

DID YOU KNOW?

In sub-Saharan Africa...

- 80–95% of the population use onsite sanitation systems that require regular emptying.
- Most wastewater is untreated and many countries lack detailed information on wastewater generation, treatment or use.
- Fertilizer use is 1/20 of the average per hectare use in Asia, accounting for only 3% of global consumption.

In the developing world...

- The main expenditure for municipalities is waste management, even so significant amounts of waste remain uncollected.
- Urban farms produce up to 90% of the fresh vegetables consumed in cities, and the majority of the vegetables produced are irrigated with polluted water from urban areas.

ABOUT WLE

The CGIAR Research Program on Water, Land and Ecosystems (WLE) combines the resources of 11 CGIAR centers, the Food and Agriculture Organization of the United Nations (FAO) and numerous national, regional and international partners to provide an integrated approach to natural resource management research. WLE promotes a new approach to sustainable intensification in which a healthy functioning ecosystem is seen as a prerequisite to agricultural development, resilience of food systems and human well-being. This program is led by the International Water Management Institute (IWMI), a member of the CGIAR Consortium, and is supported by CGIAR, a global research partnership for a food-secure future.

MAIN WAFO PROJECT PARTNERS:



Institute of Industrial Research

FURTHER INFORMATION:

To find out more about IWMI's work on Resource Recovery and Reuse, and earlier phases of *Fortifer*[™] development, visit:

Resource Recovery and Reuse (RRR): <http://wle.cgiar.org/rrr> and www.iwmi.org/Topics/RRR

From Waste to Cash – a video on how *Fortifer*[™] is created: <http://www.youtube.com/watch?v=ljiAxCYQpfl>

To learn more about the research behind the development of *Fortifer*[™], contact:

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The research detailed in this brief forms part of the WLE's Flagship program on Rural-Urban Linkages, co-led by the RUA Foundation and the International Water Management Institute (IWMI), which is dedicated to applied research on city-region food systems and the safe recovery of water, nutrients and energy from urban and agro-industrial waste streams for reuse in and beyond agriculture.

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FORTIFER[™] PELLETS BEING APPLIED TO IMPROVE CROP YIELDS
PHOTO J.NIKIEMA / IWMI



RESEARCH PROGRAM ON
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WHERE THERE'S MUCK THERE'S GOLD

TURNING AN ENVIRONMENTAL CHALLENGE INTO A BUSINESS OPPORTUNITY



THE CHALLENGE

In urban areas of Ghana, as much as 90% of human waste from toilets is discharged directly into the environment. Usually this is untreated, or only partially treated, and so results in contaminated coastal areas, waterways and land. At the same time, the majority of Ghanaian farmers are struggling with soils that are poor in nutrients and organic matter. Some use this human waste directly on their fields as a raw form of fertilizer with little or no prior treatment. This in turn poses potential health risks when the microbial contaminants (pathogens), within the untreated waste come in contact with food crop production and can cause illness and disease.

KEY FACTS ABOUT FORTIFER[™]

- It has been demonstrated to be an effective, safe and potentially sought after fertilizer for a wide range of agricultural activities (based on scientific analysis, extensive field trials and farmer engagement).
- It is a reliable source of nutrients and organic matter for improving farmer's soils.
- It is already approved for use by the Ministry of Food and Agriculture and is a registered trademark in Ghana.
- It is produced through a process that safely handles and disposes of both human waste, collected from both household and public toilets (fecal sludge), and organic waste.
- It is enriched with minerals, and is free of live microorganisms (pathogens) that could otherwise cause disease.
- Production and sale of *Fortifer*[™] can be a profitable business. It is now being produced at a large, purpose-built fecal sludge recycling plant in Tema, through a public-private partnership.

Research supporting the scaling-up and large scale production of *Fortifer*[™] under the *From Waste to Food* (WaFo) project is funded by:

MEETING THE CHALLENGE

Following over twelve years of research, an innovative solution has been developed, by the CGIAR Research Program on Water, Land and Ecosystems (WLE), the International Water Management Institute (IWMI) and their partners, in particular SANDEC/EAWAG, which effectively answers these big challenges. Human waste from both household and public toilets is passed through a multistep process during which it is dried and then sanitized through composting. It is then further enriched and pelletized to create *Fortifer*[™], a safe and effective organic fertilizer that has the potential to be highly competitive on the Ghanaian market.

As pellets, *Fortifer*[™] is easier to handle and transport, which saves money, and less minerals are lost during application than with powder fertilizers. Because the *Fortifer*[™] pellets are compacted, lower volumes are needed compared to non-pelletized fertilizers with similar properties. There is also strong evidence to indicate that the pellets allow more gradual nutrient dispersal into the soil which could reduce the need for multiple applications in a growing season.



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Grands Défis Canada

Grand Challenges Canada is funded by the Government of Canada and is dedicated to supporting Bold Ideas with Big Impact in global health. <http://www.grandchallenges.ca>

THE BUSINESS CASE FOR FORTIFER™

Fortifer™ is an opportunity for Ghanaians to achieve a number of positive results. Through its production and use, Ghanaians are able to:

- reduce their reliance on imported fertilizers.
- support local enterprise and keep the benefits within the country.
- use portions of the revenues generated to improve sanitation in nearby cities and urban areas.
- provide farmers with a product that is easily transportable, effective, and easy to apply.

