RESEARCHES ON AIR POLLUTION IN CEREAL FARMS

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Abstract

Worldwide, agriculture has become intensive with an increased specialization of farms and regions. By increasing the productive capacity of soil and crop yields, by using fertilizers and plant protection products, agriculture has reached a stage where it is possible to obtain short term profitability of farms but on a long term, a negative impact on the environment.
The main problems encountered are: negative effects on human health, contamination of surface and ground water due to nitrates and phosphates, compaction, soil erosion and degradation of landscape and wildlife habitat as a result of concentration of farms, development of monocultures, dismantling green fences and terraces, wet land drainage, etc.
People living near a farm are likely to be exposed to pesticide droplets in the air and the water consumption or contaminated food.
In this paper were identified and analyzed the existing main pollutants factors of air in vegetable farms specialized in cereals. To estimate emissions of greenhouse gases in a cereal farm, it was conducted a case study.
The main factors identified as agricultural pollutants are: pesticides, odors, smoke, dust, pollen allergen and waste.
The existing corn production technology in the focus company emphasizes the minimizing of CO_2 emissions. Thus, the dose of chemical fertilizer is determined by soil analysis that is performed annually and the recommendations of specialists. Also, vegetal waste are chopped and incorporated, which significantly reduces the amount of CO_2 emissions.
The total amount of emissions is estimated at approx. 2.35 tonnes of CO_2 per hectare of corn and 0.94 tonnes of CO_2 per tonne of corn. Most emissions are from fertilizer, about 56.6% of the total.

Key words: air pollution, cereal farms, CO_2

Most countries have sought to promote and encourage agriculture by research funding, services development and other forms of aid. This explains the fact that since the beginning of last century to the present, agricultural production increased four times, contributing to society development in general. At the same time, agricultural pollution had increased and degraded the quality of certain landscapes.

In the last years, agriculture has become intensive with an increased specialization of farms and regions. By increasing the productive capacity of soil and crop yields by using fertilizers and plant protection products, it is possible to obtain short term profitability of farms but on a long term, a negative impact on the environment.

Can be cited a series of negative phenomena, such as:

℘ *negative effects on human health* (residues of pesticides and chemical fertilizers, heavy metals and other pollutants in soil, water and all food chain);

℘ *surface and ground water contamination* caused by nitrates and phosphates, with major influence on disease degree of local populations, a decrease in capacity of water resources, increased cost of water supply;

℘ *compaction, erosion and soil pollution*, causing a decrease in its production capacity and degradation of water quality and flow capacity;

℘ *landscape and habitat degradation* of wildlife due to increased concentration of farms, the practice of monoculture, the abolition of hedges and terraces, the wet land drainage etc. (Dosskey, MG, 2002, Melanie, Ford et al., 2009, Order No. 1170, 2008).

MATERIAL AND METHOD

In this paper were identified and analyzed the main pollutants factors of air present in the vegetable farms specialized in grain.

To estimate the emissions of greenhouse gases in a grain farm, was conducted a case study in SC AGROCAPITAL SRL Iasi, Iasi County.

As analysis method was used ***The Cool Farm Tool*** software developed at the University of Aberdeen, Unilever plc. by John Hiller.

The Cool Farm Tool is a computer document that allows farmers, producers and organizations interested in agricultural production

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to calculate emissions of greenhouse gases and identify how production methods affect them.

The program was originally developed for Unilever by a research team at the University of Aberdeen and is now widely used by individual farmers, companies that buy agricultural and horticultural products, groups of companies, researchers, governments and intergovernmental agencies.

The spreadsheets have to be completed with specific data such as:

- general information: location, climate, the cultivated area;
- crop management: technological links, crop protection, fertilizer application;
- energy consumption;
- transportation of production.

Based on these data, is calculated the total annual emissions of CO_2 per cultivated area of corn and per tonne of product.

RESULTS AND DISCUSSIONS

The main identified pollutants in agriculture are: pesticides, odors, smoke, dust, allergen pollen, and waste.

One of the agricultural factors of environment pollution that affect the human and animal health is **the irrational use of pesticides.**

The public may be exposed to pesticides in various forms:

1. ingestion (food or drinking water);

2. inhalation (air or dust);

3. skin absorption (through direct contact or through clothing)

People living near a farm are likely to be exposed to pesticide droplets in the air and also at water consumption or contaminated food.

Consumers, who live away from these areas of operation, can still consume animal products and vegetables or are drinking water contaminated with pesticide residues. In addition, exposure via air is possible.

