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HUNGARIAN AGRICULTURAL RESEARCH

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Ministry of Agriculture Hungary

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Cover photo: Grey cattle (Apolka Ujj)

NEW COMMON AGRICULTURAL POLICY AND ITS FIRST YEAR'S EXPERIENCES

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In 2015 Hungary has introduced a national model of the new system for direct payments within the framework of the Common Agricultural Policy (CAP). In the 2014-2020 programming period the evaluation and control procedures regarding both pillars of the CAP regulated by EU-level legislations have been changed and became more complex compared to the previous financial period. Therefore 2015 was an exceptionally difficult but also a very exciting year for the agricultural administration, for the Agricultural and Rural Development Agency (ARDA) and for the farmers as well.

TASKS DERIVING FROM THE NEW CAP

In 2015 the biggest challenge for ARDA was the adaptation of tasks deriving from the new CAP. The operation of the organization – as the only Paying Agency in Hungary– had to be adjusted to this. There was no appointed president in ARDA in the beginning months of the year. From the 1st of March when I started to work here, there was only one month given until the start of the submission period of the single application (1st April).

Concerning the IT background, together with my colleagues with extraordinary workload we managed

Photo 1: One of the most popular organic second planted crops could be the phacelia

Photo 2: At least two second planted crops' seed mixture has to be sown

to prepare for the start of the single application period. During the restructuring of the IT system the Agency made the application surface more client-friendly and more manageable. ARDA participated in the training of 670 farm advisors so that they could help farmers to fill out and submit the applications properly. Beside this ARDA organized informatory presentations at its county offices. This year was also unique because of the modification of the structure of measures: on the one hand some support measures ceased (for example the special rice and decoupled sugar supports), on the other hand support could be claimed for new measures (e.g. greening or coupled supports). Farmers could submit applications for 35 measures in the single application (the highest number ever).

ARDA constantly screened and monitored the progress of claiming support. In case of a problem ARDA gave feedbacks for the clients. The Agency sent almost 50 000 e-mails, in which the client was warned about the formal errors, and their attention was drawn for the missing documents to raise the rate of correctly submitted applications.

In favor of the seamless submission of applications, Hungary used the option offered by the European Commission to extend the application period (applications could have been submitted until 22nd May; one week longer than the original deadline). Because of the necessary controls, a bigger prolongation of the deadline may have endangered the launch of the advance payments on 16th October 2015.

Although both ARDA and the farmers had only a little time for preparation, the application period was closed successfully. In conclusion it can be declared that the number of applications (more than 170 000) and the tendency of applications were similar to the previous years.

The cooperation of ARDA, the Hungarian Chamber of Agriculture and the farmers was necessary and inevitable for the success of this process.

OUR AIM IS TO CREATE A FARMER-FRIENDLY OFFICE

One of the main aims of the new management of ARDA was creating a farmer-friendly office beside strengthening the professionalism of the organization. A main element of this is that the Paying Agency has to operate in a most transparent way, in compliance with the relevant legislation,

Photo 3: Greening promotes the increase of legume crops sowing area

the clients living in the countryside should be considered as partners, and the interest of the clients and the signals of farmers must be taken into consideration. This is a question of approach and attitude in particular, which was transmitted to the employees by the new management and furthermore more concrete steps have been taken towards reaching the aim.

In favour of the more efficient flow of information, ARDA has transformed its helpdesk service and increased the earlier 50% rate of availability on phone - which caused so many complains – to more then 85%. The renewed helpdesk is available from 1st July 2015.

Starting a new website in November 2015, was a significant step of ARDA to become a farmer-friendly office. The aim of this renewal website is that the client could manage their affairs easier.

The most important viewpoint of creating a client-friendly office was that ARDA should perform its on-the-spot controls as a partner of the farmers. The aim is not the punishment, but helping the clients to receive the deserved subsidies. The controls do not have to be sanction-oriented and self-serving though ARDA has to apply strict rules specified by the EU and national regulations. The farmer-friendly approach of the controllers is important too, that is why the Agency placed strong emphasis on their education last spring. Communication trainings were held in order to prevent and to handle the possible of conflicts. The greater number of tasks is the reason of the increase in the number of on-the-spot controllers. 60 new controllers have been employed country-wide. Although the check-ups did not become simpler in the new system and check-ups had to be taken within shorter time because of the extension of the application period, the colleagues did their job with great commitment. All in all the on-the-spot controls were carried out much more effectively and fluently than before.

ARDA has been made proposals for legislative amendment in the past repeatedly to make the situation of the clients easier and to simplify and rationalize the processes (e.g. the initiative to relieve the certification of legal land-use). In the basis of act amendment adopted in June, the Agency accepts more documents – e.g. the property deed – for the proof of legal land-use. The possibility of sanction-free modification of the ecological focus areas was also introduced according to another initiative of this kind.

THE NEW FEATURES OF THE AGRICULTURAL SUPPORT SYSTEM

The most important change in the agricultural support system compared to the previous years is that all the area-based payment (SAPS) is now divided into basic aid and greening. As the support is split in two, the payments have been made separately. The most popular of the 20 greening

components among the Hungarian farmer were land lying fallow, double cropping and nitrogen fixing crops. These covered about 90% of the areas designated to greening, which is approximately 500 000 hectares (table 1).

Based on Member States' opinions the European Union has already recognized that a number of conditions or criteria imposed in greening are unrealistic. Both the European Commission and the European Parliament is intended to make changes in the rules of greening based on the 1st year's experiences.

The other new element in the support system was the implementation of Small Farmers Scheme (applications for this measure were possible till 15th August 2015.). This support offers simplified conditions for farmers holding land of 10 or 15 hectares. Slightly below the expectations, nearly 51 000 farmers applied into the system.

Furthermore, a new element was the support available within the frame of the single application providing a possibility for young farmers of a yearly 2 000 000 HUF additional support. Area and animal related coupled schemes are also available for farmers.

It is considered as a great success that ARDA started to pay the advance payments in the new agricultural support system on 16th October 2015 like in the previous years. This is a significant achievement, since only 11 Member States have undertaken to pay farmers advance payments and only 4 countries managed to pay advances in greening.

In addition, Hungary is the only Member State that started advance payments in 8 measures simultaneously (which is also is unprecedented in Hungary; in 2014 advance payments were started in 2 measures). Beside the basic aid and greening, advance payments were paid in a bunch of coupled schemes, like dairy cow, cattle and ewe premium. The Agency started the payments of the new Small Farmers Scheme on the 1st December. Based on a Hungarian proposal, EU legislation allows the Member States to pay a maximum of 70% in advance (instead of the previous maximum of 50%). Hungary – among very few EU Member States – used this option and paid 70% in advance.

While the Agency paid supports by the end of the years 2013 and 2014 in 169 000 and 171 000 cases, in the first days of December 2015 the counter has already exceeded 200 000.

RURAL DEVELOPMENT PROGRAMME AND SCHEMES TO BE LAUNCHED

The Hungarian Rural Development Programme was accepted by the European Union in the summer and in the new period 1300 billion HUF is available for its implementation. A dumping of schemes are to be expected as the Prime Minister's Office is about to launch seventy schemes before the end of 2016. Some of these schemes have been already launched such as the Agri-Environment Management scheme and the support of ecological farming. With a fund summing to one billion HUF a new LEADER scheme has been launched for the development of local development strategies. In the following months new schemes will be launched.

Along with the Office of the Secretary of State for Agriculture and Rural Development of the Prime Minister's Office, the Hungarian Chamber of Agriculture, and the Ministry of Agriculture, ARDA delegated members to the working groups to facilitate the development of the new support schemes. ARDA is also contributing to the development of the IT infrastructure required for the implementation. Although the Programme was developed by the Prime Minister's Office, its implementation and the evaluation of the claims are the tasks of ARDA. Before the end of the year 2015 the claims of the previous programming period had to be closed because the funds of the 2007-2013 period were only available until the 31st December 2015. This transitional period required a doubled effort from ARDA.

