

NATURE AND TECHNOLOGY FOR BIO-COMPOSTING

INNOVATIVE TECHNIQUES, PROCESSES AND METHODOLOGIES FOR ORGANIC WASTE TREATMENT IN URBAN AREAS. IN CALABRIA, A PILOT PROJECT AIMS AT TRANSFORMING ORGANIC WASTE INTO HUMUS WITH WORM FARMING: INNOVATIVE TECHNOLOGIES BASED ON NATURAL PROCESSES AND LOW CONSUMPTION OF RESOURCES.

Calabria Region is implementing a pilot project for quality bio-compost production by means of high-tech earthworm farms. They are an upgraded version of standard treatment tanks ensuring highly efficient processes.

Organic waste management

In Europe, waste is typically composed of mostly organic waste (30% of the total), paper and paperboard (30%), and other types of waste (metal 8%, glass 11%, textiles 4%, plastic 8%, other 9%). Oecd data collected in 1998 have remained almost unchanged in time, as packaging and consumption patterns for marketed products have remained the same. In 2011, urban waste management data in the EU-27 showed that 36% was landfilled, nearly 23% was incinerated, whereas 26% and 15% was

respectively recycled and composted (the later including anaerobic treatment of biodegradable waste). Between 2010 and 2011, urban waste production decreased by almost 1.1 m tons (-3.4%) at a national level. In 2012, a further decrease was recorded with a total reduction of 2.5 m tons (-7.7%) over two years. National production was below 30 m tons, with values similar to those detected in 2002/2003. The decrease in waste production went hand in hand with the drop in socio-economic indicators. As a matter of fact, between 2011 and 2012 average household consumption fell by almost 4.1% and Gdp by 2.4%. In 2012, every Italian citizen produced 504 kg of waste, i.e. 32 kg less than in 2010. The lowest production was recorded in the regions of Basilicata (below 400 kg per inhabitant per year), Molise, Calabria and Campania (all of them below 450 kg per inhabitant). In

Calabria, separate waste collection was below 20% (Ispra data, *Waste Summary Report - 2013 Edition*).

In recent years, a significant rise has been recorded in composting thanks to the increasing amount of separately collected organic waste.

The data collected in Calabria in 2015 - provided by the regional Department for Environment and Territory - indicated that urban solid waste was equal to nearly 600,000 tons produced by all the 409 municipalities in the five provinces (Catanzaro, Cosenza, Crotona, Vibo Valentia and Reggio Calabria), in an area covering 15,222 km² with a population of 1,970,521 inhabitants (source: Ancitel on Istat data referred to 1/1/2016). In 2015, separately collected organic waste amounted to almost 64,000 tons, that is a 20% average production of total urban solid waste, in fewer than half of the municipalities.

