CONSULTING FOR THE USE OF "WASTE FERTILIZERS" ON LAND - 20 YEARS OF EXPERIENCE IN AUSTRIA!

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1 INTRODUCTION

Environmental relevance of different utilisation or disposal routes for sewage sludge was the title of David Hiegelsbergers final year project in the agricultural college of St. Florian near Linz, Upper Austria. The focus of this project was the immediate release of CO_2 from different disposal/utilisation routes and the potential of phosphorus recycling through the use of sludge and sludge-compost in agriculture.

2 MATERIALS AND METHODS

2.1 Methodology

The presumption for calculating the C-content of sewage sludge was that 1 t of dewatered sludge (water content 65 %) contains ~ 9 kg nitrogen. The C/N-ratio is ~ 15/1. So 1 t of dewatered sludge contains ~ 135 kg carbon and 1 t dry matter contains ~ 386 kg carbon. If sewage sludge is utilised on land as stabilised, limed or composted sludge, easy to decompose carbon is a valuable energy source for soil micro organisms and the rest of the carbon is stored in soils as humus and humus acids.

In the case of sludge incineration, most of the energy content is used to evaporate the water contained in sludge and nearly 100 % of carbon is emitted as CO_2.

2.2 Phosphorus in municipal sludge in Austria

The amount of P in municipal sludge in Austria is ~ 6.500 t/a. Applications to agriculture return only 1.300 t/a P. The unutilised potential of 5.000 t P/a corresponds with the P consumption of ~ 200.000 ha corn. In 2006 the area of corn grown in Austria was 570.000 ha. These numbers show the potential for treating resources with care by utilising sludge in agriculture and by the recovery of phosphorus of mono-incineration ashes. Additional 3.000 t P/a can be utilised when meat and bone meal would be treated in mono-incineration plants instead of incinerators for mixed waste.

3 RESULTS AND DISCUSSION

3.1 CO2 emissions during utilisation in agriculture

For utilising sludge in agriculture usually lorries are used for road transport and spreading equipment usually consists of tractors with compost spreaders and front- or wheel loader. The CO_2 emission for utilising one lorry load sludge (~ 25 t, water content ~ 65 %) on a field in a distance of 80 km from the wastewater treatment plant (WWTP) was calculated as 229 kg CO_2. The same amount spread on land within 1 km from the WWTP without transportation by lorry produces 104,5 kg CO_2.

3.2 CO2 emissions by incineration of sludge

For incinerating sludge usually lorries are used for the transport from the WWTP to the incinerator. Before the dry matter can be burnt the contained water has to be evaporated. The consumption of energy to evaporate water is not part of this calculation. By incinerating of 1 kg carbon the emission of CO_2 is 3,77 kg. 1 t dewatered sludge contains ~ 135 kg carbon. One lorry load of sludge (~ 25 t, water content ~ 65 %) consists of ~ 3.375 kg C. This carbon is oxidised by incineration to 12.723 kg CO_2 and sent to the atmosphere immediately. For transporting sludge to the incinerator for ~ 80 kg additional 192 kg CO_2 have to be added. The immediate CO_2 emission by incinerating one lorry load sludge is 12.915 kg.

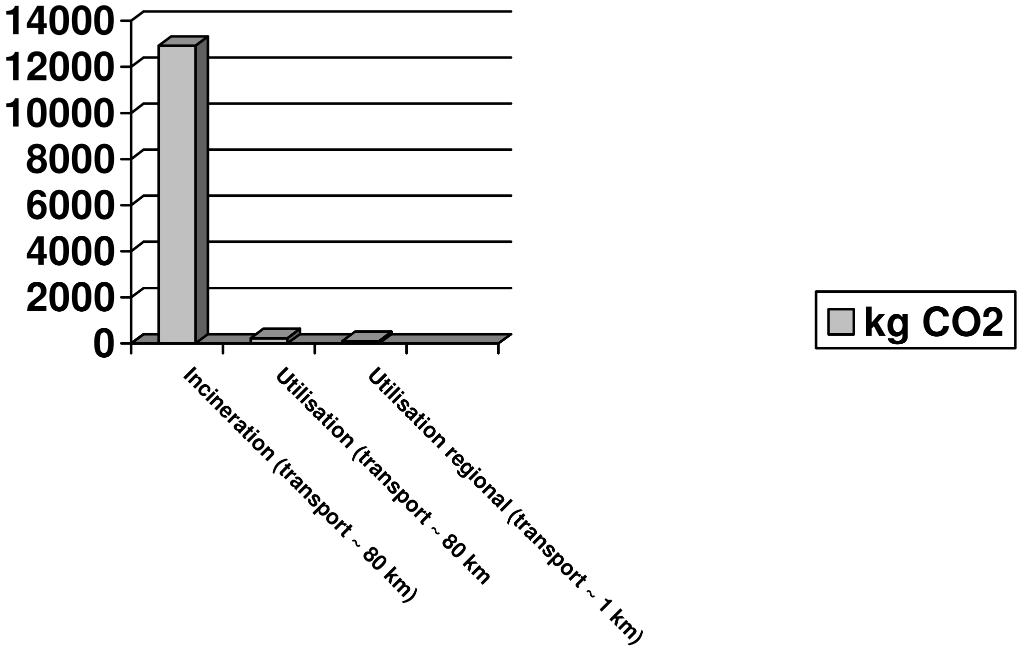

FIGURE 1 **Comparison of immediate co2 emissions by utilisation in agriculture or incineration**

The difference of the immediate CO2 emission between regional utilisation and incineration of 25 t dewatered sludge is 12.810 kg and corresponds approximately with the amount of CO2 a middleclass car (~ 150 g CO2/km) emits on a driving distance of ~ 85.000 km.