Photo 4: Mixture of second planted crops

TABLE 1: The total area claimed for greening support in Hungary in 2015

Code	Type of Ecological Focus Area (EFA)	Number of applications (piece)	Area (ha)	Weighted size of area
	Submitted arable lands	949 575	4 188 783	
1	Land lying fallow	40 011	116 010.82	116 010.82
2	Terraces	-	-	-
3	Hedges or wooded strips	7 780	1 849.42	3 698.85
4	Isolated trees	453	0.9	1.35
5	Trees in line	1 414	187.93	375.86
6	Trees in groups and field copses	1 681	217.02	325.52
7	Field margin	9 733	3 664.29	5 496.44
8	Ponds	184	36.18	54.27
9	Ditches	5 102	868.23	1 736.46
10	Kurgans	234	116.64	116.64
11	Shadoofs	26	0.00	0.00
12	Buffer strips (still water)	169	13.20	19.80
13	Buffer strips (running water)			
15	Forest edges (with production)	3 804	1 478.96	443.69
16	Forest edges (without production)	470	168.99	253.48
17	Energy forests	82	567.21	170.16
18	Afforested area	1 040	4 665.86	4 665.86
19	Second crop	19 439	144 740.46	43 422.14
20	Nitrogen-fixing crops	36 065	207 386.01	145 170.20
	Total	127 687	481 971	321 960.26
	EFA areas on arable land	96 637	473 370	309 439.18

SUMMARY AND THE TASKS AHEAD US

The next step is to simplify and clarify the application procedure for the support schemes and to enhance the accessibility and clarity of our legislation. Our goal is to create legislation that is more helpful to farmers, to create transparent and clearly understandable regulation for schemes and to create transparent application procedures. ARDA will be a partner of the farmers in this respect and will take the initiative as well.

I can only hope that the results of the development of our farmer-friendly agency are already acknowledged by the farmers. This is the path on which we would like to move further on.

2015 was the most difficult year in the history of ARDA. We can say that Hungary and the Paying Agency had very well adapted to requirements of the new CAP. Our greatest achievements are that in the first year of the 2014-2020 period we managed to smoothly launch and run the new support system and that Hungary was in the spearhead of MSs to pay advance payments.

PROTECTING HUNGARIAN AGRICULTURE BY MEANS OF ONLINE MARKETING DEVICES - WITH A PREFERENCE FOR HOME GROWN PRODUCTS

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ABSTRACT

The European Union's 2014-2020 budget period provides Hungary with a unique opportunity for Hungary to catch up with its western neighbours.

The EU funding for innovation is available and guaranteed but taking the proper course of action and sticking to it are our responsibility. In order to fully exploit this opportunity and help our country join the ranks of its neighbours, developing the agricultural sector is crucial. Naturally, our number one priority has to be the production of top quality produce that meets internationally recognised standards, but this is only our first step.

No success on the market is attainable without appropriate communication. So, if we aim to establish long term, sustainable growth in the sector, we have to foster a preference for home grown products.

This is ideally mediated by the array of devices in online marketing. These will be the main focus of our paper.

We will enumerate and analyse them so that they may not only assist boosting the sales of home grown produce but also helps raise our

country's profile on the international scene, thereby assisting our development in the long term, as well. Our analysis will outline a course for boosting the reputation of Hungarian produce and agriculture and, consequently, profits for the country.

keywords: agriculture, reputation of Hungarian products, online marketing

INTRODUCTION

The question of making and keeping Hungary agriculturally competitive is becoming even more central. This problem is hardly new: the country has been lagging behind its western neighbours since the late 1980s, and the gap only widened after the change of the regime.

Nothing highlights this more succinctly than a glance at production indicators. While the world's output in the period between 1990 and 2003 grew by 29.8%, that of Hungary shank by 25.5% (Kapronczai et al. 2009).

Our accession to the EU rendered its agricultural support system, CAP, available to us. In October 2011, the European Court published a paper detailing proposed new legislation for CAP (Popp et al. 2012). According to this, the proposed reforms of the 2014-2020 period could usher in a new era in Hungarian agriculture: rapid and significant development is possible if these resources are appropriately allotted.

So, while the opportunity to catch up is present, tangible results are only attainable if we are informed about all the salient factors (Törőné 2012).

One of them, the extent and quality of consumer demand, has shown that popularising locally grown produce is pivotal in boosting the Hungarian economy.

The production and availability of produce that meet the required standards is only the first step though; we also have to let our target audience know about them. A part of this is clearly marking the country of origin on the produce, which is often problematic - and this is where social marketing comes into the picture (Szente 2014).

Another thread that supports our cause is that of the rapidly spreading trend of localisation, the preference for locally produced goods that has arisen to offset some of the effects of globalisation (Petrás 2005). Examining the value system and preferences of consumers is also a good way to collect more relevant data (Fodor et al. 2008).

Fostering a preference for locally grown produce is vital and this also subsumes letting as many consumers know

about them as possible; this is where the devices of online marketing can help a lot. Lack of general awareness of these products is extremely problematic at present; as our study currently being published shows 61.7% of those polled have never heard about the existence of Hungarian organic mushrooms (Sándor et al. 2016).

Preference for traceably local produce is already being established, partly due to food safety measures (Lehota 2007). The majority, when faced with two identically priced products, would opt for the Hungarian one but would not necessarily do this if the local option cost more (Szente et al. 2014).

The Hungarian agrarian sector has turned out not to be productive. One of the possible causes of this may be that consumers do not encounter Hungarian and local produce first because of ineffective marketing.

The food economy, in general, with a few notable exceptions has underemployed marketing and also restricted its efforts to PR rather costly for SMEs (Gaál 2010).

MATERIAL AND METHODS

The first step towards choosing the appropriate set of marketing devices is getting to know consumer habits and behaviour. The latter was characterised by a thirst for relevant information (Gaál 2010). We have to capitalise on this to encourage a preference for Hungarian and locally grown produce, one that would translate into sales too.

This is what we aimed to examine further in our January 2016 quantitative survey where we polled 231 randomly chosen respondents.

We asked them how familiar they were with the concepts of Hungarian and local produce as well as where and how they were informed about what to shop for, and what they deemed necessary for popularising locally grown produce.

Sample taking was accidental on the Internet and the questionnaire was sent to social media pages of different content. We paid attention that the respondent should have diverse interests.

Our questionnaire posed three control questions that aimed to elucidate respondents' knowledge of the terms 'Hungarian', 'local', and 'locally produced'. We used Magyar Termék Nonprofit Kft.'s (Hungarian Product Nonprofit Ltd.) definitions.

RESULTS AND DISCUSSION

When choosing online marketing devices and evaluating relevant data, we have to regard the factors consumers orient themselves by as paramount.

Based on the above, we may safely assert that the majority of those polled prefers Hungarian produce and strongly influenced by price. They also find familiarity important.

To capitalise on this preference for local and Hungarian produce and extend it to every product we have to let customers know about them. The joint deployment of content marketing and the possibilities of social media are ideally suited to this.

Portals dedicated to the agrarian sector full of intriguing and valuable information are the way of popularising Hungarian and locally grown produce. We also examined how respondents would popularise Hungarian produce.

Price sensitivity is a top factor as are the widening of the product range and the boosting of availability. Based on the findings of our research project on organic foods (Sándor 2016), we may postulate that the product range ought to be popularised rather than broadened and online marketing is ideally suited to this. Raising the profile of these products and displaying origin on the packaging were also highlighted as significant factors.

Information gathering habits are also relevant because they supply us the key to reaching our target audience.

Most are not informed on the range of foods available to them, so it is important to do this for them. Sharing informative and intriguing articles via social media can bridge this gap. This way consumers can get informed on Hungarian and locally grown produce without having to look for them. But if they do decide to look for information, results show that they primarily do so on the internet. This means we need to pay attention to, and optimise, online forums where experts and laymen alike share their views. Asking shop assistants or experts in person seems less favoured, which leads us back to the significance of online forums again.

