FORTIFIED EXCRETA PELLETS FOR AGRICULTURE
An update on research in Ghana

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What we did so far

Ghana: 24.2 Million inhabitants, 95% depending on on-site sanitation

Research in Ghana from 2000 to date

- Direct application of urine to soil
- Land application of FS
- Extended storage of FS
- Composting of Feces
- Co-composting of FS and solid waste
- Fortification (blending) of fecal compost with fertilizer
- Agronomic trials (crop and soil response, safety)

Aim of the BMGF project

- Pelletization of FS based materials to increase the marketability
  - Increase general acceptability
  - Increase the ease of handling and placement
  - Improve fertilizer use efficiency

- Key partners: 3 Universities, 1 Municipality, 1 Research Institute


Drying


Composting/Irradiation


Grinding


Enrichment


Pelletization


Drying


Sieving

Use - Agronomic trials

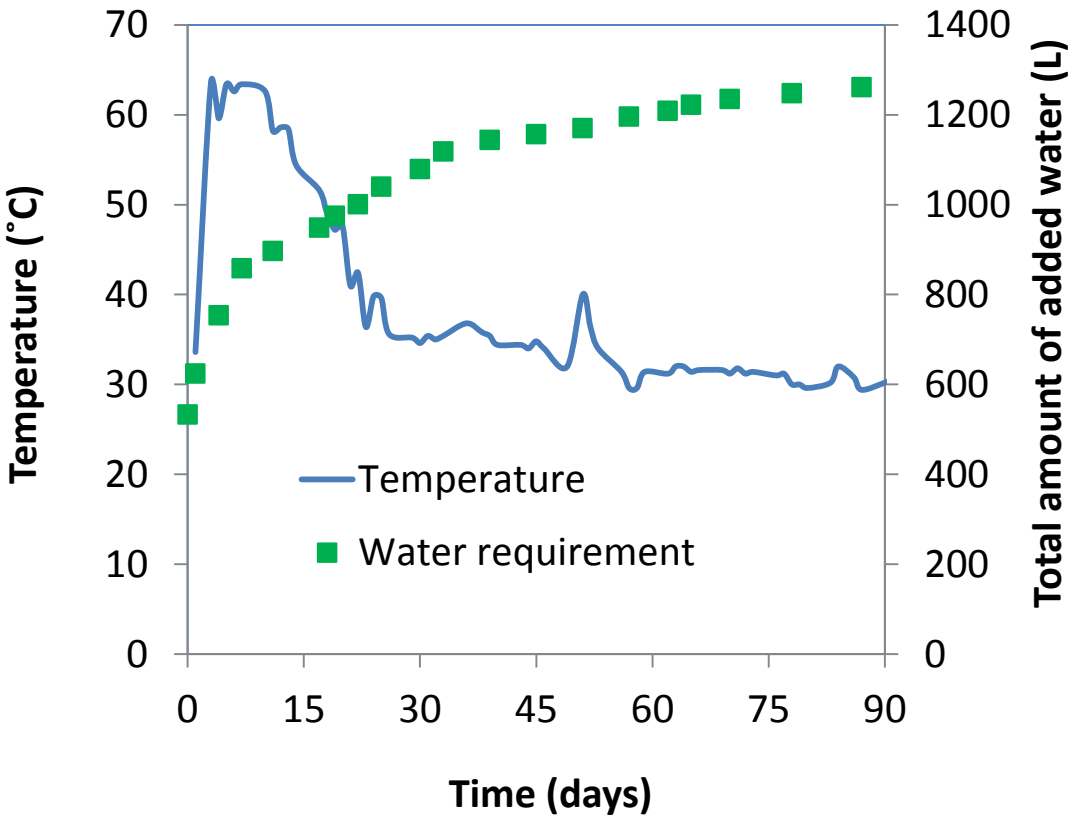
Step 1. Drying step

Over 2 tonnes DFS produced

- Size: 240 m^2 per drying bed
- 18 tankers needed
  - 6 public latrines; Average retention time at source: 2.4 weeks
  - 12 Septic tanks: Average retention time at source: 1.6 years

