WORLD WATER WEEK

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Presentation

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Experiences and opportunities for Human Excreta Fertilizers in improving small scale Agriculture

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Outline

- General problem of agriculture and sanitation in sub-Saharan Africa
- Experiences of CREPA in Human Excreta Fertilizers (research and dissemination)
- Conclusions/Perspectives

General Problem

1. Agricultural problems

Agriculture occupies more than 80% of active people in Sub Saharan Africa

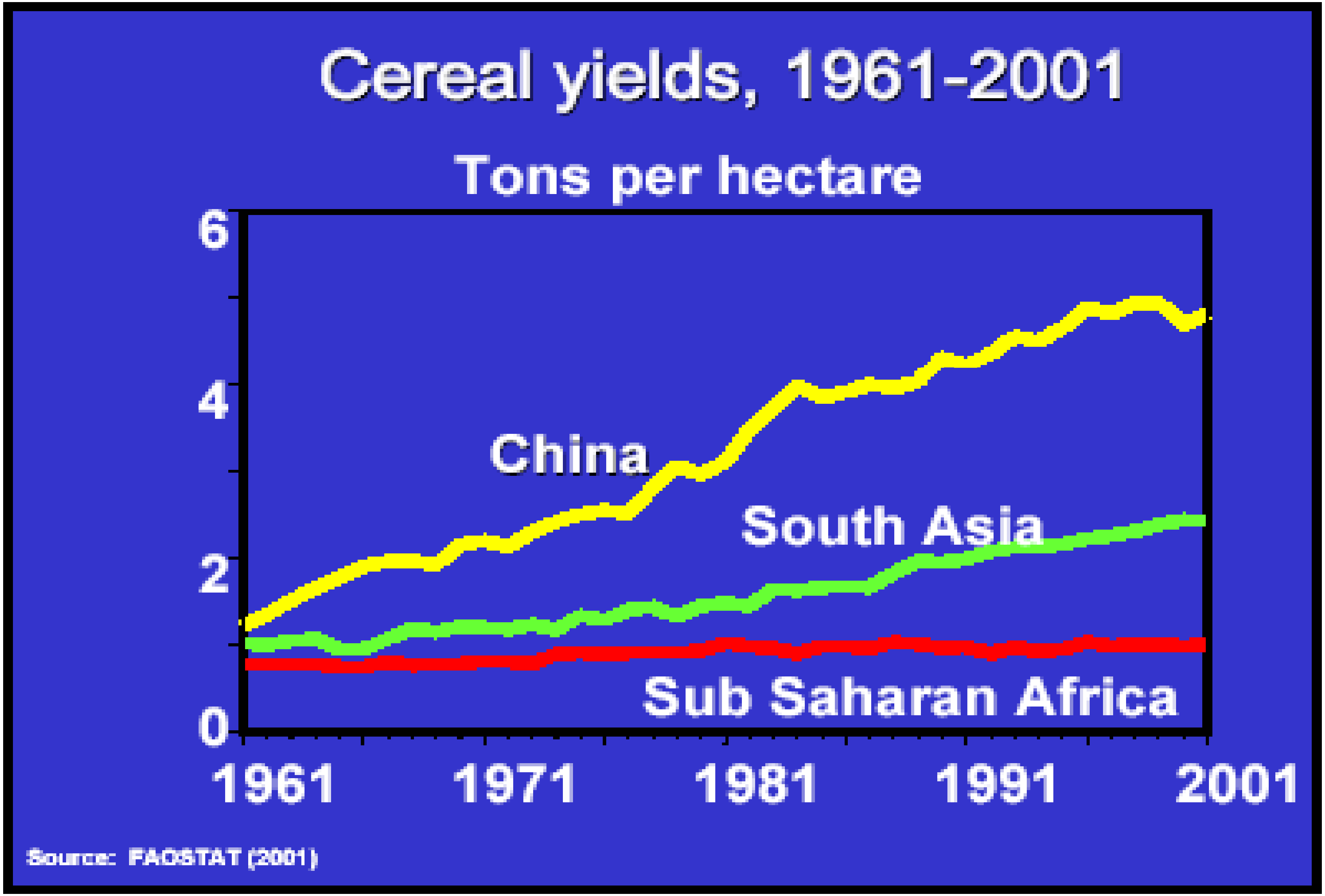
but

The rate of Yields increase = 1%, versus a demographical increase rate = 3%

Consequences

- High pressure on natural resources, mainly on soils that are more and more degraded,