The results show considerable confusion in the exact meaning of the terms. As a result, 62.8% stated incorrectly that 'local produce' denoted products made solely from ingredients that originated in Hungary, and only 32% knew

TABLE 1: Which are the most important factors to you when choosing food products?

the price - for me the product needs to be affordable	95	41.1%
the quality - I only buy high quality products	77	33.3%
availability - I shop in the nearby shops, which are always available	49	21.2%
the origin of the product - I prefer Hungarian products	133	57.6%
reputation - I prefer tried and tested products	88	38.1%
I heed the advice of my nearest and dearest	23	10,0%

Source: authors' own research, 2016

TABLE 2: What do you deem the most effective way of persuading consumers to buy Hungarian products?		
More, and more prominent information about the origin of the product on its packaging	83	35.9%
People need to be informed about the quality and availability of Hungarian products	80	34.6%
The range of products needs to be widened, and made more available for the man of the street	107	46.3%
Hungarian products should cost less	127	55%
Boosting the reputation of Hungarian products will lead to more people buying them	72	31.2%

Source: authors' own research, 2016

TABLE 3: Where do you find relevant information on food products before choosing which one to buy?		
I surf the net, and read the experts' recommendations and descriptions	56	24.2%
I only read the label on the product, and do no further research	102	44.2%
I ask an expert	9	3.9%
I surf the net and read about the others' opinions and recommendations	42	18.2%
I ask shop assistants for their opinion, which I trust	22	9.5%

Source: authors' own research, 2016

that these products are made mainly, but not solely, from Hungarian ingredients. 5.2% thought that these foods were merely assembled in Hungary but their ingredients came from abroad. We also asked what they understood by 'Hungarian product', which 78.4% identified correctly, 20.3% confused with 'local product', and 1.3% mixed up with 'locally produced'. This last category, despite its deceptive moniker, merely means 'assembled from imported ingredients in Hungary' - 68.4% knew this. 13.4% thought most, while 18.2% all the ingredients to be Hungarian, too.

CONCLUSIONS

We assumed that the main obstacle to the growing preference of Hungarian products was lack of consumer awareness. Based on our findings, we can state that although consumers show a clear preference for Hungarian products, knowledge of both products and salient concepts left much to be desired. As this area mainly comprises the SME sector, we need to pay heed to their particular characteristics (and budgets), when assembling our range of devices. ATL communication devices fall short both on their measurability and cost here (Gacsi and Zeman 2013), so we need to emphasize BTL devices.

We need a popular and readily accessible forum where we may impart knowledge of both concepts and products to our customers couched in easy-to-swallow, bite sized pieces of content marketing. Communication flows more easily when products are clearly labelled as local or Hungarian; the savvy copywriter can harness this insight with attention-grabbing headlines.

Otherwise good content is not nearly enough if it does not reach its audience. To reach the target audience, social media – especially Facebook – is the most effective device.

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FROM THE FORESTS AND MEADOWS TO THE GARDENS…

THE DOMESTICATION OF BERRIES

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The parent species of **garden strawberry** *Fragaria* x *ananassa* spread on the plain and mountainous areas of Eurasia after the last Ice Age. One of its species, *Fragaria chiloënsis* got into Europe from Chile and Virginia strawberry (*F. virginiana*) native to North America is also present in breeding. There are three species native to Hungary: wild strawberry (*F. vesca*) lives from the plains to Alpine regions, musk strawberry (*F. moschata*) appears in similar regions, but it prefers less calcareous soils; *F. viridis* lives in the wild, primarily on more calcareous soils.

They gained the attention of botanists in the 14th-15th century and by making use of their huge diversity, they made successful selection, then effectively cross-breeding them. Ruellius praises garden strawberry related to wild strawberry in his herbal (1536). Gerarde (1597) mentions its red, white and yellowish white breeds. Of course in the beginning, the collection of strawberries in the wild was dominant across Europe, that was how the remontant form was found in the Alps. Musk strawberry proved to be a less suitable gene source as the hybrids of strawberries from Chile and its European relatives. Chilean strawberry was brought by captain Frazier (1712), only five stems survived the long journey to the Netherlands. They recognized its pomological value because the frontilla was guarded vigilantly (Alonso de Ovelle wrote it in his book, in 1646). The hybrids of North and South American species became the ancestors of garden strawberries. Dutch, English, French, then Belgian and German breeders competed with each other to create the new species.

Figure 1: Pages of the Book of Hours of Pannonhalma

Figure 2: Tahi strawberry on a stamp

Essentially, this provided the source of strawberries in Hungary and the types of its cultivation. Béla the Blind founded the city of Prešov (Eperjes in Hungarian, containing "eper", the Hungarian word for strawberry in its name) in 1132 where there were a lot of strawberries in the forests; it was even represented in the coat of arms of the city. The view of nature and struggle to find symbols of the Middle Ages and the Renaissance highlighted strawberry by any of its species, varieties. The three-folded leaf of the strawberry stem elevated it to be a symbol of the Holy Trinity in most of the Christian world. Its white flowers represent cleanliness and its mostly red fruit can be fitted into the story of the death of Jesus Christ. The marginal illuminations of the book of hours in the Low Countries depict the wounds in the Passion of Christ or the martyrdom of saints with the fruit of the strawberry. There are several books of hours among Hungarian antique items, one of the most beautifully illustrated one is the book of hours of Pannonhalma (circa 1500). Of course, the monks did not create plain and dull margins, therefore the date as well as often the date and time can be set.

Trapezuntius corvina is very precious. It was made in Buda but ended up in Istanbul as a war trophy and it depicts a lot of strawberries and blackberries. Later, various documents, letters contain valuable information on strawberry. János Dessewffy makes excuses in May 1557 to the royal court in Vienna for not being able to send strawberry to the emperor. András Bagody only sent

Figure 3: White strawberry

Figure 5: Tasty little reds in tree

Figure 4: The gooseberry of the Grimani Breviary (in the background)

three buckets of strawberries to Boldizsár Batthyány in June 1575 that was a big sensation even at that time. György Lencsés (circa 1570) and then the Dictionarium of Verancsics (1595) mention it as 'eperj'; then István Mátyus wrote about it in 1787: „Regarding its tastes, the strawberries are closer to pineapple, especially those big kinds…" Rácz (2014) collected a lot of its folk names, the special tool for picking *Fragaria viridis* (in Hungarian: csattogós "clattering" strawberry) was the clatterer.

It is the attribute of seduction in the pictures of Hieronymus Bosch (blackberry is for lust). The dictionary of Molnár Albert Szenczi (1604) contains "epery", Dávid Baróti Szabó (1779) regards "szamóca" (Hungarian word usually used for wild strawberry) to be a loanword; in its scientific Latin name, "fragus" or "tasty" is the root for the word *Fragaria*. In Garden of Poson (1667), János Lippay mentions both collected and cultivated garden strawberry. The latter can be cultivated with a lot of effort, but it is much tastier than those growing in the wild and bearing small fruits. Around Bratislava, it was grown in between rows of grape vines or in the gardens, propagated from offshoots. The forms with red and white fruits were both known to the scientist monk who found white strawberry to be especially sweet.

Mihály Csokonai Vitéz (1797) was inspired by strawberry to write a poem, he even compared it to the lips of young women for kissing as it is also compared to them now. In the 19th century, mostly French and German varieties appeared in the gardens as well as Dutch and English ones on a smaller scale. Its certain concentration can be observed: its cultivation had become more substantial in smaller settlement groups of Nógrád, Pest, Bács-Kiskun, Győr-Sopron-Moson, Szabolcs-Szatmár-Bereg counties. But after 1875, phylloxera infestation "freed up" new grape-cultivating areas, it was the time when its valuable cultivation area in the Danube Bend was formed. Szentendre Island became its optimal cultivation area, the local breed of the German Lujza variety became main variety but since then, unfortunately the "Tahi strawberry" has been almost completely eliminated.

