

ECOSAN Fertilisers with Potential to Increase Yields in West Africa

Linus Dagerskog, Simeon Kenfack and Håkan Jönsson



Ambroise Dipama selling his vegetables
Foto: Linus Dagerskog / CREPA

In 2002 CREPA initiated a regional research and demonstration programme on ecological sanitation in seven West African countries. ECOSAN is focused on simultaneously improving sanitation and food production. This is done by making urine and faeces more hygienic and then using them as safe fertilisers. Demonstrations showed that crops fertilised with ECOSAN products often gave a higher yield during a longer harvest period.

The research and demonstration programme of CREPA (Centre Régional pour l'Eau Potable et l'Assainissement à faible coût), started in Benin, Burkina Faso, Côte d'Ivoire, Guinea, Mali, Senegal and Togo. During the research period from 2003 to 2005, ECOSAN (Ecological Sanitation) fertilisers were successfully tested on eleven different crops. The table shows the field results from applying urine as a source of nitrogen compared to reference plots (no fertiliser) and plots with NPK and urea.

The agronomic research by CREPA in Burkina Faso was led by Dr Bonzi, head of soil fertility at INERA (the National Institute for Environmental and Agronomic Research). He mentioned that the research showed that hygienised urine can replace urea as a fast-acting nitrogen fertiliser; while hygienised faeces can be used as

Table 1 Urine compared to NPK and urea as a source of nitrogen

Plant		Auber- gine	Gombo	Tomato	Lettuce	Chou	Sorghum	Maize	Manioc	Ground nuts	Cotton	Igname
Country		Burkina	Burkina	Burkina	Togo	Togo	Burkina	Benin	Côte d'Ivoire	Benin	Mali	Cote d'Ivoire
Reference plot	Harvest: Ton/ha	2,8	1,7	2,1	6,8	19,1	2,3	2,4	45	0,44	0,18	4,0
NPK + Urea	Harvest: Ton/ha	17,1	2,6	5,8	13,3	31,0	4,1	3,5	60	0,78	0,38	6,0
PK + Urine	Harvest: Ton/ha	16,0	2,3	5,2	15,7	32,0	3,8	3,6	60	0,56	0,35	8,0

a base fertiliser instead of mineral NPK (14:23:14), which is the most common fertiliser in Burkina Faso. Combining faeces and urine gave very good results. In maize trials the yield was about 30 percent higher with faeces and urine compared to when NPK and urea was used. The total dose of the macro nutrients N, P and K were the same in both cases, but the urine and faeces also provided organic material, micronutrients and a slight increase in the soil pH. Hygienised faeces is therefore recommended as a base fertiliser, if it is available. The recommendation for maize is about 1 tonne of faeces per hectare, or 25 grams per plant. In Burkina Faso the soils are extremely poor in organic matter (less than 1 percent), so the use of hygienised faeces, manure or compost is strongly recommended to improve the soil structure.

ECOSAN fertiliser improves not only production, but also appearance. The ECOSAN-fertilised vegetables looked very nice and their harvest period was significantly extended. These are all important factors for the vegetable farmer who sells his produce on the market.

The use of ECOSAN fertilisers is introduced in the community through participative experimentation with the farmers. The farmers choose the crops to be tested and are assisted in the application of the fertilisers. The ECOSAN-fertilised plots are compared with the conventionally fertilised plots, and this appeared to be a learning process for everyone.

The ECOSAN fertilisers have been renamed in Burkina Faso into "birg-koom" and "birg-koenga", which mean liquid and solid fertiliser. These name change makes it easier for people to get past the mental barrier. Some are also worried about the urine odour. It is explained that the odour is the nitrogen that is evaporating, and that a strong odour indicates a good-quality fertiliser.

The odour is normal – if there is no odour you should be worried!

ECOSAN-fertilised vegetables in Saaba

One of the ECOSAN pilot sites in Burkina Faso is in Saaba, a peri-urban municipality with 35,000 inhabitants, located 10 km from the capital Ouagadougou. In Saaba, 70 UD toilets were built between 2003 and 2005 and about 40 urban farmers were trained on the use of ECOSAN fertilisers. Ambroise Dipama, who grows vegetables on 1.5 hectares close to the Saaba dam, participated in the training programme in 2005. Below are excerpts from an interview with Ambroise.

I first started using ECOSAN fertilisers in 2005, after the training by Dr Bonzi. We were told to store the urine for 45 days and the

faecal material for at least six months. Wood ash is always added to the faeces right after defecation to help kill off the pathogens. I grow mostly onion, which gives the best benefit for me, but I don't apply the urine or faeces to crops that grow directly in the ground, like onion. Instead I use the ECOSAN fertilisers on crops such as aubergine, tomato and zucchini.

If I have access to hygienised faeces I apply it before sowing, about a handful per plant. Urine is then applied during the growth of the plant. If I only have urine and no faeces, I apply a small amount of NPK as base fertiliser first. I apply the first dose of urine about three weeks after sowing or transplanting and then after three weeks again for a second dose. I first make a furrow some distance from the plants and then apply the urine. Water is applied afterwards to dilute the urine and make it infiltrate into the soil. I apply about one litre of urine per square metre during each application.