Step 2. Composting

Three different formulations



Temperature change and water added during composting of DFS

FS + Sawdust or market waste

Step 3. Grinding

- Capacity: 450 kg/hr

Step 4. Enrichment

- Enrichment: allows to align the composition to the needs for different crops and soil
- Also contributes to further sanitization

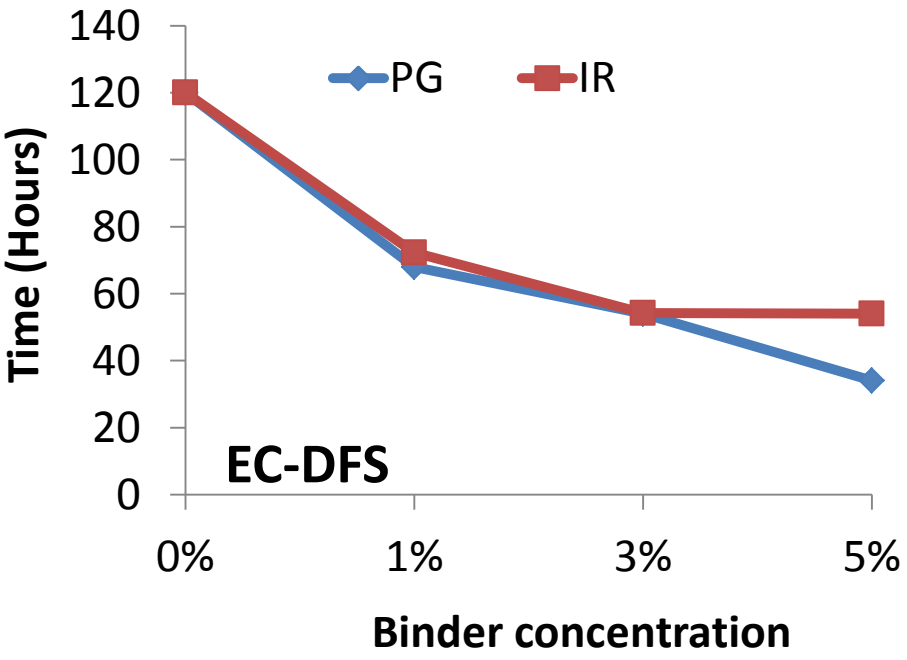
Step 5. Pelletization

- Capacity: 100 kg/hr
- Water and binders are also added
  - 2 binders tested: Clay, Irradiated/pre-gelatinized starch

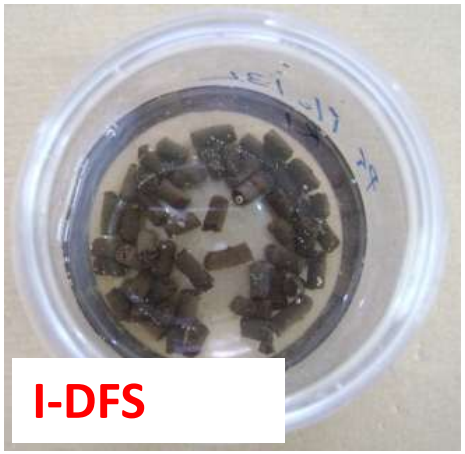
Critical factors for pelletization

- Moisture content
- Minimizing loss (fine materials generated during production)
- Pellet stability
- Bulk density: at least 20-50 % reduction
- Disintegration time (nutrient availability timing)

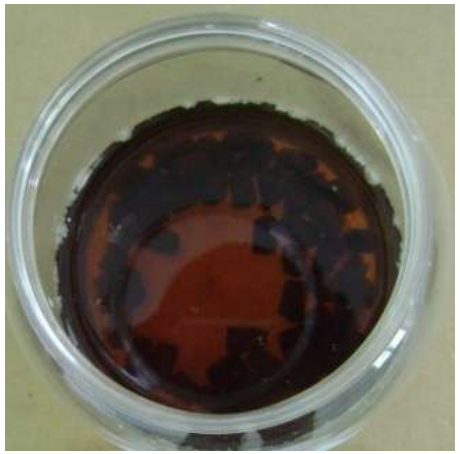
Disintegration time (hours)



