Reducing the environmental impact by applying livestock manure on farmland in Taiwan

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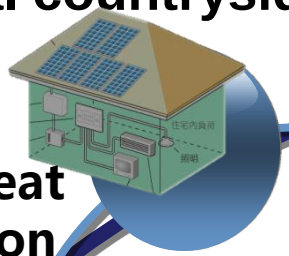
Circular agriculture

Ecological countryside

Loop architecture



Power/heat generation

Recycle to farmland/compst

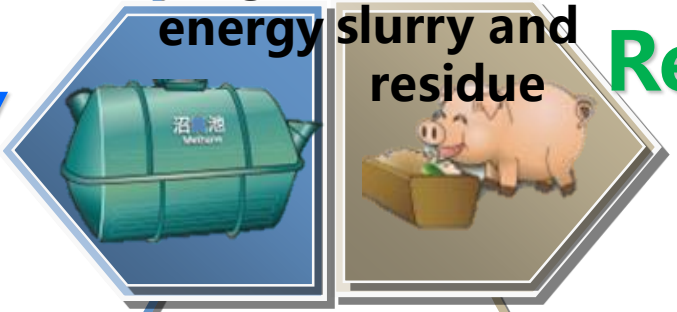
Algae culture

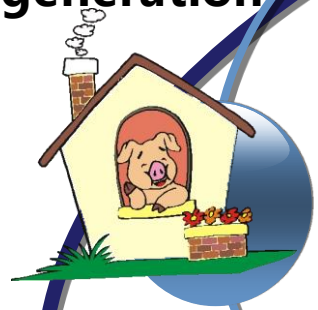
Biogas energy

Biogas slurry and residue

ENERGY

Resource



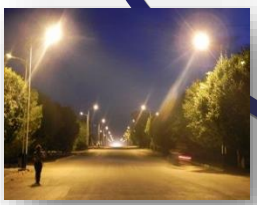