Production of Fortifer™ within Ghana also creates new jobs, reduces public health risks, ensures a cleaner and healthier environment, enhances food security and supports the development of a green economy.

There is strong potential for increasing the market share of locally produced, organic fertilizer in the Ghanaian market. Currently farmers in Ghana mostly use inorganic fertilizer. Even then the levels of fertilizer use in general are still very low in Ghana (12kg/hectare) compared with other countries (Kenya: 32kg/hectare) or the global average (90kg/hectare). High transaction and transportation costs which increase the overall cost of fertilizer appear to be the major reasons for Ghana's low fertilizer application levels.

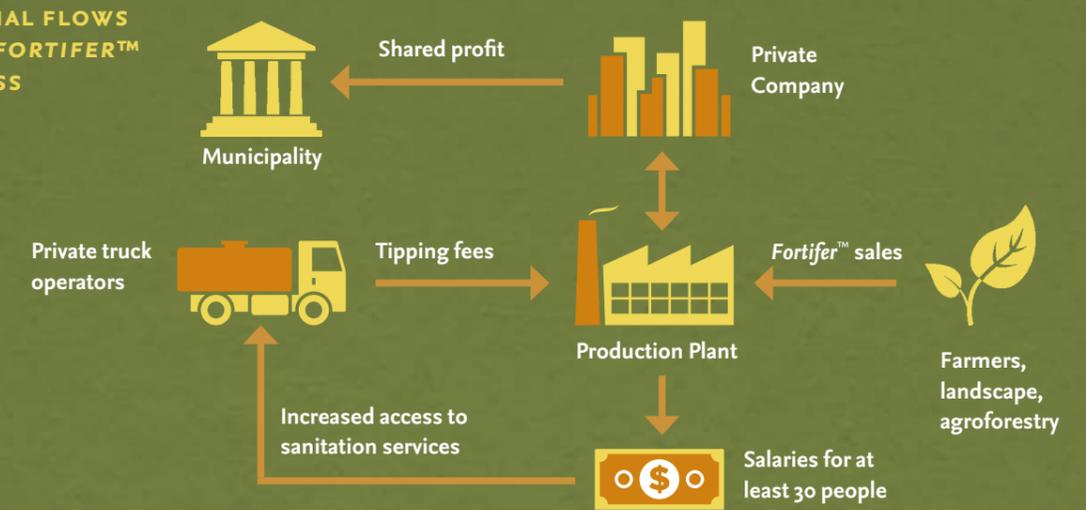
In Ghana, over 80% of existing total inorganic fertilizer demand is supplied by a few major importers. The market will be more diversified following the establishment of the country's first public-private enterprise geared specifically to innovatively processing and producing safe, effective and affordable fecal sludge-based fertilizer: Fortifer™. Through extensive, multi-season field trials it has been shown that Fortifer™ is an effective option that successfully promotes the growth and yield of cash crops such as: okra, tomatoes, green peppers, cabbage, lettuce, maize and rice, providing both nutrients and organic matter to the soil. Farmers engaged during the research process have also consistently stated their willingness to pay for a locally produced organic fertilizers such as Fortifer™.

According to a 2014 market study, factors inhibiting farmers in Ghana from making more use of fertilizers include; high prices, lack of suitable credit offerings to secure the fertilizers when needed, and a lack of convenient places to buy fertilizer. Three key potential customer groups have been identified for Fortifer™ in Ghana; farmers in organized groups, such as farmer-based organizations, farmers directly linked with the Ghana Irrigation Development Authority, and farmers in other managed irrigation schemes.



FORTIFER™ FIELD TRIALS WITH GREEN PEPPER, VALLEY VIEW UNIVERSITY, GHANA. PHOTO THOR WINDHAM-WRIGHT

FINANCIAL FLOWS IN THE FORTIFER™ BUSINESS



FINANCIAL FLOWS IN THE FORTIFER™ PUBLIC-PRIVATE PARTNERSHIP BUSINESS MODEL

A new, large purpose-built fecal sludge recycling plant has been built in Tema to produce Fortifer™. This business represents a public-private partnership between the Tema Metropolitan Assembly and Jekora Ventures Ltd, a Ghanaian waste management business. This plant is able to treat 12,500 cubic metres of fecal sludge a year, which is equivalent to that generated by a population of 65,000 to 100,000. At the same time more than 700 metric tonnes of organic food waste will be processed. Together these two inputs will be used to produce 500 metric tonnes of safe, nutrient rich, compost that is high in organic matter, a year.

Based on this structure and financial flows the Tema plant business is anticipated to break even within the first five years. It is understood that the money received by the Tema Metropolitan Assembly will be reinvested to improve sanitation in the area.

THE FORTIFER™ PRODUCTION PROCESS

Human waste collected from both household and public toilets is first sieved and then allowed to naturally dry out, first through filtration and then through evaporation. Any excess liquid goes through a sand filter (or another suitable treatment) before being released into the environment.

The dry solids, which are rich in organic matter and nutrients, are then mixed with organic food waste. The decomposition of this mixture (co-composting) is then facilitated through a process of regular interval heaping and turning. This allows good aeration which aids the decomposition process. Crucially, the decomposition process also naturally generates heat which when well controlled reaches high enough levels to destroy any microbial contaminants (pathogens) that had been present in the waste. This effectively sanitizes the waste mix. Fortifer™ meets the international safety standards set for composts by the World Health Organization (WHO).

FORTIFER™ PRODUCTION PROCESS