Binder good for transport stability
And also for breakdown in soil



t = 0 hr



t = 46 hr, 0% binder

t = 46 hr, 5% pre-gelatinized starch

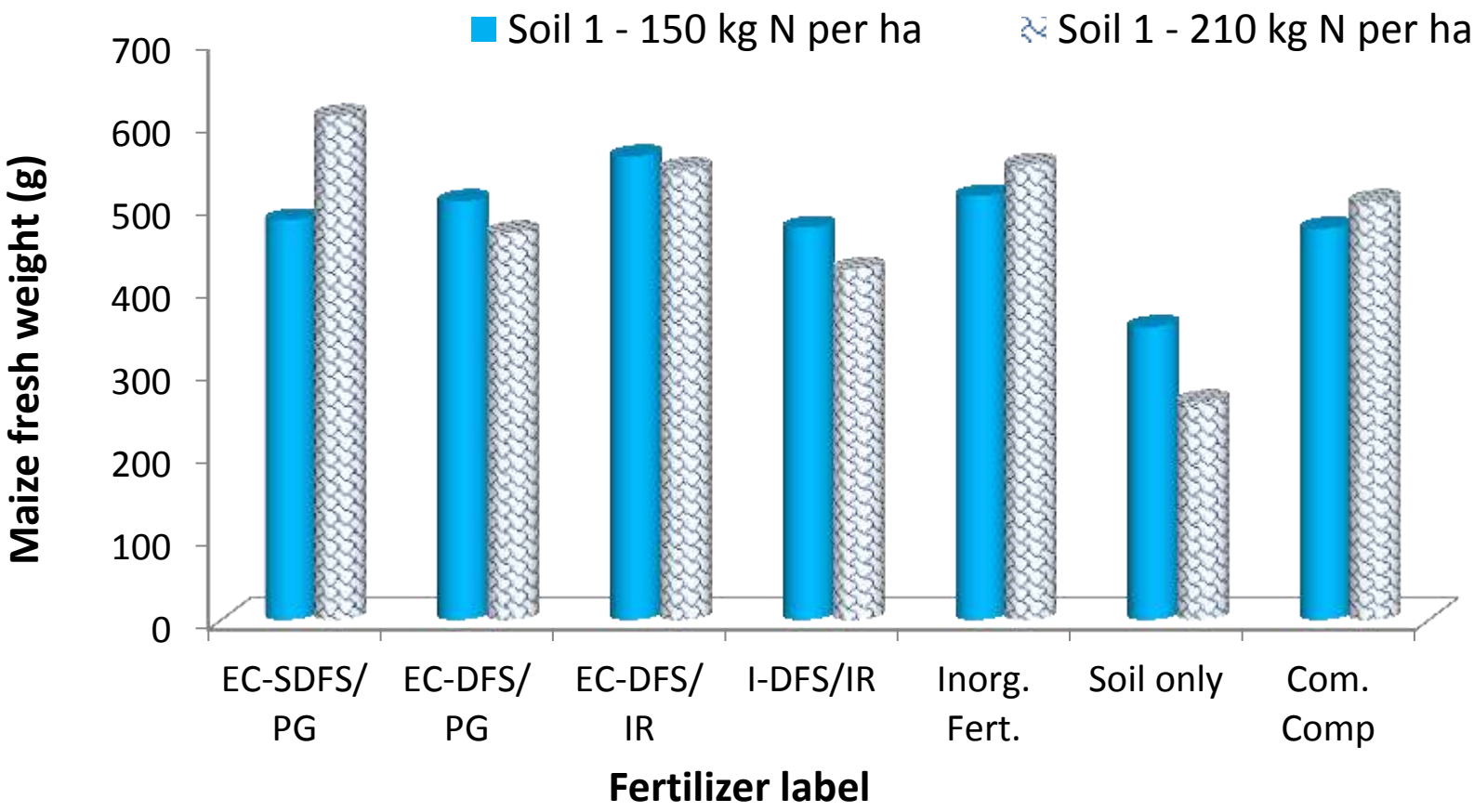
t = 46 hr, 5% irradiated starch

On-going greenhouse/field experiments

Tested products	
A. EC-SDFS with 3% pre-gelatinized (PG) starch **B. EC-DFS with 3% PG