

# Microbiological contamination of vegetables from poultry waste manure: a case study of peri-urban vegetable production in Grand-Popo, Benin

The farmers in Grand-Popo in Benin increased vegetable yields with the use of 20 to 50 t.ha<sup>-1</sup> of poultry manure and more than 1 t.ha<sup>-1</sup> for inorganic fertilizers (NPK and urea). This method of yield intensification leads to increased sanitation risk due to the contamination of environment and vegetables by fecal germs (Midmore and Jansen, 2003). A market gardening trial was performed in 2009 in order to test this hypothesis.

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## Materials and methods

- Split-plot with two factors under three repetitions conducted within two cropping seasons conducted at Yodo-Condji and Ayi-Guinnou. Vegetables: *Solanum macrocarpum* ("Mboma"), *Solanum esculentum* (tomato), *Daucus carota* (carrot). Manures: T0 = zero fertilizer; T1 = 1.2 t.ha<sup>-1</sup> of NPK + 1.2 t.ha<sup>-1</sup> of urea; T2 = 20 t.ha<sup>-1</sup> of poultry manure + 1.2 t.ha<sup>-1</sup> of NPK + 1.2 t.ha<sup>-1</sup> of urea; T3 = 40 t.ha<sup>-1</sup> of poultry manure.
- Measured variables: populations of fecal coliforms (FC), *Escherichia coli* (EC) and fecal streptococci (FS).

## Results and discussion

- Variance analyses revealed a highly significant difference at  $\alpha = 5\%$  within the two campaigns (Time variable) for fecal coliforms and streptococci.
- Time x vegetable and time x site x vegetable showed a highly significant difference at  $\alpha = 5\%$  for the streptococci whereas a significant difference at  $\alpha = 5\%$  was shown by the variable "site".
- No significant difference was observed within the manures for the three fecal germs.
- No significant difference related to *Escherichia coli*.
- Contamination by fecal germs under T0 and T1 is not related to the supplying of poultry manure during the trial but by the natural presence of fecal bacteria and cumulative effects of previous fertilization (Figures 1, 2 and 3).
- T2 and T3 confirmed the preponderant effects of poultry manure mainly on FC and FS populations of the three vegetables (Figures 1 and 3). Only carrot showed an affinity for EC under T3 (Figure 2).
- Presence of EC showed the recent contamination whereas the significant occurrence of FS justified the role of the former fertilizers.

## Conclusions

- Results confirm the microbiological contamination of vegetables, which in turn has the risk of gastro-enteritis and diarrhea for the consumers.
- Integration of market gardening and livestock which is considered as an agronomic tool to intensify the yields also presents some negative side effects.
- Innovating the cropping systems has to be mindful of the environment and public health concerns and should be done through multidisciplinary research integrating more environmental and socio-economic components. This will help to cope with this situation.

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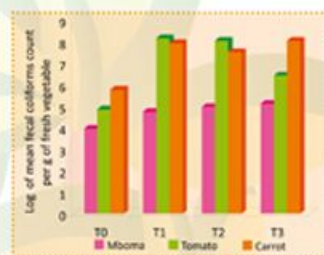
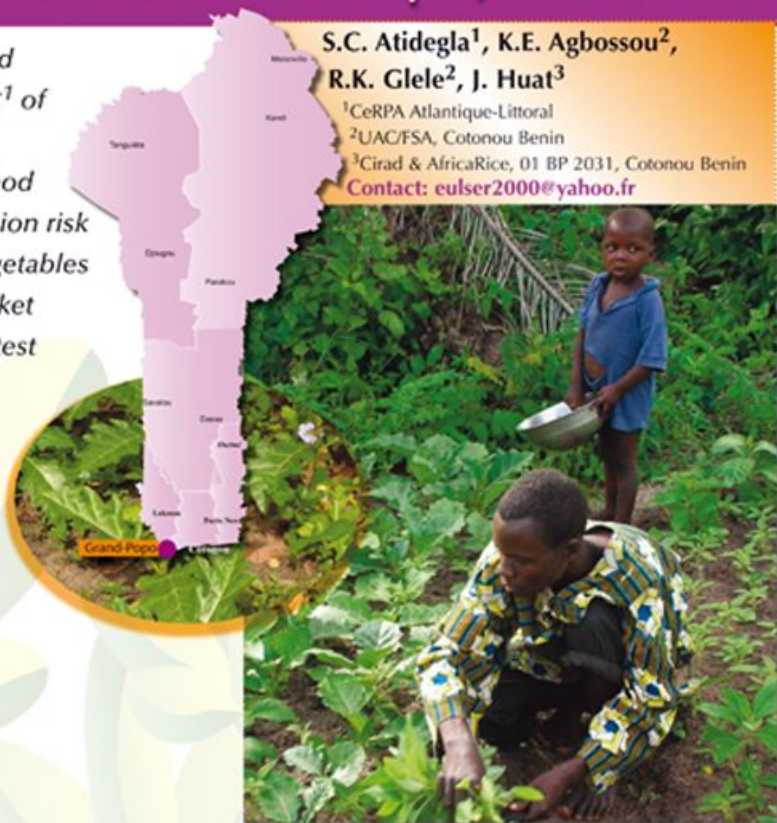


Figure 1. Number of FC in vegetables from T0, T1, T2 and T3.



Figure 2. Number of EC in vegetables from T0, T1, T2 and T3.

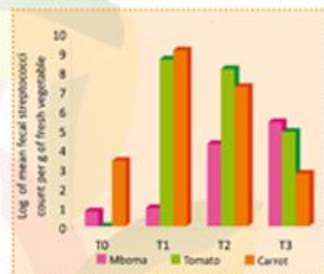


Figure 3. Number of FS in vegetables from T0, T1, T2 and T3.



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