3.3 Realisation of potentials by utilisation

During the 6th DWA-sludge days in Fulda, Germany, Dr. Claus-Gerhard Bergs from the German ministry for environment made clear that utilisation of sludge in agriculture is state of the art and part of recycling methods.

An additional benefit of sludge use in agriculture is that it is an easy method for recycling phosphorus and other valuable resources like organic matter, nitrogen, potassium, lime, trace elements etc. The main requirement for use in agriculture is to consider the nutrient content in soils and the crop nutrient requirement. Well designed nutrient management plans are a consistently reliable way of ensuring best use of sludge within short transport distances from source.

The biggest advantage of regional utilisation is the fact, that it can be realised immediately, without need to wait for new technologies, without big investments, without high energy consumption and transport distances. The effect of resource protection is realised by utilisation of any ton of sludge in agriculture when the need is well calculated.

4 CONCLUSIONS

Carbon sequestration in soils is increasingly regarded as an effective method to slow down emissions of greenhouse gases and impact climate change effects. Intensive farming and the use of mineral fertilizers are suggested as reasons why the organic matter content in many soils decreases. So it is urgent to find ways to stabilise or increase the humus content of soils. The question is where to find sources for organic matter to increase the soil organic carbon content which is energy for the soil organisms with the added benefit of better physical and chemical fertility. The dry matter of waste fertilizers like compost from source-separated collected biowaste, sludge from waste water treatment, sludge compost, etc. usually consist of more than 30 % organics. Major nutrients and trace elements are additional contents of waste fertilizers which can reduce the reliance of farming on primary mineral and energy resources. Examples are phosphorus with its limited mineral deposits or nitrogen with its high energy consumption for production of mineral fertilizers. Nevertheless during the last decade the discussions about the use of waste fertilizers on land were dominated by studies about possible pollutions and risk analyses for substances which derive from everyday commodities as well as from industrial processes with much higher emission loads to the environment by other paths, like air or products, than by the waste water stream. When it was decided, that organic waste and waste water sludge are renewable fuels it seemed, that only incineration can be the future treatment and utilisation for them. Co-incineration in coal power-stations or in incinerators for mixed household waste seemed to be perfect solutions because the additional technical requirements to incinerate organics are not very high, continuous treatment all over the year is guaranteed and energy cycle efficiency or resource protection are something nobody asked for.

New developments like the awareness of phosphorus being a limited resource changed the discussions about future treatment and utilisation of waste fertilizers. One minimum requirement seems to build mono-incinerators for waste water treatment sludge to avoid dilution of the phosphorus content in the ash because phosphorus recycling requires minimum concentrations in the ashes. Mono incinerators, fed with sludge containing ~ 20 % dry matter need additional energy to evaporate ~ 80 % water before the organics can be burnt. This fact leads to the question what sense makes a fuel with negative energy cycle efficiency? To gain phosphorus as a fertilizer, additional industrial processes with need of chemicals and energy are necessary. This means additional emissions of carbon-dioxide (CO_2) as well as other pollutants.

The alternative to industrial processes like incineration and production of phosphorus-fertilizers is to spread waste fertilizers on land if the quality fits the requirements for utilisation. Main requirement for the use in agriculture is to consider the nutrient content in soils und the nutrient requirement of plants. Proper fertilising plans are a perfect instrument to ensure a professional use of waste fertilizers within short transport distances. The biggest advantage of regional utilisation is the fact, that it can be realised immediately, without need to wait for new technologies, without big investments, without high energy consumption and transport distances. The effect of resource protection is realised by utilisation of any ton of sludge in agriculture when the need is well calculated.
In 2009 presented his final year project for the agricultural college St. Florian near Linz, Upper Austria to detect the immediate discharge of carbon-dioxide by different treatment and disposal routes for sewage sludge and the potential of phosphorus recycling by the use of sludge and sludge-compost in agriculture.

Main conclusions of David Hiegelsberger´s final year project are:

- Utilisation of sewage sludge and sludge compost within short distances causes least CO2 emissions – regional utilisation should be favored.
- Phosphorus comes by direct utilisation in agriculture to soils and plants without detour.
- Sewage sludge, derived in large wastewater (WWTP) treatment plants, which cannot be used in agriculture directly has to be treated in mono-incineration plants because phosphorus recovery is only possible from ashes with high phosphorus-content.

REFERENCES

Hiegelsberger D 2009. Environmental relevance of different utilisation or disposal routes for sewage sludge. Final Year project, Agricultural College St. Florian near Linz, Austria