Gooseberry or "köszméte", *Ribes uva-crispa* (*R. grossularia*) can be found in northern and mild climate parts of Europe as well as the forests of Siberia to Manchuria and Northern China; but it can also bear fruit on the Western side of the Himalayas and Atlas Mountains, too.

Figure 6: Jonkheer van Tets

Figure 7: Josta (species hybrid)

Many forms of it live wildly, it is a colline-prealpine species, it has become rarer in mountain areas. Its first depiction can be found in the Grimani Breviary of Venice (late 15th century) but its description was published way earlier, in a 12th century French psalter. In 1589, Clusius got shrubs with red berries from the mayor of Amsterdam. In the 18th century, the English, and in the 19th century, the Americans excelled in breeding them.

It probably reached Hungary via Poland. In 1595 according to András Beythe, it is highly recommended for pregnant women but it found its way into the pharmacies due to other goals. In 1667, Lippay mentioned varieties with plain and pubescent, red and green fruits; they were used for various meat meals, furthermore, for meat soup, pastry, too. Tusser (1573) and Rea (1655) described the varieties "Ivy", "Dutch White" and "Green" as well as "Hedge-hod". Mawe (1778) introduced 24 (!) varieties in his horticultural work, including round and oval, plain and pubescent, red, yellow, white and green fruits. The great phylloxera infestation gave momentum to its Hungarian cultivation, it was cultivated on 300 acres at the end of the 19th century on the hillsides of Szentendre and Gyöngyös, then the "Hajdúság" became gooseberry producing area. The appearance of powdery mildew from the New World created a whole new situation.

Golden currant (*R. aureum*) came to Hungary from the New World. It is spread less because of its fruit and more as a subject of gooseberry. Contradictory opinions are known about its graft, some claim that it was introduced due to German influence or the success of a farmer from Abony in Debrecen. Today, approximately 500 varieties of it can be found in cultivation. In Hungary, the local varieties of Szentendre, Gyöngyös and Debrecen and the varieties selected from them have become prevalent. Billard, a Frenchman with a tree nursery started to market gooseberry without thorns in the second half of the 19th century. Strangely, these type of varieties did not spread. In 1953, the hybrid of gooseberry and currant (*R.* x *culverwelli*) appeared and it is spreading even today.

Returning to linguistic records, it is in the Wordbook of Bistrița (Beszterce) as agrestum around 1595, originally meaning unripe grape. György Lencsés (circa 1577) also mentions the name "piszke", updated by Kresznerics in 1831; there are several other names in the dialect atlas, "piszke", "biszke", furthermore, "büszke" is also a form that has survived even to this day. The Latin 'agrestum' circulated in Europe conveyed by the Neo-Latin languages.

Balázs Szikszai Fabriczius mentions it as "omphax" in Nomenclatura (1590) meaning "unripe grape" in Latin: "one was expecting grape, picked only gooseberry" – held the old saying. Miksa Natter-Nád had an interesting deduction because the word "piszke" can be derived from the cleaning of it, from "peszmog" because a part of the petals remains on the berry dried. In the vocabulary of Ferenc Pápai Páriz (1708 and 1767), the work of József Benkő (1781), at Dávid Baróti Szabó (1784), in the Diószegi – Fazekas vocabulary (1807) and the Czuczor – Fogarasi vocabulary (1862-1874) both "uva crispa" and "uva spina" denote the same: thorny gooseberry with mildly sour fruits. Latin "grossularia" also means unripe – in this case – fig; Ruellius who was a prebend in Paris also mentioned this explanation in his herbal.

Although the cultivation of currant varieties is not of an outstanding volume in Hungary, it is rich in wildly living species that had a role in the forming of currant breeds. Rock red currant (*R. petraeum*) can be found in Bükk Mountains, it is a glacial remnant; alpine currant (*R. alpinum*) is a part of montane-subalpine flora; redcurrant (*R. rubrum*) is a planar-colline species and blackcurrant (*R. nigrum*) is also native to planar, watery areas in floodplains (Hanság, Kisalföld, Gödi-sziget) but cultivars can easily become wild.

The cultivation of currants started around Mainz and Passau with the domestication of rock red currant and *R. spicatum*. In the beginning, it was used exclusively for medical purposes. In the Herbal of Geralde, he called it a garden fruit, both parent species derived from forest currant. Lippay mentions red, white and black species

Figure 8: Fruit of red raspberry

Figure 9: Fruit of yellow raspberry

groups in the Garden of Poson. Its naturalisation in Hungary started in Rákoscsaba, then continued in Fertőd–two breeds are reminders of its place of origin: "well-yielder of Csaba" and "long-clustered of Fertőd". Blackcurrant became liked in the 20th century, although Lippay and then Veszelszki described it, too. Melius Juhász did not introduce it in his Herbarium, although he used Kräuterbuch of Lonicerus as a source that mentioned currants.

In 1583, Clusius adopted the name "tiny seagrape" from István Beythe that became little grape of St. John. It has many folk names, the currently used "ribizli" has been known since 1720, this word of ours originated from Germany. Many herbals call it *Ribes* but its etymological origin is very doubtful because Danish and Arabic influence can be observed in it. In the 15th century, Reinie Benedetto wrote rhubarb as ribes. But Hieronymus Bock introduced it in 1539 as: "A nice little bush that bears tasty, red John-grape, it is gladly planted even in decorative gardens".

In Fertőd, Aladár Porpáczy the Younger and the Elder cross-bred current breeds; by cross-breeding blackcurrant and gooseberry, a new species was created ("riszméte", "rikő") that quickly became popular thanks to its resistance to illnesses and the size of its clusters and berries.

Raspberry, *Rubus idaeus* is a fruit that has been collected and consumed provenly since the Neolithic Age; it is also frequent in the waste dumps of the Swiss pole buildings; it was found in Hungary from that age, too. Its values were recognised by both the Greeks and Latins as well as the Chinese and Indian healers in the Antiquity. In the 4th century, Palladius wrote about it as a cultivated fruit. More than a thousand years later, Turner praises raspberry in a similar way, he knew of more than 20 of its breeds. Lippay also dealt with it, he observed the quality differences between raspberries collected in the garden and in the forest. Scandinavian people in the 16th-17th century made wine of it, according to a German saying "red raspberry wine makes the pain and suffering go away".

It is also frequent in names of places, especially where it can naturally occur, e.g. in geographic names: "Málnapatak" (1514) in Nógrád county (literally meaning "Raspberry Creek") and in Transylvania (Málnás, 1266; literally meaning "Raspberry-y"). József Csapó (1775) and József Benkő (1783) mention it as the embroidery of Mary or e.g. "embroidery tree". Ferenc Entz described four types of raspberries (common red, Chili, Fastolf and Maltese or white) in his Notebook of Horticulture. Due to its scientific name, Linné established that raspberry appears in Asia Minor and Crete because its name means „Rubus of Mount Ida". Other raspberry species also had a role in creating new breeds sich as the Mysore/Ceylon/hill raspberry (*R. nivaeus*) that is cold resistant and bears very sweet fruit; another valuable wild species is the black raspberry (*R. occidentalis*) and can be clearly distinguished from raspberries with dark blue fruits; there are a lot of geographical names in the USA that are related to raspberry. The raspberry breeds of Fertőd and the blackberry-raspberry of Fertőd (*R.* x *mohácsyanus*) are known but the raspberry of Szentendre should also not be forgotten.

There are many species of **blackberries** in Hungary, Soó (1966) described around 50 species, and there are widely spread species or so-called microspecies in small areas. The following ones are the most important: *R. fruticosus*, European dewberry (*R. caesius*), stone bramble (*R. saxatilis*, protected species!), *R. serpens*, Himalayan giant blackberry (*R. procerus*) and *R. hirtus* blackberries are mainly important in Hungary from a floristic point of view because the parent species in cultivation are Western European (*R. laciniatus* etc.) and USA species (*P. argutus*, *P. ursinus*, *R. macropetalus*).