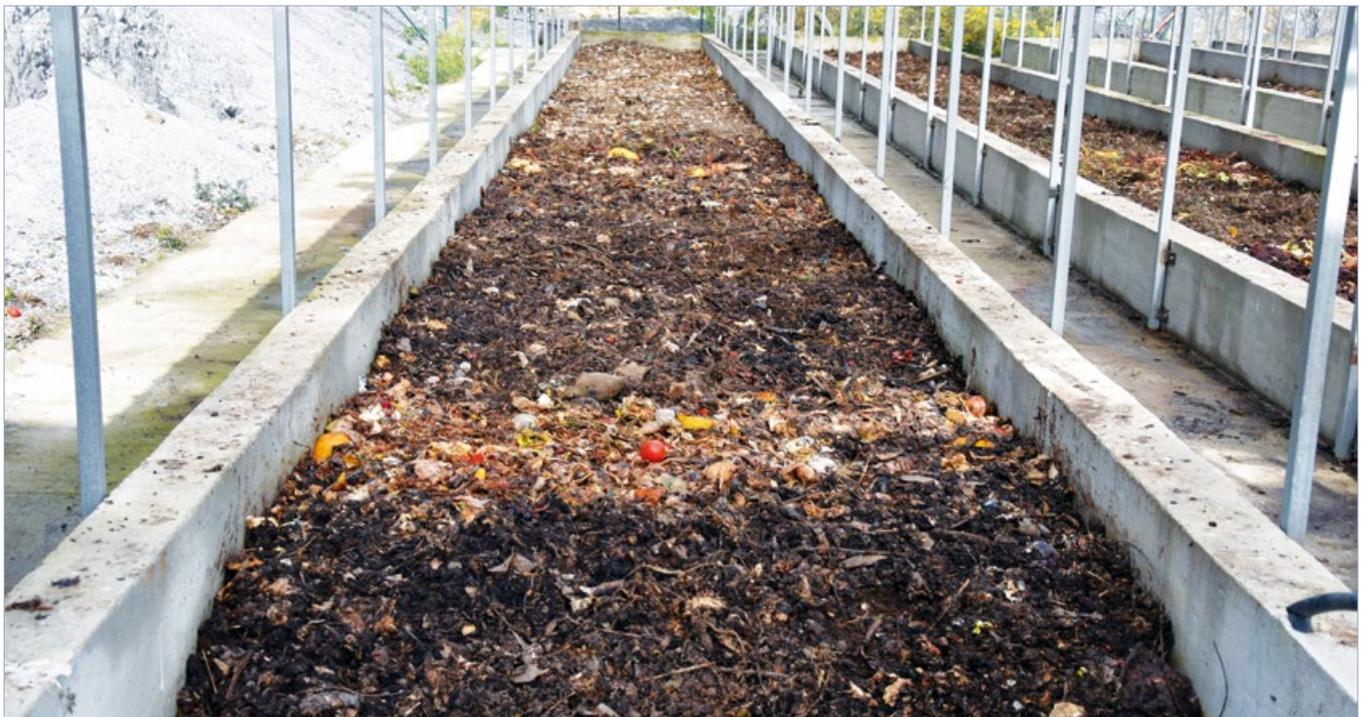


PHOTO: V. BARONE

Technological and ecological tanks

The project was designed by the working group of the Department for Environment of Calabria Regional Authority and is still in its pilot phase. The idea is to create pilot tanks servicing urban areas, such as villages or parts of cities with high quality organic waste sorting. Earthworm farming will be taken as a model. The goal is to achieve top efficiency in bio-compost production. With a view to reducing organic waste, fully natural processes requiring low energy/resource consumption will be implemented with innovative systems. Techniques and methodologies increasing volume reduction system efficiency will be validated reasonably quickly. During the pilot phase, heat and motion sensors will be installed inside tanks to monitor worm activity. Sensors will be positioned in the tanks following regular grids (observation matrices) and will be used to collect data on the life status (working worm density by area) and activity status (percentage of organic waste transformed into bio-compost). Data will be managed by a central unit monitoring a whole set of real-time data (site temperature, humidity, solar radiation) and making the necessary corrections during the pilot phase.

In its early phase, the project will involve small towns and villages in the five provinces, also in the light of earthworm farming initiatives launched by the municipalities on their own. The project will be divided into different steps:

- 1) data collection on earthworm farms currently in place in Calabria
- 2) data processing to identify consumption and size mathematical models
- 3) operating platform design with the direct involvement of municipalities and local communities
- 4) preparation of “prototype” farms with control and monitoring systems (active and passive sensors)
- 5) development of a multimedia platform providing real-time data
- 6) data post-processing and definition of mathematical models
- 7) plant validation, correction and implementation
- 8) definition of procedures for the operating management of products and household implementation

1 Worm farm in the province of Cosenza.
2 Worm bedding.

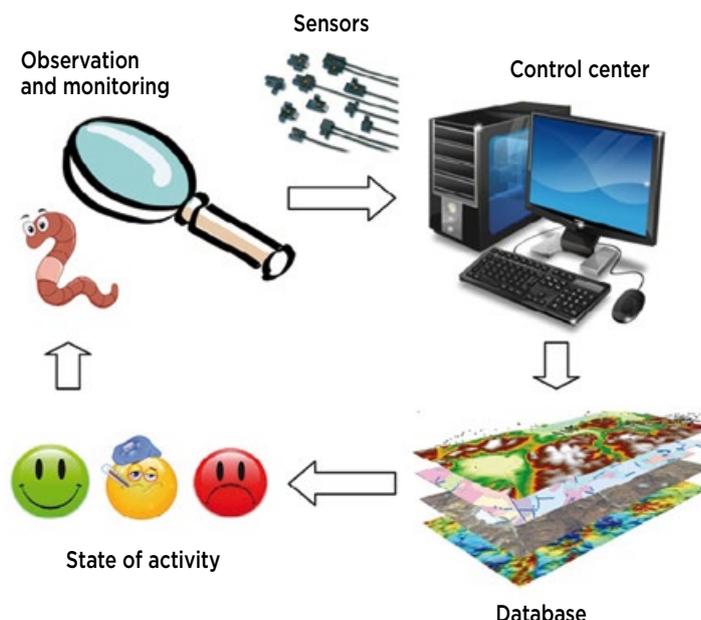


FIG. 1
EARTHWORM
FARMING FOR
COMPOST
PRODUCTION

Phases of the
Experimental project.



2

9) GIS mapping of pilot activities with a multi-parameter assessment in the areas concerned (waste life cycle).

Conclusions

In the final step, optimal usage will be defined for each plant according to a specific timeline to ensure the best possible volume reduction performance and organic waste reduction based on different variables. Collected waste volume reduction will be implemented by sustainable and innovative technologies providing an alternative to standard waste treatment. Transforming organic

waste into humus can reduce and even eliminate the amount of landfilled waste, decrease transport costs and limit waste. Such innovative monitoring, management and control system in earthworm farming can be defined with a scientific approach to implement a low-cost and easily replicable prototype system.

**Gabriele Alitto¹, Vincenzo Barone²,
Antonino Demasi¹, Saverio Curcio¹,
Orsola Reillo¹**

1. Calabria Region
2. University of Calabria