Livestock house

Biotechnical produce

Anaerobic treatment facility

Hog excretion

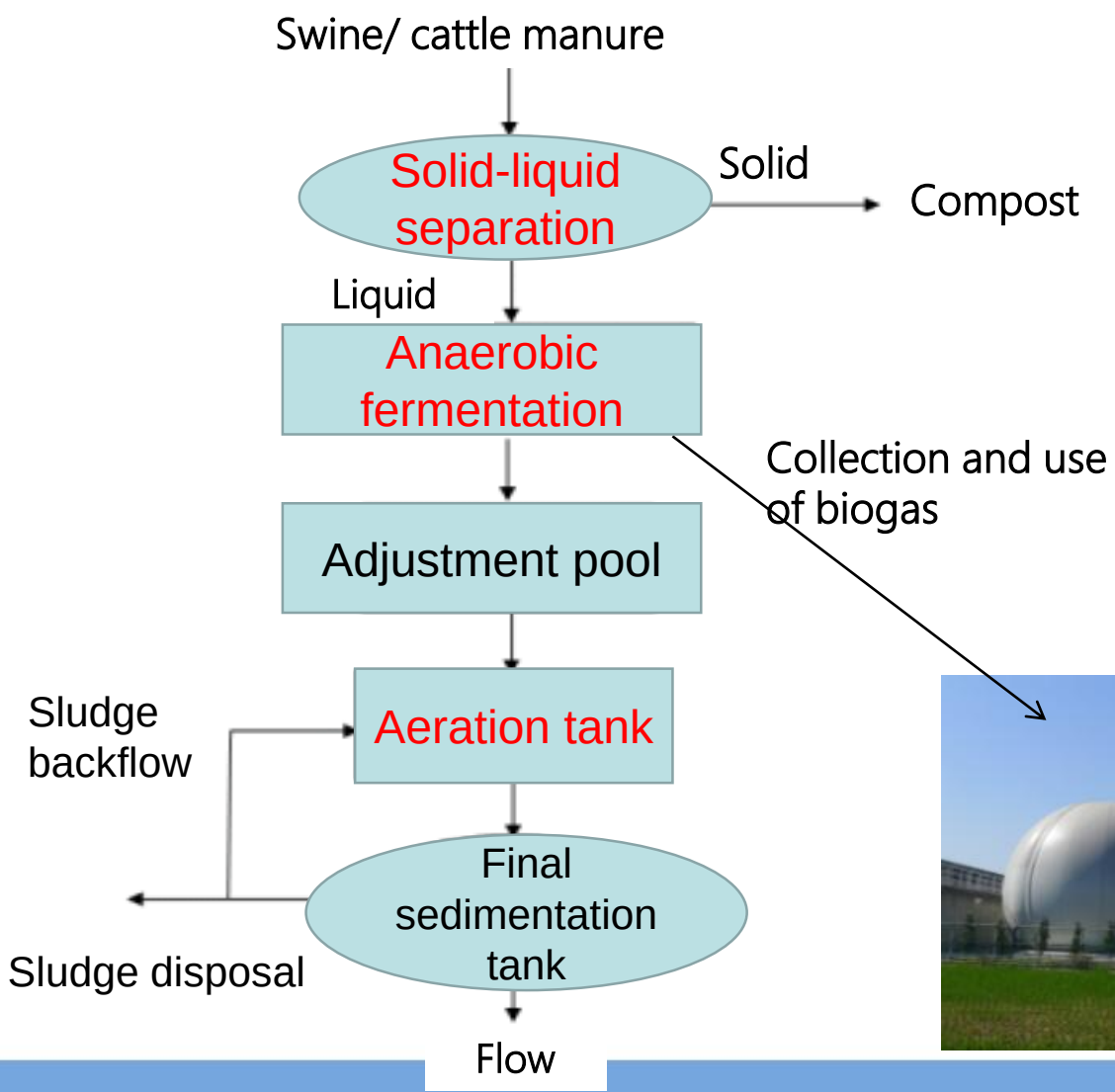


Repurchase by Taipower company/regional grid

fertilizer/feed

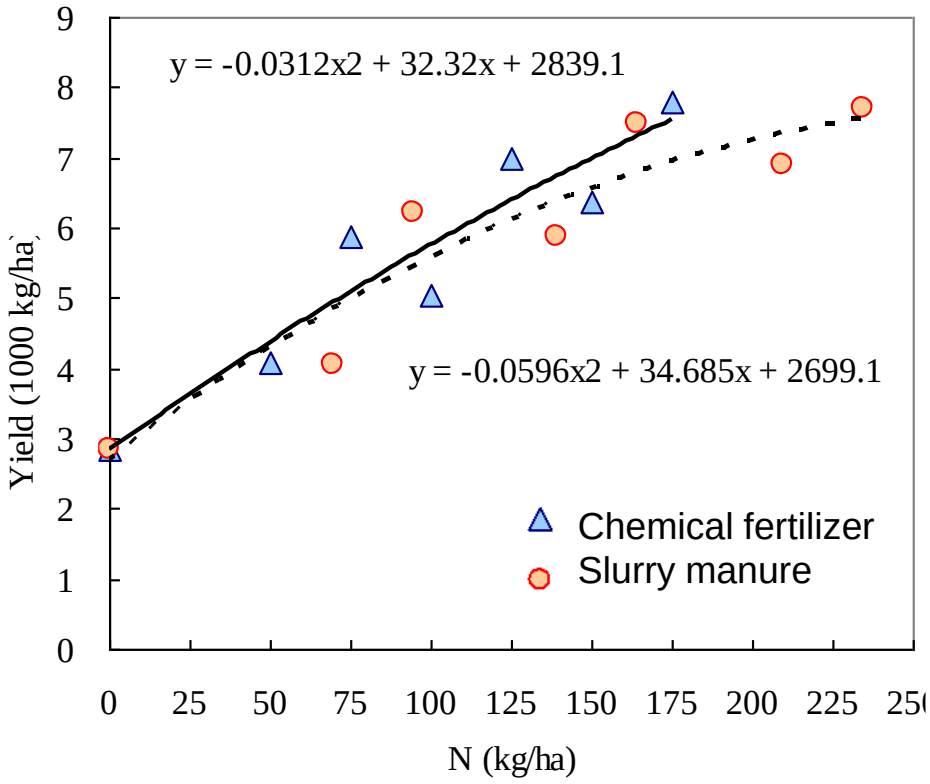
Planting vegetation/crop

The three-step treatment on livestock farm in Taiwan

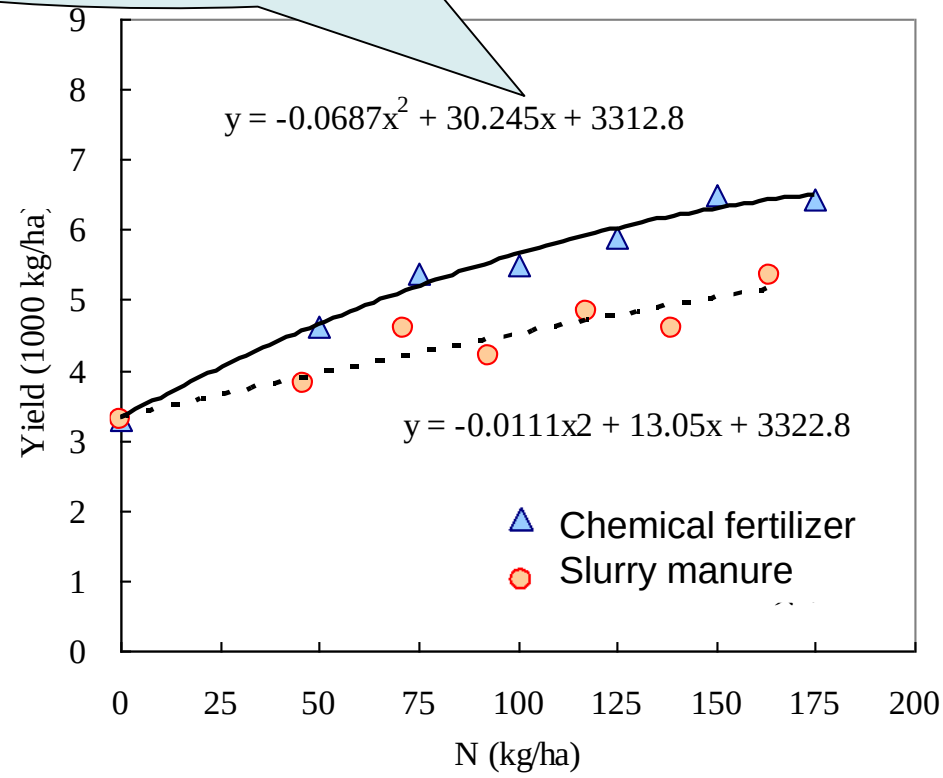


1.Nutrient Supply: Rice yield of field experiment

Nutrients are vulnerable to leach or evaporate during rainy hot summer