The domestication of blackberry can be traced back to 1829. According to the report of Lovett, he collected blackberry stems from the forest that he selected. Today, blackberries with stiff nodes and without thorns are the most popular, they are widely cultivated in Hungary, too.

Figure 10: Downy blackberry

Table 1:The morphologic comparison of raspberry and European dewberry

Property	*Rubus idaeus*	*Rubus caesius*
Type of shrub	turion	stolon, rooted
Direction of stem	upwards	mostly horizontal
Leaves	5-leaflets	3-leaflets
Underside	whitish, downy	bare, green
Place of flower	terminal (3-leaflet)	terminal
Flower type	raceme	short dicyma
Surface of fruit	hairy	barely hairy
Color of fruit	red, yellow, white	glacous blue
Chromosome number	2n=14	2n=28
Ploidia degree	2n=28, 42	(2n=42, rare)
Ecological feature	colline-subalpine	plain-prealpine

Many blackberry species were known even in the Antiquity, Galen, Dioscoride and Pliny dealt with it, Ovid also praised it. Its fruit was consumed and its healing effect was also used („goutberry"). András Beythe emphasised this value of it in his "Fives könüv".

In diplomas, it is known since the 14th century: dumus rubi (1344), rubetum (1471); the Wordbook of Bistriţa (Beszterce) knows about it (1395 k.) as well as the Schlägli Wordbook (1405 k.), one of the Strassburg Incunables (1486) and the Cluj-Napoca (Kolozsvár) Glossary (1550-1557). The word "csipkebokor" (today: rose hip bush) (see Melius Juhász 1578) was mostly used for *Rubus fruticosus* but its earliest name can be read as "szedery". In the Bible of Gáspár Károli, the burning bush could have been the *Rubus sanctus* that can also be the "source" of the menorah.

There are many names used for blackberry in various languages and also in old Hungarian and regional languages; but in the Diószegi-Fazekas Herbal, the old word form was used for the same as for protected "kövi szederj" (stone bramble). It can be only observed after the spread of *Morus* species mainly in Transdanubia that folk language uses blackberry tree instead of strawberry tree; this was adopted by literary language. The duality is already in the Garden of Poson of Lippay (1667) and it continues to exist among the Hungarians in Slovakia, too. Obtaining real tea proved to be difficult for a long time, the use of the leaves of European dewberry was invented to substitute it. In Hungary, a company named Herbária bought these. Today, raspberry and blackberry is cultivated – and collected – for its fruit: it is used freshly, frozen, for jam, juice or rarely for wine.

Figure 11a: Rubus sanctus

Figure 11b: It became the menorah

Figure 12: Fruit of cultivated blackberry

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THE ROLE OF THE AGRICULTURAL – ENVIRONMENTAL PROGRAM IN SOIL PRODUCTIVITY MANAGEMENT

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From 7th November 2015 to 31st December agricultural producers will be given the opportunity to apply for agricultural – environmental management support. The form of rural development support known as 'AEM' has made an impact among producers and agricultural experts in Hungarian agricultural production for the last 13 years.

When the National Agricultural Environmental Program started back in 2002, 2.2 billion HUF was allocated to it in the Hungarian budget. When Hungary joined the European Union, thanks to 80 percent EU funding the amount that could be paid in the form of AEM support within the framework of the National Rural Development Plan (hereafter: NRDP) rose to 42 billion in 2004. Under the first complete Hungarian rural development program, called the New Hungary Rural Development Program (hereafter: NHRDP-AEM) which was adapted to the seven-year planning cycle of the European Union, the AEM support scheme restarted in 2009. The financial resources of NHRDP-AEM increased in proportion to the resources of the NRDP AEM and in 2010 56 billion HUF was paid out. Compared to the earlier versions, the requirements and rules of the support program, called the Rural Development Program – AEM (hereafter: RDP-AEM), which started this year, are different, while the professional goals have remained the same for more than a decade.

The goal of AEM support is to foster the development and the long-term existence of agricultural production techniques that promote environmental sustainability and the protection of nature, at the same time ensuring the conditions for quality food production and encouraging the creation of a sustainable agricultural environment for the long-term. Farmers (who join the program voluntarily) undertake to comply with the requirements and rules and are compensated in return for any losses that accrue due to meeting the program specifications (such as undertaking extra activities or incurring extra costs).

To foster the sustainability of agricultural production it is essential that soil conditions should be maintained at an appropriate level and the condition of poor soils should be improved. Soil protection should play an essential

role in modern agriculture as soils are not only support media, but also living systems. The amount of soil that is available is limited, and its quality is decreasing, which means that soil protection is of high importance. Our soils are deteriorating in terms of both quantity and quality. Soil compression, erosion, decreases in organic matter content and the depletion of nutrients all necessitate the creation of a more conscious system of management. The AEM, reintroduced this year, focuses on managing these issues.

The functions of soil:

- soil is a conditionally renewable natural resource (when used, its quality does not necessarily decrease, but maintaining its sustainability requires conscious activity: this includes practical use of the soil, agrotechnology and amelioration);
- it is a habitat for soil-based microorganisms and a growth medium for plants and cultivars;
- it is a medium for the production of primary vegetation biomass;
- it is a storage medium for water and plant nutrients;
- it acts as a buffering medium for natural and human stressors;
- it works as a filtration system which can protect deep-layer water reserves from surface pollution.

In Hungary, the following soil degradation processes are most common:

- water erosion,

- wind erosion (deflation),
- acidification,
- sodification,
- compression,
- extreme ground water situations,
- biological degradation,
- a decrease in mould and nutrient content,
- a decrease in buffering capacity and an increase in toxicity.

There are several ways of dealing with these problems. Important are the selection of suitable soil cultivation tools, the cessation of farming techniques that involve soil turning, more conscious use of crop rotation, creation of an optimal crop structure and the growing of plants that improve soil structure and water supply. To maintain soil fertility it helps to grow plant species of different types (e.g. autumn/spring, mould increasing/decreasing, deep/shallow root structure, nitrogen increasing/consuming, early fast/slow growth, weed repressing/fostering, etc.). On erosion-sensitive soils it is essential that vegetation cover is continuously maintained.

ORGANIC MATTER RESUPPLY

There are several ways that organic matter can be supplied to the soil. Fertilizers have been used for a long time to maintain the nutrient content of soils and promote plant yields. It

is certainly necessary to resupply nutrients to the soil, as when cultivated vegetable parts are collected, nutrients are lost with them. The basic principle of maintaining the productivity of soils is that the amount of organic matter, macro and micro elements that are removed through plant cultivation should be resupplied to the soil.

During plant cultivation there are two ways to resupply nutrients: organic manuring and artificial fertilizers. Organic manures are of several types. They include stable manure, liquid manure, green manure, raw and fermented straw manure, the stubble and root remains of papilionaceous and spiked crops, composts, turf and other industrial organic waste.

Stable manure is basically a mixture of animal excrement and bedding materials which is mixed into the soil following fermentation. Its use goes back to the time when animal husbandry began, and it is still one of the most important manures. Stable manure is considered to be an essential link between good plant cultivation and animal husbandry. Good quality stable manure improves the structure of the soil, resupplies nutrients and increases the mould content of soils. Stable manure has a beneficial effect on soil structure, air, heat and water management and supports useful microorganisms. Unfortunately, industrially produced artificial fertilizers have radically decreased the share of stable manure that is used, although due to its multifunctional nature stable manure cannot be fully substituted. In addition to this fact, a decrease in the number of domestic animals has also resulted in smaller amounts of stable manure being generated and used.

Another way to enrich the soil with organic matter is by using **green manure**.

