Agriculture and its contribution to global warming

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Abstract. Global warming has recently attracted attention, and not without reason. According to data collected by scientists, the average temperature on the surface of the planet increases, and thus, sea level rises as a result. These transformations could be fraught with consequences such as natural disasters and other unwanted events. The phenomenon is known to occur as a result of greenhouse gases. There are many aspects associated with the release of these gases. The work is intended to illustrate areas in agriculture involved or responsible for these changes.

1. Introduction
The Global Warming (GW) phenomenon has recently attracted more and more attention, scientists and activists turn to people through social networks and media to unknowledge the problem, and yet, no significant steps are taken towards solving the problem. There are some incidents in favor of reducing or lessening the influences on the subject of matter, but currently there are few actions to solve the problem. This is not for first time the planet has faced this phenomenon. In the past, long time ago, the level of carbon dioxide (CO\textsubscript{2}) was higher than 1000 ppm and the concentration of it today is more than 400 ppm, which several centuries ago was around 300 ppm \cite{1}. However, it is predicted that it will reach 1000 ppm at the end of the century \cite{2}.

Key gases associated with GW are: carbon dioxide, methane, nitrous oxide and fluorinated gasses. The first mentioned is accounted to be the main contributor to the changes in the planet. Emission of this gases into the atmosphere occurs after burning fossil fuels, trees, waste (solid) etc. The following two gases emission can be related with agriculture (partially) \cite{3}. According to the data, agriculture accounts for approximately 25\% of GHG emissions of global GHG emissions \cite{4}.

The following are some common effects of GW: torrential rains and flooding, drought, wildfires, disease outbreaks etc. \cite{5}. However, greenhouse gasses are not the problem, in fact, they keep the planet warm and make life possible. The problem began, when people artificially increased the concentration of GHG \cite{6}. Therefore, it is necessary to find new ways to solve this problem, since it will damage and change the world in which we live.
2. Agriculture and greenhouse gas emissions (GHGE)

It is clear that there is a need to reduce of GHGE, but the reality is that, without further changes in this area, emission will increase dramatically in the coming years. This is due to population growth and therefore requires more productivity to meet needs.

The common areas are as follows: burning of residues (BR), agricultural soils (AS), enteric fermentation (EF), rice cultivation (RC) and manure management (MM).

2.1. Burning of residues

Harvesting on any farm is a crucial part. In small and large farms, the amount and quality of the final product will depend on the way of gathering. On large farms, the process is automated, while on small farms the work is done by the labourforce (most of the time). Nevertheless, after harvesting, the residues are left on the land. The traditional way of disposing of waste is burning them while they are on the land. This type of residues removal is natural, but is still considered a factor contributing to the increase in the amount of GHG. BR is fraught with the release hazardous gasses, both dangerous to human health and to the environment. When BR in the process, the following gasses can form: carbon dioxide, carbon monoxide, nitrogen oxide, methane etc. The contribution of burning residues to the global GHGE is only 0.5% [7].

2.2. Agricultural soils

AS is one of the main sources of GHGE. It produces approximately half of the emissions in agriculture. The main gas produced (emitted) in AS is nitrous oxide. On any farm, the main goal is a high yield. Therefore, synthetic fertilizers are used to increase productivity. These synthetic fertilizers are nitrogen-based fertilizers, which when used give a higher yield as mentioned earlier. Although emission occur even with no cultivation, it is due to the natural emission. Nitrous oxide is formed as a byproduct of microbial activity, which is a process of nitrification or denitrification [7].

2.3. Enteric fermentation

livestock is one of the main components in agriculture. It plays a vital role on farming and contribute approximately 12.9% of global calories and 27.9% of global protein consumed. With population growth, the need in increase production rate will be inevitable [8, 9]. Livestock systems have both advantages and disadvantages. livestock affects global warming by producing natural gasses. Animals that contribute to global warming and the release of methane CH4 into the atmosphere are called ruminant animals such as: (sheep, goats, camels etc). They have a unique digestive system, which differs them from other animals and allows them to digest coarse plant material. EF is fermentation that occurs in the digestive systems of ruminant animals [10].