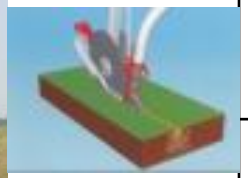


1st crop



2nd crop

2. Odor and ammonium emission

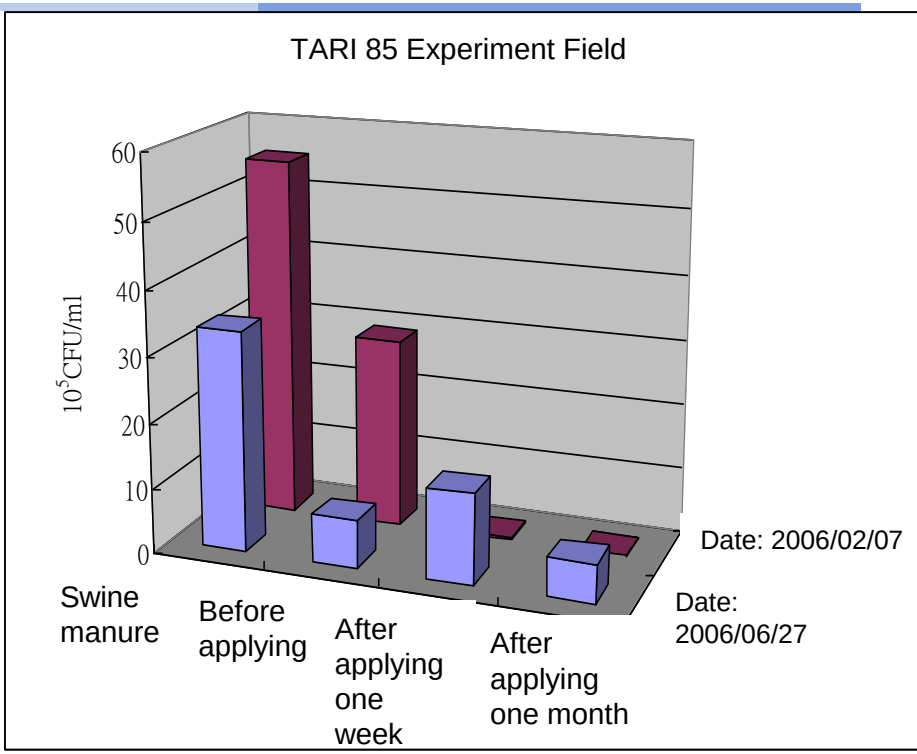
Application methods	Application machine (tractor)	Land use	Odor	Ammonium concentration (ppm)
Injection with soil covered	 	**Cultivated land**	**<20**	**--**
Injection without soil covered		**pasture**	**<40**	**< 0.7**
spraying		**Not specific**	**<50 (> 50)**	**4 hr<1.6 4-24hr<1**
trench application with irrigation water		**Not specific**	**<20**	**< 0.3**