Green manure plants are a mixture of cultivated plants or plants which cover the soil in a layer of vegetation. They should be mixed into the soil in their entirety at the stage of the first flowering after sowing to improve the fertility of the soil.

The effect of green manuring mostly depends on the quantity of green plants that are mixed into the soil. Green manuring not only increases the nutrient supply of the soil, but it also modifies nutrient composition and quality.

Nowadays, there are three different ways of doing green manuring:

- green manure plants of summer sowing,
- plants of autumn sowing that overwinter,
- intercultural plants mixed into the soil.

Green manure plants include, for example, oil radish, white mustard, phacelia, and lupine.

The nutrient content of soils can be significantly improved by using various composts. **Composts** are manures produced during the aerobic decomposition of organic matter. The raw material used in compost may be almost any kind of organic matter: green remains, animal manure, or the organic part of community waste, etc.

The regulations contained in RDP-AEM include restrictions and specify additional agricultural activities that should be carried out. The restrictions, due to their nature, have protective functions. The termination of a harmful activity may support the maintenance of soil quality in several ways. Additional activities may have protective functions, may create the basis for more conscious nutrient management, or by defining optimal crop structure can support nutrient uptake. As the nutrient supply capacity of soils depends on more than one characteristic, the specific regulations apply to several functions of the soil. The following categorization is based on how the AEM regulations prevent or slow down soil degradation processes.

SOIL PROTECTION REGULATIONS

These restrictions aim at protecting soil structure, limiting pollution, maintaining biological health and preventing erosion.

• No machinery can be used if a soil is waterlogged;

• The use of waste water, waste water sludge and compost containing waste water sludge is prohibited;

• In erosion-sensitive areas, tobacco, sugar beet, cattle-turnip, potato and artichoke cannot be grown;

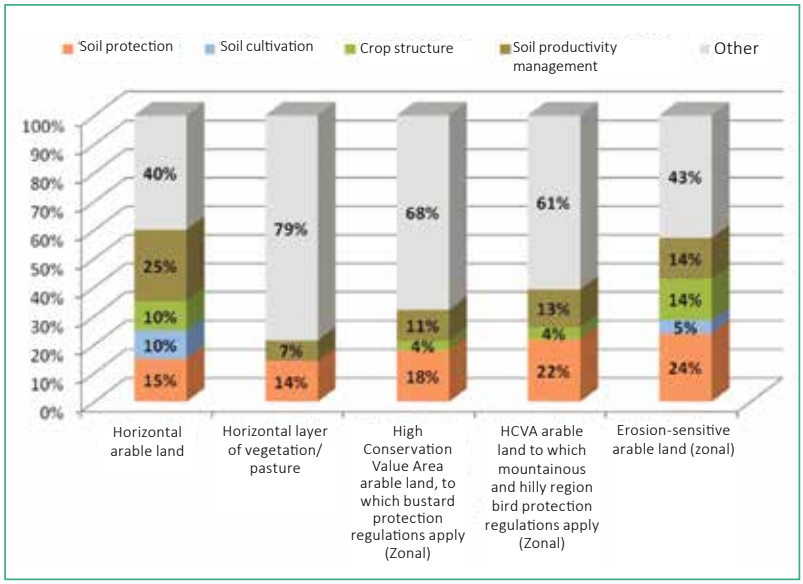
• A layer of grassy vegetation should be maintained on the on surface of the soil;

• N supply should not exceed 90 kg/hectare/year in the case that nutrients are supplied;

• Pesticides and soil disinfectants cannot be used;

• Soil cover should be maintained in the case of spring sowing by using cover plants or leaving stubble on the field until at least 28th February;

• Watering is prohibited.



SOIL CULTIVATION REGULATIONS

The primary goal of these regulations is to ensure maintenance of the optimal soil structure and water levels, and through the correct directions and techniques of soil cultivation to prevent soil erosion and salinification. Improper methods of soil cultivation may have no direct effect on the organic matter condition of the soil, but in the long term may lead to the degradation of soil structure and washing out of organic matter. The regulations specify:

• Medium-deep loosening a minimum of once every 5 years;

• No-turn soil cultivation methods;

• The use of contour cultivation in erosion-sensitive areas if cultivation areas are of over 20 hectares in size

• Immediate closure of soil after stubble stripping.

CROP STRUCTURE REGULATIONS

The effect of papilionaceous fodder plants on the soil is well-known. Such green fallow has a positive impact on the biological condition of the soil. However, the cultivation of hoed plants is risky in erosion-sensitive areas.

• In terms of crop structure, 15 percent should be rough papilionaceous fodder and a minimum 5 percent green fallow. This regulation applies to the areas specified in the regulations (every 5 years if under 100 hectares of land, or/and every year if over 100 hectares).

• Over the whole area specified in the regulations the cultivation of perennial cultures (filiform papilionaceous plants, their grassy mixtures, green fallow), or when main crops are concerned, the following crop structure should be ensured: minimum 20 percent eared crops, minimum 20 percent filiform papilionaceous fodder (perennial filiform papilionaceous plants or a mixture of them or a grassy mixture), minimum 20 percent green fallow, minimum 10 percent autumn coleseed, maximum 20 percent other cultures. The regulation applies to the specified areas (every 5 years if under 100 hectares of land, or/and every year if over 100 hectares).

• The proportion of hoed plants should not exceed 20 percent of all crops on a yearly basis.

• The cultivation of perennial plant cultures (filiform papilionaceous plants or their grassy mixtures, green fallow), or in 5 years the following crop structure for main crops: minimum 30 percent eared crops, minimum 20 percent perennial filiform papilionaceous fodder (perennial filiform papilionaceous, or a mixture of them, or a grassy mixture), minimum 20 percent green fallow, maximum 20 percent other cultures).

• Over the entire area specified in the regulations the cultivation of perennial cultures (filiform papilionaceous fodder, a grassy mixture of them, green fallow), or in 5 years the following crop structure for main crops: minimum 20 percent eared crops, minimum 20 percent perennial filiform papilionaceous fodder (perennial filiform papilionaceous, or their mixture or a grassy mixture), minimum 20 percent green fallow, maximum 30 percent other cultures.

• A yearly minimum 20 percent filiform papilionaceous fodder and minimum 20 percent green fallow in the crop structure. The regulation applies to the categories specified (every 5 years if under 100 hectares of land, or/and every year if over 100 hectares).

SOIL PRODUCTIVITY MANAGEMENT REGULATIONS

Conscious planning is essential for optimal nutrient management. As a result, the regulations contain requirements about soil examinations, expert involvement and planning. In harmony with the supporting goals of AEM,

the use of organic nutrient substitution materials play an important role in nutrient resupply. The regulations specify:

- preparation of a nutrient management plan based on a soil examination with the involvement of soil experts
- the cultivation of green manure plants at least once every 5 years, or the spreading of stable manure or bacterium manure.
- a detailed soil examination in an accredited laboratory.
- once more every 5 years the cultivation of green manure plants, or the spreading of stable manure or bacterium manure.
- the involvement of plant and soil protection experts in management.
- The prohibition of manure-spreading; nutrient resupply should be ensure through natural fertilization from grazing animals.

The use of stable and bacterium manure is necessary only in case of horizontal arable land (as specified in the regulations) when the material can be turned and mixed into the soil. In the case of grasses (as also specified) when the material cannot be turned into the soil only animal excrement can be used. The use of all other types of manure is disallowed.

THE APPEARANCE OF SOIL REGULATIONS IN AEM THEMATIC CATEGORIES

The former AEM target programs have been replaced by so-called thematic regulation groups within the RDP-AEM support system. These include a number of compulsory and optional regulations which a farmer can freely choose to apply, subject to some limitations. The figure below shows the relevant soil regulations in the thematic regulation groups based on the categorization provided earlier.