- 200 million people live in chronically hunger conditions



Sub-Saharan Africa stands at the same level of cereal yields since the 60's, while Asia and China have succeeded their green revolution

Actual and potential yields of food crops in Sub-Saharan Africa

	Yield (t/Ha)			
	Maize	Rice	Wheat	Sorghum
Actual yields 1990 (same in 2007)	1.6	2.0	1.5	0.5
Potential yields	> 5.0	5.0	3.5	2.5

Varieties with better performance exist but Sahelian countries are still far from self-sufficiency

Bationo et al. (1990)

Efforts Made to achieve an African Green Revolution…

Development and dissemination of Integrated Soil Fertility Management technologies (ISFM):

- **Soil and Water Conservation (SWC)**
- **Agro Forestry Systems (AFS)**
- **Assisted Natural Regeneration (ANR)**

- **Soil fertility improvement using fertilizers and soil amendments etc.**

but problems remain with fertilizers…

Problems with fertilizers

Mineral fertilizers in Sub-Saharan Africa:

- Non-control of chemical fertilisers quality…
- Soil acidification in the long term…
- Costs become more and more unbearable by small scale farmers…

Obligation to look for alternatives…

Why not Human waste: faeces and urine?

2. Sanitation problems

1. Lack of toilets

2. Management of waste from existing toilets

Consequences of considering human excreta as waste...

- **Health problems**
- **Environmental pollution**
- **LOSS OF NUTRIENTS!**

Need to think differently: waste as resource...

We need to link sanitation to agriculture in order to:

Sanitize and produce more.

Our excreta, as you know, are fertilizers:

- **Rich in N, P, K, and other trace elements**
- **Accessible for everybody**

Need to think differently: waste as resource…

Since 2002 CREPA has experience in ecological sanitation (ECOSAN) promoting the use of sanitized faeces and urine as fertilizer for vegetable and cereal production at small scale farmers' level in West and Central Africa.

2002 - 2005 Research (7 countries)
2006 - 2010 Dissemination (10 countries)

Agronomic experiences with human fertilizers in the CREPA network

1. Control of the agronomic value of faeces and urines

Before any eventual reuse of human excreta in agriculture, it was necessary to know their agronomic values.

Thus lab analysis on the sanitized faeces and urines gave the following results:

Agronomic characteristics of urine

Countries	Urine		
	Nitrogen mg/l	Phosphorus mg/l	Potassium mg/l
Burkina Faso	3002	370	314
Côte d'Ivoire	3600	260	200
Mali	3300	738	-
Senegal	3000	287	439
Togo	4400	800	700

Urines are rich in nitrogen and contain also P and K and other trace elements...

Agronomic characteristics of faeces

	N (g/kg)	P (g/kg)	K (g/kg)
Birg-Koenga = Sanitized human faeces (n=10 latrines)	37	15	22

In Burkina Faso : Faeces are two times richer in N, 8 times richer in P and equivalent rich in K compared to cow manure

12-sept.-08

2. Determination of doses and Dissemination of application techniques at small farmers' level

The research actions carried out in the countries on diversified crops, enabled to determine the doses and application techniques of sanitized excreta for the profit of the small scale farmers…

An example of technical fact sheet of application is presented as follow (example from Burkina Faso)

Example of factsheet for dose and application periods of ECOSAN fertilizers : faeces and urines