3.Public health

1.Although E.Coli and little Cryptosporidium eggs were detected in pig manure but zoonoses pathogen of salmonella, roundworms eggs and whipworm eggs not detected.

2. Zoonoses pathogen of cryptosporidium eggs, salmonella, roundworms eggs and whipworm eggs not detected on farmlands after application for 1 month.

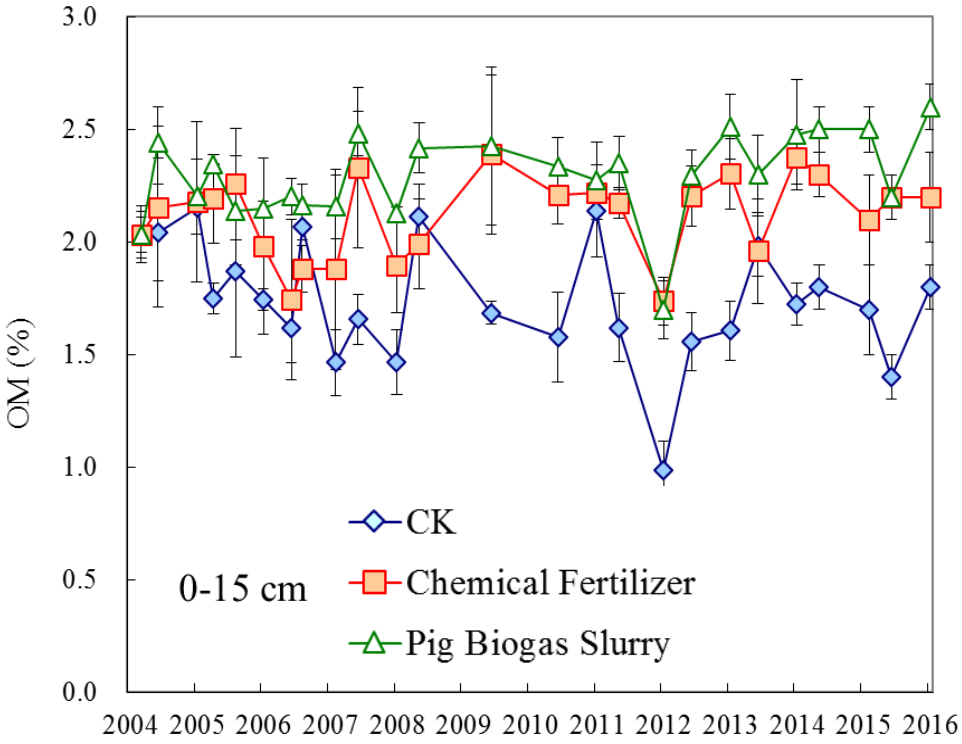
3. Soil microbial phase was not affected after applying manure for 1 month.