I have noted several advantages with ECOSAN fertiliser compared to chemical fertiliser. It is clear that the plants give fruit for a longer period. With zucchini for example, the chemical fertiliser gives a lot of fruit but all in a short time, around 30 days, while the fruiting continues up to 60 days with the ECOSAN fertilisers. To me this is very important. The quality also seems to be better. The ECOSAN fertiliser gives fewer fruits, but they are bigger and more beautiful compared to when I use chemical fertiliser. When it comes to taste, I have not noticed any difference. The ladies who come to buy my crops and bring them to the market do not mind my way of fertilising. Almost everyone in Burkina has grown up in a village, and everyone knows that the field closest to the house is the one with the best production.



70 UD toilets were built between 2003 and 2005.
Foto: Linus Dagerskog / CREPA



Dr. Bonzi of CREPA and farmers: a learning process for everyone
Foto: Linus Dagerskog / CREPA

As people became aware of the results, they started to bring their urine to their own fields

I would be prepared to pay for the fertilisers, but not more than I would pay for chemical fertiliser. At the moment though, the toilet owners don't want to sell urine to me, since they know the value it gives to their own land. ECOSAN has been a blessing for me. We now have a toilet that is easy to empty, and that produces safe fertiliser. I buy around 20 bags of NPK (50 kg) per year for the three crop cycles on my land. Where I apply urine I reduce the quantity of chemical NPK by half, but I only have enough urine for about 300 m² per crop cycle. We are 15 people in my family, but many of us work or go to school during the days, so we don't manage to collect as much urine and faeces as I would like. We fill up a 20-litre jerry can with urine in about ten days, which I then take to my field located 1.5 km away. In the beginning I could also collect urine from other households that have UD toilets. However, over time, as people became aware of the results, they started to bring the urine to their own fields to enrich the soil for the next rainy season, instead of giving it away.

Production of ECOSAN fertiliser

The quantity of fertiliser in the urine and faeces from a person is equal to the quantity in the food and drinks consumed. There is an equilibrium in the human body – what goes in also comes out. The human production of nitrogen and phosphorous can be estimated from data on protein consumption (Jönsson et al., 2004). In West Africa the average diet, and hence excreta, contains about 2.8 kg of nitrogen, 0.45 kg of phosphorous and about 1.3 kg of potassium per person per year. This is worth around \$8 in Burkina Faso if compared to the cost for the corresponding quantity of chemical fertiliser (data from January 2008). The population of Burkina Faso (13 million people) has the potential to produce ECOSAN fertilisers worth about \$100 million per year. At the moment Burkina Faso imports chemical fertiliser for roughly the same amount.

60 kg of N per hectare is a recommended fertilisation for cereals in Burkina Faso. This would require the urine and faeces from around 20 people. Basically what is taken away from the field needs to be brought back to maintain the soil fertility. ECOSAN

fertiliser is one step in the direction of more sustainable agriculture, but it needs to be complemented with recycling of organic kitchen waste, crop residues from the harvest and animal manure. Conservation agriculture techniques are also important to reduce soil and nutrient losses by rain run-off and winds.

ECOSAN dissemination and challenges

After the research phase, CREPA started an ECOSAN dissemination programme in ten West African countries (the seven research countries + Congo, Guinea Bissau and Niger), with financing from Sida. In the rural projects, the possibility to gain safe fertiliser was shown to be an important motivating factor for the households when adopting ECOSAN. The challenge in the rural areas, is the prevailing poverty and thus the farmers' lack of money to invest in UD toilets. Low-cost models made mostly of local materials need to be developed if replication is going to pick up. To benefit from a larger scale, reuse-oriented toilets also need to be integrated in national sanitation programmes. In the more urbanised areas, the big challenge concerns storage and transport. Many citizens do not see any use for ECOSAN products (since they do not cultivate), but there is a very high potential production of ECOSAN fertilisers in the city, which could be of great benefit for the urban and periurban farmers.

The first large urban ECOSAN project in West Africa is now being implemented in four periurban sectors in the capital of Burkina Faso, Ouagadougou. CREPA, GTZ (German cooperation) and ONEA (National Water and Sanitation Office) are collaborating in this EU-funded project. 1000 UD toilets are about to be built and the private sector is involved in the construction of toilets as well as in the collection, transport, treatment and delivery of the ECOSAN fertilisers. However, in the preliminary stage, the willingness of the household to pay to get their urine and faeces collected and of the urban farmers to buy the ECOSAN fertilisers does not cover the cost of transportation and the treatment/conditioning at the eco-station. This means that the municipality or the state has to put in money to make the system economically viable. Capacity building and lobbying is now needed so that the authorities understand that investing in ecological sanitation systems benefits several public interests, such as protecting health and the environment and improving agricultural production. NETSSAF (Network for the development of Sustainable approaches for large scale implementation of Sanitation in Africa) is presently preparing the groundwork for wider implementation of sustainable sanitation projects.

Linus Dagerskog, CREPA /EcoSanRes, Stockholm Environment Institute. Email: linusdagerskog@yahoo.fr

Simeon Kenfack, CREPA

Håkan Jönsson, EcoSanRes, Stockholm Environment Institute / Swedish University of Agricultural Sciences

More information:

CREPA www.reseaucrepa.org
NETSSAF www.netssaf.net