starch** **C. EC-DFS with 3% irradiated (IR) starch** **D. I-DFS with 3% IR starch**	E. Inorganic fertilizer (IF) F. Soil only G. Commercial organic fertilizer or poultry manure
• **Application rates: 150 & 210 kg N/ha** • **Two (2) soil types**	• Crops: maize and cabbage

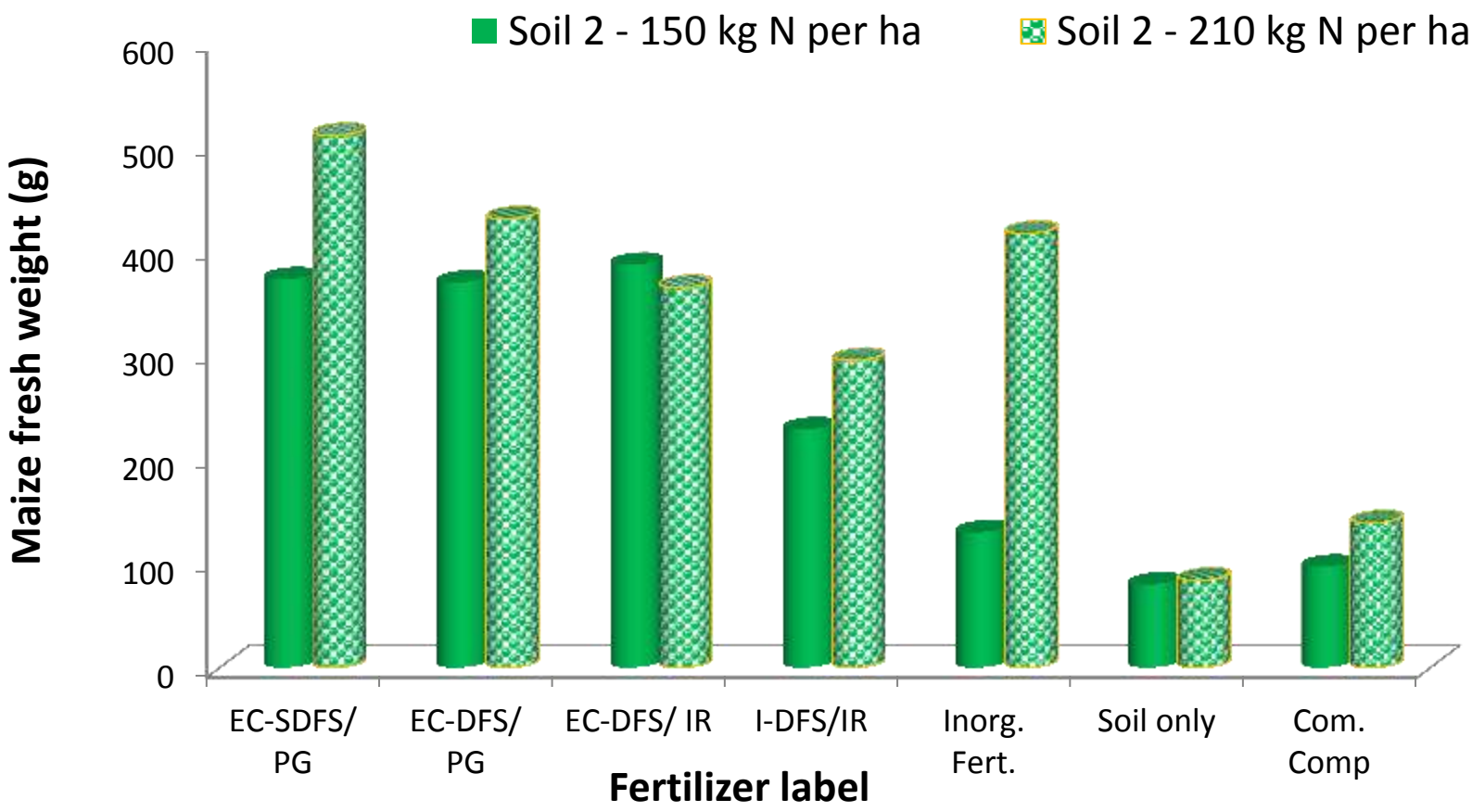
Soil 1 (good forest soil)