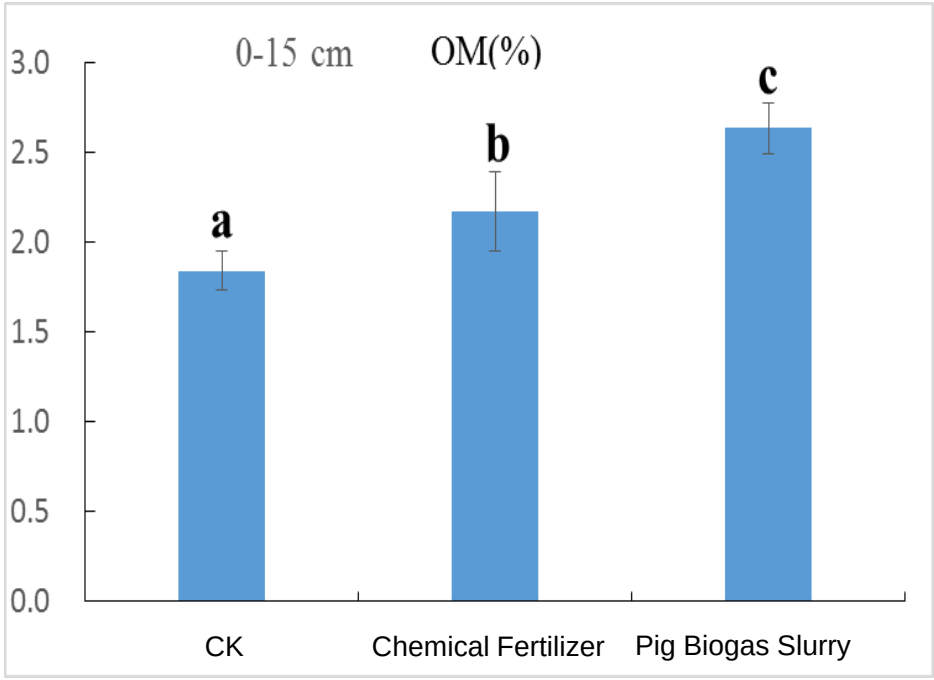


E.Coli Detection

Crop harvest is suggested two weeks after applying manure.

4. Increase SOC sink





Accumulation of soil organic matter is significantly different in soil with long term application of swine manure from that of chemical fertilizer.