The persistence problem of **pesticides** may be highlighted indicating that this attribute exists in a range from *moderate persistent* (a long life from one to 18 months - 2,4-D, atrazine), *persistent* (up to a lifetime of 20 years - DDT, aldrin, dieldrin, endrin, heptachlor, toxaphene) or *permanent* (lead, mercury, arsenic).

Odors from animal farms affect air quality. Disposal of animal waste on land can exacerbate the influence of smell, in addition, strong winds can move air dried particles. Air quality is also affected by smoke resulting from burning crop residues, and the transmission of allergen pollen, at distances of hundreds of kilometers.

Smoke generated by burning plant waste is composed mainly of small particles, gases and water vapor, with traces of hazardous air pollutants. In certain circumstances, it may have adverse effects on health, especially among people with heart and lung disease. Older adults and children are also in the high risk group.

The most harmful are the particles (or particles in suspension) less than 2.5 microns in diameter (70 microns is the diameter of a human hair). When these particles are inhaled deep into lungs, can damage lung tissue and cause respiratory and cardiovascular diseases.

Short-term symptoms that may occur after exposure to smoke are: irritation of the throat, cough, irritated sinuses, headaches, runny nose, stinging the eyes. Serious reactions are found among people with asthma, emphysema, congestive heart disease and other existing medical conditions, and also in children and the elderly.

Another important pollutant factor from agriculture is **greenhouse emissions.**

Greenhouse gases specified in Annex A of the Kyoto Protocol are: *carbon dioxide (CO_2), methane (CH_4), nitrogen peroxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), hexafluoride sulfur (SF6)* (Kyoto Protocol, 1997).

The main sources of greenhouse emissions from agriculture are: enteric fermentation, manure management, rice cultivation, agricultural soils, burning of savannas, field burning of agricultural waste, solid waste disposal on land, wastewater handling, waste incineration, etc. (fig. 1) (Anne Bennett, 2009; Cestti, Rita et. al., 2003 W. Wang, 2005).

Estimation of CO_2 emissions in cereal farms (case study in SC AGROCAPITAL SRL Iasi, Iasi County)

SC AGROCAPITAL SRL is a commercial society with private capital, founded in 2008 in Iasi County. The company is part of the S.C. SACOM SPA, an Italian commercial company, founded in 1981, that operates on the fertilizers market and agricultural trade.

The SACOM products are results from transforming the natural elements, fertilizers and microorganisms, studied permanently to support a modern and friendly environmentally agriculture.

SC SACOM SPA has focused on the use of natural microorganisms to increase the absorption of fertilizers, creating his own range of bio-fertilizers in agriculture truly effective.

S.C. AGROCAPITAL SRL applies the most innovative technologies and information systems, thus streamlining the consumption of technical means and fuel.

In 2010, the average corn production was 2.5 tons / ha. It was cultivated on an area of 137

ha. In the area cultivated with corn, the production varied widely, due to taken into culture for the first time some large areas of land with a high degree of weeds (table 1).

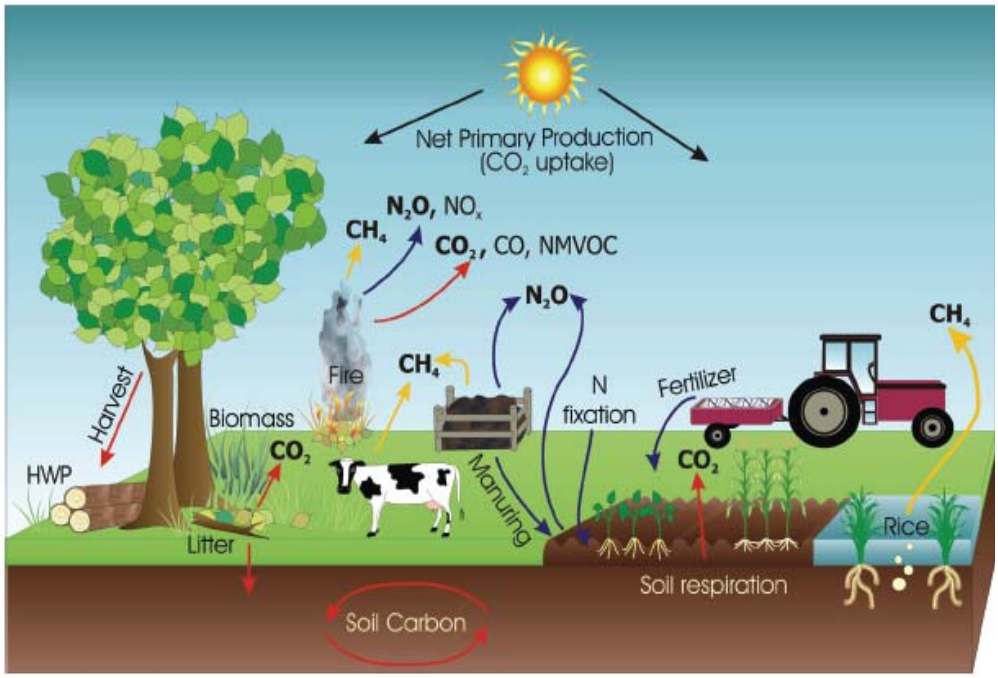

Figure 1 **Sources of greenhouse emissions from agriculture**
(*Source: Keith Paustian and co., 2006)*