This figure clearly indicates that the issue of cultivated land protection mainly affects arable lands. Less than a quarter of the regulations which apply to horizontal grass are related to soil. 60 percent of horizontal arable land regulations relate to soils, while the proportion for erosion-sensitive arable lands is only 57 percent; however, the majority of these rules are compulsory. It is not by accident that the highest proportion of soil protection regulations (24 percent) affect erosion-sensitive arable lands. The same regulations for permanently grass-covered areas are designed to foster maintenance of soil structure and promote the pollution-free condition of such areas, and to substitute for erosion prevention techniques. Due to the risk of erosion, of the two categories of High Conservation Value Areas (HCVAs), most regulations about soil protection apply to mountainous and hilly regions.

25 percent of the regulations that affect horizontal arable land relate to soil productivity management, which shows how AEM goals are designed to shift the focus of farming towards the use of organic materials in order to ensure the long-term sustainability of the fertility of the land.

AEM support encourages the creation of an environmentally-aware farming system, in which production takes place in a closed system in which plant cultivation, animal husbandry and nutrient resupply are in harmony. New applications for AEM support can be submitted electronically through customer centers between 7th November 2015 and 31st December 2015.

For more information about the support system, the following websites may be consulted:

https://www.szechenyi2020.hu

https://www.mvh.gov.hu

TECHNOLOGICAL POSSIBILITIES OF REDUCTION OF AGRICULTURE ORIGINATED PM_{10}

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ABSTRACT

The main source of primary PM in agriculture is the soil, the secondary PM produced in the air resulting from ammonia. To reduce PM_{10} emission from plant production, different tillage, arable connected and not arable connected technologies are available. Such are timed tillage, integrated pest management, agricultural equipment conversions and soil moistening with water spraying. The use of artificial windbreaks and mulching also helps withholding the erosion caused by the wind, thus reducing PM emissions. Also a wide variety of methods are available during the harvest, which reduces the amount of soil particles and chopped plant material residues getting into the air. The major source of secondary PM, the ammonia reducible with well-timed manure spreading and quick application on the field, in compliance with the specifications of the 'Nitrate Directive'. The amount of dust resulting from livestock breeding can be reduced by changing the feeding technology, moistening the feed or using water or oil spraying. The PM_{10} emission of the manure can be reduced by using additives, covering up the storage or using a biofilter as well. The agricultural machines are also significant emitters of the PM_{10}. Diesel engines produce primary particles (soot), which would be filtered out by using DPF (Diesel Particulate Filter). Shift to gas drive would be a realistic and environmentally friendly solution compared to diesel. Due to lower oil consumption, higher oil drain interval, slower engine wear substantial cost savings could be achieved. By burning of gas, much less hydrocarbon, carbon monoxide and nitrogen oxide would be emitted into the air, unlike use of petrol.

keywords: PM_{10}, agriculture, mitigation, NH_3

INTRODUCTION

During the research we collected applied and suggested good practices to reduce PM_{10} in agriculture. The primary and the secondary PM_{10} fraction reduction technologies were separated, and the sources from cultivation and animal husbandry were distinguished.

Depending on the source, the PM may comprises a variety of materials and that may include elemental carbon, aromatic and aliphatic organic compounds, organic halogenated compounds, metals including heavy metals, trace elements, nitrates, sulfates, and other salts, silicates and other soil-borne materials, last but not least live derived particles, spores, pollen as well.

Considering the formation, the PM can be divided into two groups: primary and secondary originated. The primary PM is formed as solid particle, and directly released into the air. The secondary PM is formed from materials in the air (SO_2, NOx, NH_3 and VOCs). The main source of secondary PM is ammonia (NH_3). The highest amount of ammonia originates from agricultural activities. In the air, the ammonia easily converted into aerosol or is exposed to dry and wet deposition processes. It may be reacted with various acidic compounds, including nitric acid (HNO_3), hydrochloric acid (HCl) and sulfuric acid (H_2SO_4), and as a result ammonium aerosols, i.e. fine particulate matter (PM) are formed.

TECHNOLOGIES SUGGESTED TO REDUCE WIND EROSION

To reduce PM_{10} emission from plant production, different tillage, arable connected and not arable connected technologies are available.

During the cultivation timing, the work is scheduled for a time when the PM_{10} emission of soil is the smallest. So when the surface of the soil is smooth and dry and contains fine-grained soil particles and therefore it is the most susceptible to wind erosion, the cultivation must be avoided if possible. Injection of chemicals into the irrigation system results in fertilizers and pesticides and other necessary plant growing substances directly forwarded out to the

field, thus reducing the use of agricultural machinery. The interconnection of different tillage operations reducing the soil disturbance, so for example fertilizers and pesticides recommended to apply at the same time. Integrated pest management is merging different pest control technologies used in conventional and organic farming. It aims to provide habitat for beneficial insects, reduce the use of herbicides and pesticides, thus reducing the production area for spraying as well as soil operations. Smaller PM_{10} emission and erosion during the cultivation and the harvest available with agricultural equipment conversions including spoilers to exhaust sideways or upwards, diverting, covering against dust, in addition, spraying water during tillage. Wind speed, temperature and humidity have effects on the transport and flotation ability of PM_{10}. In case of high wind speed, minimizing the farming operations can help reduce the dust emissions. The use of water on the soil prior to crop planting, effectively reduces the PM_{10} emissions. The moisture forms a layer on the soil surface and therefore it is more difficult for the particulate matter to release into the air. The practice of precision farming avoids duplication in the conduct of individual operations as well as allows the operations in adverse weather conditions. Reducing the number of cultivation interventions overall, improves soil structure and helps to reduce PM_{10} emissions (Best Management Practices Governor's Agricultural Committee, Second Edition, 2008).

The use of artificial wind blocks (fences, walls, bales of hay) breaks erosion in unprotected agricultural areas. Covering the fields with plants, crop residues or green manure crops inhibits soil movement transport and protects the surface of the soil. With continuous plant growing, the time when the surface is uncovered can be minimized. Reasonable and more homogeneous areas are more favorable in both ecological and erosion perspective.

HARVESTING TECHNOLOGIES

The harvesting of cereals is now fully mechanized and is done by threaded combine harvesters. Among the cultural works before the harvest, the most important step (in PM_{10} dust emission point of view) is the creation of a smooth and groove-free surface, because soil particles may get into the air by the cutting device. During the harvest, the cutting deck raising and lowering carried out by hydraulics, which must be set so that the fully lowered cutter bar skids just touch the ground. When turning at the end of table or during movement without harvest, the reaper should be raised.

PM_{10} emissions from the fodder comes from reaping, threshing and winnowing respectively, therefore prior to harvest the applying of the most appropriate technology is recommended. To mitigate the PM_{10} emission from soil particles resulting from the technologies, increasing of

stubble height is suggestible, which reduce the degree of soil contamination of the feed.

Harvesting in one go is proposed in the case of root vegetables and tuber plants, so the disturbance of the topsoil is really decreased. In case of other vegetables, the precise adjustment of cutting depth of cutters is also suggested, as well as the development of the uniform surface.

PROPOSED TECHNOLOGIES FOR REDUCING AMMONIA FROM AGRICULTURAL AREAS

The proposed technologies for reducing ammonia emission from agricultural areas are related to the ways and circumstances of spreading the manure on these areas. Take into account the nutrient demand of the plants required to grow, the spreaded manure can be minimized based on the specific nutrient content and the expected yield. To determine the missing nutrients making a nutrient balance is recommended, to avoid unnecessary increasing of the N rate and to apply the appropriate amount of all other nutrients. During the spreading of manure, the smooth application and quick incorporation into the soil is the most recommended technology to mitigate the PM_{10} emission related to ammonia. The fertilizer application is bound to an application plan, which most important criteria's is the compliance with regulations of "Nitrate Directive". The wet and cold weather is favorable for slurry application, because it results in less ammonium ion transformation to gaseous ammonia.