4. Reduce the GHGs emission

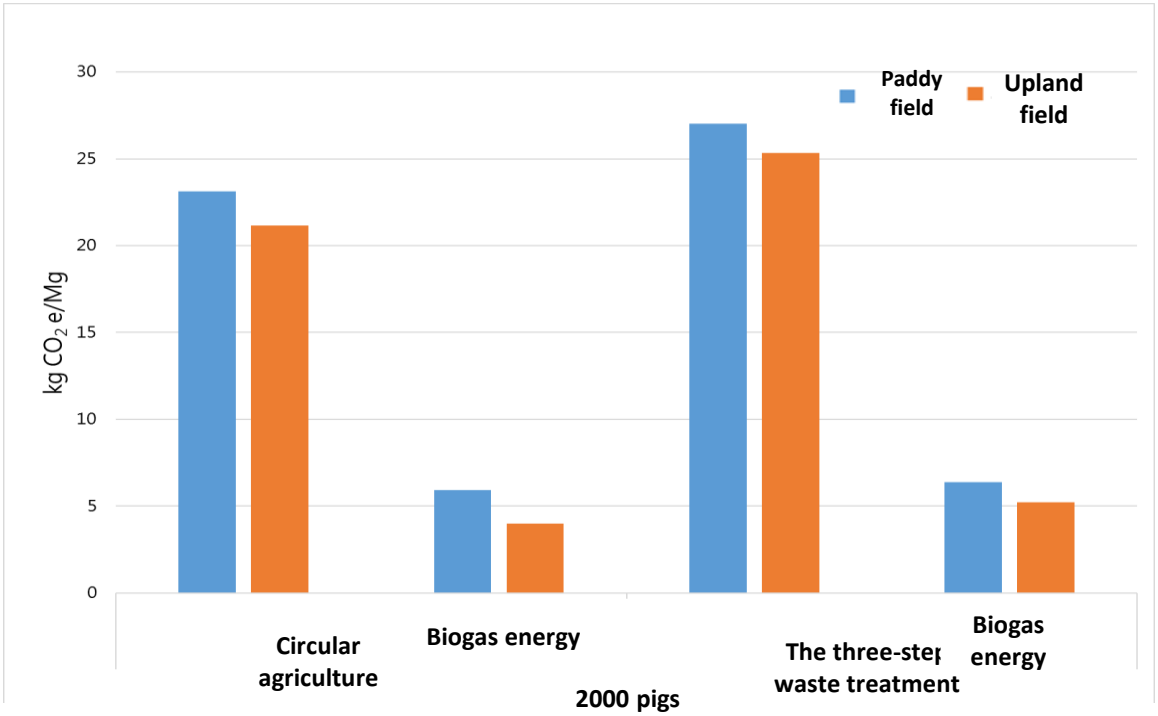


Figure 6. Carbon emission comparison of different livestock manure water treatment.

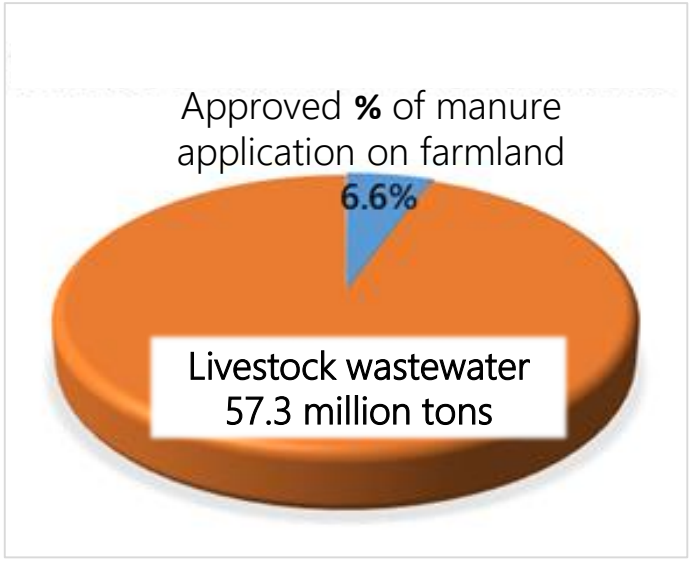


Figure 7. Reuse amount of livestock wastewater on farmland in Taiwan.