Periods	Aubergine	Gombo	Tomato	Cabbage	Onion / carrot	Lettuce (Salad)	Sweet pepper	Courgette	Sorghum / millet	Maize
Doses of faeces	600g / m^2 (6t/ha) or (.200g./ per seed hole	300g / m^2 (3t / ha) 100g / per seed hole	600g / m^2 (6t/ha) (200g./ per seed hole	500g / m^2 (5 t / ha) (100g./ per seed hole)	500g / m^2 (5 t / ha) (10g./ per seed hole)	500g / m^2 (5 t / ha) (25g./ per seed hole)	600g / m^2 (6t/ha) (200g./ per seed hole)	500g / m^2 (6t/ha) (150g./ per seed hole)	50 g per zaï pit (seed hole). Before sowing (or 5-7 days after germination)	
15 days after germination / pricking. (2 weeks)	0,5 litre / Seed hole	0.3 litre per seed hole	0.4 litre per seed hole (Beginning flowering)	0,5 litre / per seed hole		1 litre /m^2 (for 20 plants /m^2) diluted at 100%	0,5 litre / per seed hole	0,5 litre / per seed hole (Beginning flowering)	0,5 litre per seed hole at thinning	0,6 litre per seed hole
21 days after germination / pricking (3 weeks)					1 litre urine / m^2 (for 50 plants/m^2) diluted at 100%					
28 days after germination / pricking (4 weeks)			0.4 litre per seed hole	0,5 litre / per seed hole		1 litre /m^2 (for 20 plants/m^2) diluted at 100%	0,6 litre / per seed hole (1st fruits appearance)	0,5 litre / per seed hole		
35 days after germination / pricking (5 weeks)	0,5 litre / per seed hole	0.3 litre per seed hole							0,5 litre per seed hole	0,6 litre per seed hole
42 days after germination / pricking (6 weeks)				0,25 litre / per seed hole	1 litre d'urine / m^2 ((for 50 plants/m^2) diluted at 100%		0,5 litre / per seed hole			
56 days after germination / pricking (8 weeks)	0,5 litre / per seed hole	0.3 litre per seed hole								

Technique of manual application...

1. Soil preparation before application

2. Manual Application of hygienic faeces on maize

3. Manual Application of hygienic urine on maize and cabbage

Urine drip irrigation system in Côte d'Ivoire

Farmers capacity development for Dissemination

Strategies used:

- **Farmers fields school (FFS)**
  - **how to prepare plants,**
  - **how to protect the operator**
  - **how to adapt local materiel for application of fertilizers**
  - **how to appreciate the quality of Ecosan fertilizers**
  - **how the know the dose per type of crop**
  - **how to apply the Ecosan fertilizers**
  - **participatory evaluation of the effects (agronomic and economic) compared to the chemical fertilizers**
  - **Etc….**

- **Fields visits by others farmers**

Compared Yields of some main crops (tons/ha)

Crop	Aubergine	Tomate	Lettuce	Cabbage	Maize	Manioc	Cotton	Igname
Country	Burkina	Burkina	Togo	Togo	Benin	Côte d'Ivoire	Mali	Cote d'Ivoire
Control	2,8	2,1	6,8	19,1	2,4	45	0,18	4,0
NPK+urea	17,1	5,8	13,3	31,0	3,5	60	0,38	6,0
Some NPK +urine	16,0	5,2	15,7	32,0	3,6	60	0,35	8,0

Example with maize in Burkina Faso

(3 years synthesis, extra early variety, potential of yield 2.5 tons ha^{-1})

Treatments	Germination rate (%)	Weight of 1000 grains (g)	Grain Yields (t ha^{-1})
Control	96	110,8[a]	0,13[a]
Fertilizer NPK + Urea	97	122,9[a]	1,05[b]
Faeces Q/2 +Urine Q/2	99	149,8[b]	2,15[c]
Probability	*0.057*	*< 0,001*	*< 0,001*

The applications of faeces and urine gave the best yields (twice the production obtained with fertilizer NPK + Urea)

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Averages of tests with 70 vegetable farmers in the ECOSAN_UE project (tons ha-1)

Crops	Yields using NPK+Urea	Yields using NPK+hygienic Urine (Birg-Koom)	Surplus of production by urine
Courgette	13,1	18,3	+5,2
Cabbage	31,2	37,2	+6,0
Carrot	49,0	60,0	+11,0
Sweet pepper	9,7	15,6	+5,9
Tomato	19.7	29,2	+9,5
Onion	4,0	5,9	+1,9
Turnip	109,2	114,1	+4,9
Aubergine	41,5	54,8	+13,3

With the urine there are three levels of interest :

- **Less money spent on buying fertilizer**
- **Higher production compared to the urea**
- **Longer fruiting time**

Effects of excreta on soils:

Urines = no significant improvement in the stocks of N, P and K in the soils after harvest

→ Urines can be used as dressing nitrogen fertilizer

Faeces = improve soil organic matter content; decrease the soil acidity, increase the available P in the soil. Its effects are similar to that of very well mineralised organic substrate.