Table1

Information for estimating CO_2 emissions in the SC AGROCAPITAL SRL Iasi for the area cultivated with corn in 2010

General informations	
Climate	Temperatures
The annual average temperature - °C	10
Soil texture	Medium
Soil Organic Matter	1.72 < SOM <= 5.16
Soil moisture	Moist
Soil drainage	Poor
Soil pH	5.5 < pH <= 7.3
Crop type	Corn
Cultivated area - ha	137
Total production – tonnes	342.5
Number of pesticide application	2
Crop residue – tonnes/ha	2.85
Crop residue management	Left on field; Incorporated or mulch
Average transport distance of the production – km	45
Type of production transport vehicle	Heavy Goods Vehicle – greater than 3.5 tone
Changes in land use	70% of land was taken into cultivation for the first time
Changes in crop residue management	All crop residue began for the first time to be chopped and incorporated into the soil

In the SC AGROCAPITAL SRL Iasi, corn fertilization was performed in two stages, first one, at seedbed preparation and the second one, with mechanical weed control. The dose of chemical fertilizer has been established based on soil analysis, that is performed annually and on the recommendations of specialists (table 2).

Table 2

Information on the application of chemical fertilizers in the SC AGROCAPITAL SRL Iasi, 2010

No.	Fertilizer type	Dose – kg/ha	Method of application
1	Compound NPK 9:22:25	200	incorporate
2	Compound NPK 3:16:16	150	incorporate

Table 3

Information on the annual consumption of diesel for the area planted with corn in SC AGROCAPITAL SRL Iasi, 2010

No.	Mechanical work	No. of passes	Consumption of diesel fuel - l
1	Plowing	1	483.39
2	Disc harrow	2	1434.62
3	Row crop cultivator	1	398.36
4	Herbicide spraying	2	383.60
5	Fertiliser spraying	2	2082.40
6	Harvest – corn combine	1	2852.42
Total			7634.79

In the mechanical work performed on corn were consumed approx. 7634.79 liters of fuel (table 3).

Based on calculations made with ***The Cool Farm Cool*** program, results the following:

- total emissions from the total area of corn was 321.74 tonnes of CO_2 equivalent, 2.35 tonnes CO_2 per hectare and per tonne of product, 0.94 tonnes of CO_2;

- most of the CO_2 emissions was resulting from fertilization: 56.6% of total (table 4).

Table 4

Estimation of CO_2 emissions in SC AGROCAPITAL SRL Iasi in 2010

CO_2 emissions source	CO_2 (kg)	N_2O (kg)	CH_4 (kg)	Emissions per total area cultivated with corn – CO_2 equivalent – tonnes	Return on:	
					hectare	tonnes
Fertilizers	46032.0	-	-	46.03	0.3	0.1
Emissions induced by fertilizers	-	459.695	-	136.07	1.0	0.4
Pesticides	5617.0	-	-	5.62	-	-
Crop residue management	-	29.443	-	8.71	0.1	-
Changes in total carbon stored (due to the introduction into the culture of new lands)	81296.5	-	-	81.30	0.6	0.2
Energy (diesel)	40922.5	-	-	40.92	0.3	0.1
Transport production off the farm	-	-	-	3.09	-	-
Total	173867.96	489.14	-	321.74	2.35	0.94

CONCLUSSIONS

The main agricultural pollutants are pesticides, odors, smoke, dust, allergen pollen, and waste. People living near a farm can be exposed to pesticide droplets in the air, at water consumption of contaminated food.

An important pollutant factor in agricultural is greenhouse emissions. The main sources of greenhouse emissions from agriculture are: enteric fermentation, manure management, rice cultivation, agricultural soils, field burning of agricultural waste, solid waste disposal on land, wastewater management, waste incineration, and others.

The existing corn production technology in SC AGROCAPITAL SRL, focuses on minimizing CO_2 emissions. Thus, the dose of chemical fertilizer is determined by soil analysis, and by recommendations from specialists. Also, plant residue are incorporated into the soil, leading to a reduce the amount of CO_2 emissions from 5.57 tonnes per hectare, where plant residue were collected and stored, to 2.35 tons per hectare.

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