2.3.1. Manure management. The other side of livestock contributing to emissions is manure. Emission is produced when the manure is in solid, slurry or liquid state. In all states, after excretion, biodegradation occurs and formation of gases occurs. Carbon dioxide and methane are the key gases from manure. Despite the fact that the ability to form gases disappears as the manure cools and dries. Therefore, one can conclude that more effective usage or management will lead to lessening the influence on GW.

2.4. Rice cultivation

For most people living today, rice is a vital element of the diet. It is the staple food of millions of people living in Asia, Africa and Latin America. These areas are densely populated, and thus, rice will be probably their key source of nutrition in the near decades [11]. Therefore, RC could be in demand not only South and East Asia, but also in other areas of the world. like EF, RC is fraught with the methane release to the atmosphere which in fact leads to GW. CH4 in rice fields formed during anaerobic decomposition. Also, emission of nitrous oxide arises as fertilizers (based specifically on nitrogen) are
used [12]. Emission level varies in different countries. Although leading parts of the world of RC are from South and East Asia.

3. Comparison of results
This paragraph focuses on outlining the values of areas that effect GW. The leaders in gas emissions are China, India and Brazil. The following figures illustrate the average values of CO₂ eq (in gigagrams) for each year between 2010 and 2017. Data uploaded from the site «FAO» and the program is called MICCA.

At the first, China is considered. Figure 1 shows the outcomes of AS and its influence to GW. The values are steadily going up until 2015, and then are decreasing from 345,000 Gg to a value of 335,000 Gg. Values for EF varies around 160000 Gg and remains almost constant throughout the chosen period. RC values are steadily going up from 111000 to 114000 Gg. However, the values for MM are steadily decreasing from 66000 to 63000 Gg. Lastly, the values for BR are lower than 1000Gg.

Similarly, the values for India will be discussed. While China has higher AS values, India has higher EF values. Figure 2 illustrates the values for EF. The EF value stayed constant until 2015 (around 284000 Gg) and then approached approximately 290000 Gg. The values for AS vary between 210000 and 220000 Gg throughout the period. Similarly, values for RC also vary between 95000 and 98000 Gg. The results for MM showed that between 2010 and 2015, the values remained at the same level around 28500 Gg and then rose to 29000 Gg in 2017. BR values throughout the entire period remained below 5000 Gg.

At the last, the values of Brazil are discussed. Same as in India, higher values are in EF area. Values can be depicted in figure 3. Values range from 160000 to 170000 Gg. AS values within the period range from 143000 Gg to 165000 Gg. RC values steadily dawns from 37000 to 27000 Gg. MM values are constant and stays around 11000 Gg. And finally, BR values below 2000 Gg.

Observing the results, one can note, that in each country there are different values of emissions in different areas. These differences can be related to the specifics of countries.

![Agricultural Soils (CO₂eq)](image)

**Figure 1.** CO₂ eq for AS (China).
4. Discussion
It is not surprising, the three selected countries are accountable for the dramatic changes. With the combination of population of these countries amounts to almost half the world's population. The results show China is leading in GHGE. The main areas contributing to GHGE are AS and EF. Similarly, India also has EF and AS as areas responsible for GW. However, GHGE from EF is higher than from AS. Like India, Brazil has the same tendency, but has less effect on GW. RC and MM for all countries remain the same position. These two are in third and fourth place. Similarly, BR takes the same place for all three and also has less effect on GW than the others. Turning to the results, one can conclude that the trend of all areas responsible for GW for all countries follows the same trend.

5. Conclusion
In conclusion, the work was prepared to identify the main parts that cause emissions in agriculture. The main areas responsible for GW were discussed. In addition, the participation of the three main countries in GW was examined. The outcomes illustrated that there are similarities in the results of the three chosen countries.
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