The ammonia volatilization comes from the inappropriate application of manure, so in terms of PM_{10} emission reductions work processes such as loading, spreading and plowing should be done at the same time. The depreciation of the manure it is as follows:

- spreaded and immediately inverted fertilizer	100%
- spreaded but inverted after 6 hours	80%
- spreaded but inverted after 24 hours	70%
- spreaded but inverted after 4 days	50%

The significant decrease occurs primarily due to the impact of nitrogen loss (Radics 1994).

AIRBORNE DUST EMISSION REDUCTION RESULTING FROM ANIMAL HUSBANDRY TECHNOLOGIES

Authors found that at livestock farms the dust concentrations were significantly higher in times of feed allocation, so in some cases it is may be worth to consider changing foraging technologies to another one which has lower dust emission.

Water spraying and liquid feeding alone is not effective enough to reduce the concentration of dust. Zheng's studies indicate that the most effective method is the oil-water spraying and mixing the dry feed with animal fat (Zheng et al. 2012). The use of fats in animal nutrition has other positive aspects, as they major sources of energy, improves the incorporation of protein and improve the palatability of feed. However, it should be noted that too much fat has laxative effect (Vetési et al. 2005).

THE POSSIBILITIES OF REDUCING DUST AT ANIMAL HUSBANDRY AND FROM BEDDING

Although we are using buildings in animal husbandry for thousands of years, major changes are not happened in them over time. However at the end of the 19th Century a number of new inventions has have been made that allowed keeping the animals in large quantities. Today, the number of animals often raises to tens of thousands in a single building. But the increase of animals has increased the amount of by-products. The dust generated from shed feathers and leather, as well as manure in these buildings has a magnitude that cannot function without the operation of a proper building design and ventilation system. Therefore in the modern building, the appropriate prevailing sanitary conditions are important elements in preventing the formation of PM_{10}. Employees should always keep the building in its purest state. The liquid and dry manure produced should be removed as often as possible. The ventilation system has a significant effect on hygienic conditions and thus the temperature in the building. The increase of the building's prevailing humidity lead to the reduction of the pollutants in the air, while the increase of temperature usually increases the amount of generated particles. However, the increased humidity could lead to increased infectious bacteria and endotoxin concentration (Banhazi et al. 2009).

Based on the research, the dust concentration in the air of poultry farms is much higher than for other species (Hartung 1998; Seedorf 2000). Whyte (1993) found that the daily dose of respirable dust fraction in poultry farms varies between 2.1 and 28.5 mg / m^3. The occupational exposure limit of dust in the air is 5 mg / m^3 according to the Swedish National Board of Occupational Safety and Health. An overall study investigated Northern Europe's livestock farms (Takai 1998), and a higher respirable dust content was found in sites where freedom of movement was allowed compared to than in cage designed plants. Based on Ellen's (2000) measurements, the concentration of dust in the perchery and aviary systems is also 4-5 times higher than in the case of cage laying hens.

Spraying a small amount of oil into the air at regular times can significantly reduce dust concentration in livestock buildings (Zhang 1998). Using this system the quantity of respirable powder was reduced by 85%, the amount of powder potentially getting into the lungs was reduced by 80% (Bánhazi 2005).

The electrostatic precipitator (ESP) is a relatively long-

known method for filtering dust from air (ESP), which is using an inductive electrical charge. ESP's are already used in industry for more than 90 years. The ESP systems biggest disadvantage is the high cost and the relatively large space requirement. The advantages are the simple and low-cost operation and the ability to also reduce ammonia from the air.

POSSIBILITIES OF PM_{10} REDUCTION ORIGINATED FROM ANIMAL HUSBANDRY

The formation of livestock buildings can also have effects on the magnitude of ammonia emissions. Liang et al. (2005) found that at different mode poultry farms, the ammonia emission of conveyor belt manure removing operating systems (belt housing) is 67 % lower, compared to traditional cage systems (high rise layer housing).

Use and disposal of manure is one of the most challenging parts of animal husbandry by the perspective of the environment. Significant amounts of ammonia emissions occur during the handling and storage. The solid manure often goes through a composting process in order to reduce the volume and the moisture content. A significant drawback of the composting is the loss of valuable N and NH_3, which varies between 3 and 60% (Bernal et al. 2009), thereby reducing the usability of the manure for crop production. Additional materials such as zeolite and biochar can help reduce the nitrogen losses by 52% (Steiner et al. 2010; Luo et al. 2011). The slurry storage released from NH_3 is also a significant loss, as well as anaerobic conditions because CH_4, H_2S and VOCs are generated. The increasing separation of solids (e.g. by adding flocculation agents) will help to reduce the amount of nitrogen entering the store, thus reducing its potential emission even further (Garcia et al. 2009; Pérez Sangrador et al. 2012). Based on studies using flocculating material and lattice resulted in the reduction of solid and volatile materials greater than 90%, COD and nitrogen content more than 70% and the total phosphorus content greater than 50%.The coverage of slurry pits can be a proper solution to ammonia, methane and VOC emission reduction. Permeable, semi-permeable and impermeable coverings exist. Guarino et al. (2006) tested several semi-permeable materials to examine emission mitigation. These materials where corn stalk, wood chips, vegetable oil, swelling clay and wheat straw. The examined (pig and cattle) slurry pits showed 60-100 % ammonia emission reduction in case of using 140 mm solid or 9 mm liquid covering material. The further advantage of the covering is that the trapped gas can be burned as biogas thus producing heat and electricity.

The easiest way of the mitigation of NH_3 in an animal husbandry stables is cleaning the air with use of fans and extractors. By artificial ventilation not only the used air is exchangeable, but the inner temperature and humidity can also be controlled. The appropriate circumstances have a significant effect on the animals' comfort (eg. pigs show different behavior in warmer and cooler buildings) and by this on the NH_3 emission (Ni 1998). Berckmans et al.'s (1994) investigations showed that the temperature and the air flow of the building affects the temperature of the slurry, thereby increasing or decreasing the amount of generated NH_3. The mitigation can be enhanced by biofilter systems built into the ventilation system. In the biofilter system, the polluted air passes through a filter bed, followed by a microbial biofilm/liquid phase where microorganisms finish the biodegradation. The final products are usually water, carbon dioxide, mineral salts and oxidisable organic compounds. Based on studies, biofilter systems can remove 60-75 % of ammonia, 95 % of hydrogen and 90 % of odors from the air. The biofilters are relatively easily and economically applied and maintained, but require fairly large areas, and a higher-capacity axial fan is required to divert the air through the filters.

TECHNOLOGIES SUGGESTED TO REDUCE EMISSIONS FROM DIESEL DRIVEN AGRICULTURAL MACHINERY

The exhaust gas of diesel engines contains particulate matter and soluble materials. The components are soot and amorphous carbon (C); ash, slag and lubricating oil additives; corrosion and wear products; dust from air filtration failure (SiO_2); unburned hydrocarbons (HC); lubricating oil products; sulphate (SO_4) and bound water (Varga 2012). In aspect of PM emission, the prominent fraction is the diesel soot (LITO Technik 2006). At today's engine technology, the Diesel Particulate Filter (DPF) is the most tried and tested technology, by which 99 percent of the emitted soot can be filtered. Particulate filters can be combined according to the various technologies, and can be connected with other

systems, such as diesel soot particulate and nitrogen oxide reduction system (DPNR) or the continuously regenerating filter system (CRT).

The gas drive - be it biological or fossil - provide a realistic and environmentally friendly alternative to diesel drive. Due to the lower oil consumption and higher oil drain intervals result in substantial cost savings. The engine wear will decrease by 30-40%, increasing the gas engine's life term, which promotes waste prevention. The highest advantage of the natural gas (CNG) is that it is the least polluting and also the cheapest kind of fuel among the currently used ones. Compared to the gasoline engines, the gas drive have lower carbon monoxide (by 60-90 %), nitrogen oxide (by 20-40 %) and hydrocarbons (40-60 %) emissions as well.

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