→ Faeces is similar to chemical N-P-K fertilizer in term of nutrients content

Some Pictures of Harvests in the ECOSAN_UE project

Ouagadougou, Burkina Faso

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Urine **Urea**

Urine

Urea

Urine **Urine** **Urea**

Urine **Urea**

Urine

Urea

Urine

Urea

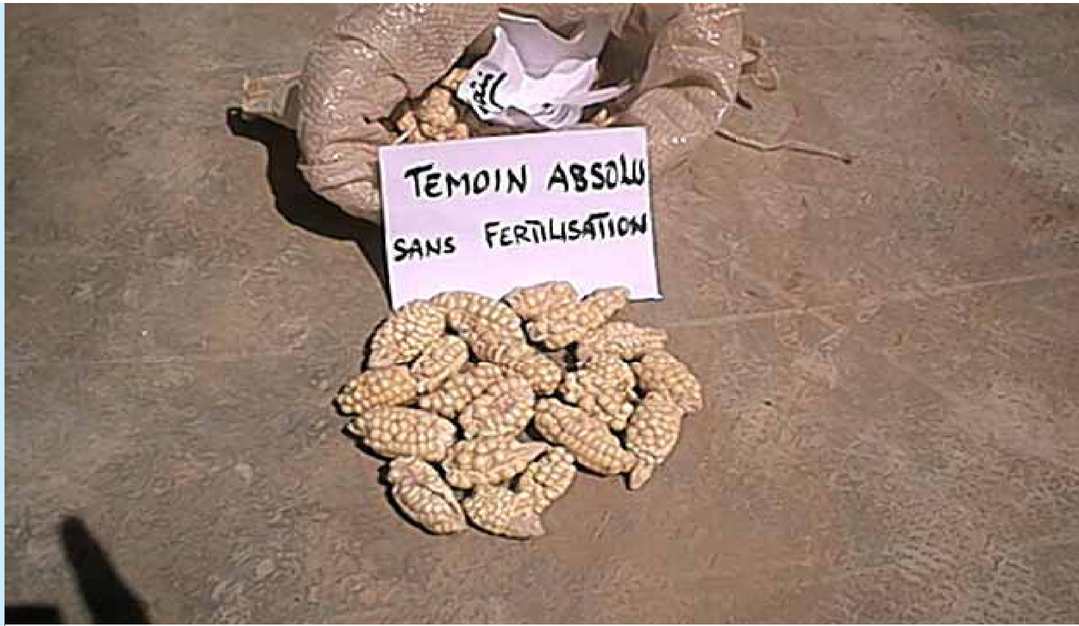
Urine **Urea**


ECO SAN
Culture: MELON
Fertilisant: BIRG-Koom
Date (Semis / Repiquage): 20-01-08

Urine


Culture: MELON
Fertilisant: UREE
Date (Semis / Repiquage):

Urea



Control

Urine + faeces

NPK + Urea

CONLUSIONS/PERSPECTIVES

- A strong emphasis on reuse is helping to spread the interest for Ecosan in West Africa. The Ecosan toilet is viewed as the family fertilizer factory.

- CREPA's largest sanitation project is now EcoSan_EU$_2$ (1,5 million Euro, 2008-2011) which is funded within the EU food security program. The project integrates soil and water conservation and the use of Ecosan fertilizers in 30 villages in eastern Burkina Faso.

- CREPA cover a very small number of cities and villages in the countries of the network. More actors and funding needed to scale up the approach to the profit of African populations that face more and more expensive life.

- Seeing sanitation from food security perspective could attract more interest from politicians and more funding!

Thank you for your Attention