0.46
Rye bread	
Artificial fertilizer	0.04
Pesticides	0.05
Seed	0.01
Gasoil	0.03
Water	-
Total	0.13
Packed bread	
Artificial fertilizer	0.02
Pesticides	0.03
Seed	0.008
Gasoil	0.01
Water	-
Total	0.068

Source: own calculation

Overall, in agro-economic approach the wastage of breads is accompanied by significant resource utilization beyond the considerable financial loss – both expressed by non-financial and financial value. However, in our opinion the extent of food wastage in Hungarian households is much bigger than 10% published by Császár (2015), it rather approaches to the ratio of food wastage in EU households, which is 25%.

REFERENCES:

ANONYMUS: Az őszi búza fuzáriumos kalászfertőzés elleni védelme. http://www.biokontroll.hu/cms/index.php?option=com_content&view=article&id=1637:az-szi-buza-fuzariumos-kalaszfertzes-elleni-vedelme&catid=281:noevenyvedelem&lang=hu&Itemid letöltés: 2016.06.02.

BÁNÁTI, D. (2006): Agricultural ethics. Editorial. Acta Alimentaria, 35 (2), 149-151.

BORBÉLY, CS. (2014): Az élelmiszerpazarlás kérdése. Holstein Magazin, XXII. évf. 4. sz./2014.

CSÁSZÁR, L. (2014): Az élelmiszer-pazarlás prioritást élvező probléma. Megtartották az Élelmiszer Érték Fórumot. Élelmiszer, XXII. évf. 10. sz./2014.

CSÁSZÁR, L. (2015): Új utak az élelmiszermentésben. Élelmiszer, XXIII. évf. 10. sz./2015

EURÓPAI BIZOTTSÁG (2011): Az EU elindult az „újrahasznosító társadalommá válás" útján, de még számos területen van szükség előrelépésre. European Commission, Brüsszel, 2011.01.19.

HOEKSTRA, A. (2010): The waterfootprint: water in the supply chain – Water Footprint Network. Emain practice – focus on water, The Environmentalist, 01.03.2010., issue 93.

HUNGARIEN FOOD BANK (2015): Amiből sokan jóllakhatnak. http://www.elelmiszerbank.hu/elemiszerbank_szja_201503_LT.html letöltés: 2016.06.02.

KOZÁK, Á. (2009): Táplálkozás, fogyasztás és életmód a rendszerváltás utáni Magyarországon. Élelmiszer, Táplálkozás és Marketing VI. évf. 1-2/2009.

KSH (2010-2012): A háztartások fogyasztása. http://www.ksh.hu/apps/shop.kereses?p_lang=HU&p_session_id=685742699634086&p_szo=%E9lelmiszer+kiad%E1s letöltés: 2016.05.28.

KSH (2012-2014): A fontosabb szántóföldi növények betakarított területe, összes termése és termésátlaga.

http://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_omn007a.html letöltés: 2016.05.28.

KSH (2013): Magyar statisztikai évkönyv, 2013. http://www.ksh.hu/docs/hun/xftp/idoszaki/evkonyv/evkonyv_2013.pdf letöltés: 2016.05.28.

KSH (2016): Egyes termékek és szolgáltatások éves fogyasztói átlagára. http://www.ksh.hu/docs/hun/xstadat/xstadat_eves/i_qsf003b.html letöltés: 2016.05.28.

LAKATOS, E. (2013): Élelmiszeripari technológiák I. Malom-, Sütő-, és Édesipar. file:///C:/Users/2017.01.25/Downloads/2010-0018_kotet_015_elelmiszeripari_technologiak_i.pdf letöltés: 2017.07.05.

MAGYAR PÉKSZÖVETSÉG (2009): A Magyar sütőipar általános helyzete. http://www.pekszovetseg.hu/magyar-sutoipar-altalanos-helyzete letöltés: 2016.05.28.

MAGYAR VÖRÖSKERESZT (2014): Szociális segítségnyújtás. http://www.voroskereszt.hu/szocialis-segitsegnyujtas.html letöltés: 2016.06.02.

MNB (2017): Az MNB legfrissebb hivatalos devizaárfolyamai. https://www.mnb.hu/arfolyamok letöltés: 2017.07.05.

NAV (2014): 2013-ban alkalmazott üzemanyagárak. https://www.nav.gov.hu/nav/szolgaltatasok/uzemanyag/uzemanyagarak/2013_ben_alkalmazott_20150212.html letöltés: 2016.05.28.

NAV (2015): 2014-ben alkalmazott üzemanyagárak. https://www.nav.gov.hu/nav/szolgaltatasok/uzemanyag/uzemanyagarak/2014_uzemanyagarak.html letöltés: 2016.05.28.

NAV (2016): 2015-ben alkalmazott üzemanyagárak. https://www.nav.gov.hu/nav/szolgaltatasok/uzemanyag/uzemanyagarak/2015_ben_alkalmazot20160112.html letöltés: 2016.05.28.

PAPNÉ SZABÓ, I. (2008): Búzakenyerek. Kiadó: Nemzeti Szakképzési és Felnőttképzési Intézet.

PARFITT, J. – BARTHEL, M. – MACNAUGHTON, S. (2010): Food Waste within food supply chains: quantification and potential for change to 2050. Philosophical Transactions of the Royal Society B: Biological Sciences, 365 (1554), 3065-3081.

SCHNEIDER, F. (2008): Wasting Food – An Insistent Behaviour. In: Edmonton Waste Management Centre of Excellence (Hrsg.), Waste – The Social Context '08 Urban Issues & Solutions. International conference, 11-15 May 2008, Edmonton, Alberta, Canada.

WRAP (2008): The food we waste. Food Waste Report. Waste and Resources Action Programme.

ZENTAI, J. (2013): Élelmiszeripari melléktermék és hulladék feldolgozási technológiák áttekintése. http://www.tqconsulting.hu/elelmiszeripari-mellektermek-es-hulladek-feldolgozasi-technologiak-attekintese letöltés: 2016.05.28.