5. Heavy metal accumulation in soil

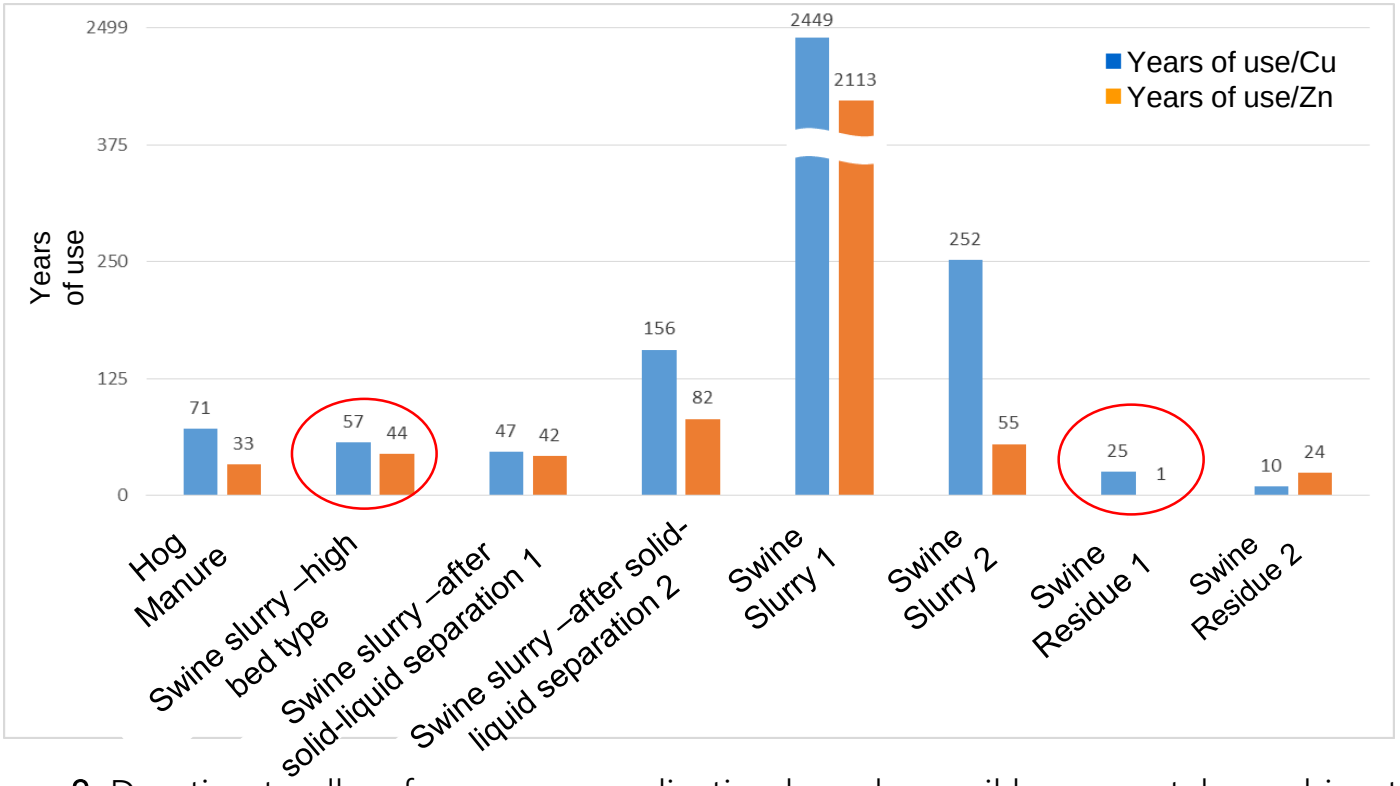


Figure 8. Duration to allow for manure application based on soil heavy metals reaching the environmental monitoring norm.

Benefit of circular agriculture

Winner A

Enterprise

1. Obtaining carbon credits and green electricity
2. Favorable development

Winner B

The most winner

Residents

1.Clean water body
2.Availible water resource increase
3.Enviroment improvement

Livestock farmer

1.Reduce operation cost
2.Increse income

Winner C

Farmer

1.Reduce consumption of chemical fertilizer
2.Improve soil properties