At flowering



Soil 2 (typically depleted soil)

At flowering



Summary of results (I)

Challenge	
Disease incidence	*Fortifer* is safe (total CF, E. coli, helminths, heavy metals)
Transportation	With pellets 50-80 % of the initial volume remains
Handling	*Fortifer* pellets are strong and do not easily break
Perception	Preliminary market analysis in 4 selected regions of Ghana confirmed positive response to pellets
Application	Dust-free process. Targeted application of specific amounts. Composition and nutrient release of the pellets can be steered according to crop.

Accompanying demand study

1. Identification of market segments (customers)
2. Quantification of segment size and locations
3. Perception studies, WTP, ATP
4. Comparison of WTP with likely costs of compost production and transport for customer

   → First assessment of market demand

- ❑ FS co-compost
- ❑ Pelletized, fortified FS co-compost (different N-P-K configurations)

Market segments for perception and WTP studies

Urban farming systems:

1) Market oriented vegetable farmers
2) Staple crop farmers
3) Backyard farmers
4) Ornamental flower producers

Peri-urban farming systems:

1) Vegetable farmers,
2) Staple crop farmers
3) Fruits plantations (pineapple)
4) Cotton, cocoa, rubber, palm oil plantations (often outgrower systems)

Real estate developers (housing) and landscape designers

Parks & Gardens (municipal departments)

Not yet explored

- Mining companies (land rehabilitation)
- Irrigation schemes (paddy)
- Forest plantations
- Regional expansion (Burkina)

Some results from demand analysis

- 80% of farmers show positive perceptions and are willing to use and pay for FS co-compost (n=600)
- Reasons for low WTP in general more economic/technical than cultural
- Revenue scenarios promising, but large variations in the WTP between different farming systems (→ targeted production & promotion).

Variations between farming systems

- Peri-urban farming system: more tenure security than urban farmers, more interest in long-term soil fertility build-up.
- Maize-cassava shifting cultivation, or short term vegetables: interest in quick nutrient injection, not in long-term benefits.
- Smallholders: large group but low WTP; compared new product with their current product (cheap poultry manure).
- Plantations: high demand and WTP; compared with industrial fertilizer, but also high quality and packaging requirements.
- Irrigation &. Compost = increased water holding capacity: Good or bad?

Summary (II)

- Urban agriculture only a tiny market; peri-urban farming systems much higher demand.
- Construction and plantation sectors are premium customers for any significant compost sale.
- Smallholder needs could be subsidized through the demand from premium customers (pro-poor).
- In contrast to plantations, real estate sector has low requirements on quality and packaging.
- Big Plus: Plantations and estate developers have their own transport capacities.

Regional analysis

Distribution of Farmers by Acceptability of FS Co-Compost (n=600)

City	Kumasi	Accra	Tamale
FS acceptable	83 %	74 %	84 %
Unacceptable	17 %	26 %	16 %
Illegal FS use common (raw)	–	+	+++
Competing products (PM, ...)	+++	++	+

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- **All national partners!**

Many thanks for your kind attention !