

Introduction

- In Mali, untreated irrigation water, undecomposed manure and contaminated soils used by vegetable farmers are sources of pathogenic bacteria contamination and are difficult to control.
 - In Bamako, these sources of irrigation water have been observed to have high faecal coliform contamination levels above the WHO recommended standards for unrestricted irrigation (Traoré, 2020).
 - Majority of Malians are not aware about the protocol prescribed by Mali Health Service.
 - The disinfection methods for vegetables vary widely and are applied ineffectively by consumers due to poor knowledge and inadequate information.
- ➔ The efficiency of common vegetable disinfectants in Mali were evaluated in reducing pathogenic bacteria on irrigated lettuce from Bamako.

Materiel and Methods

- Leaves for each lettuce sample collected randomly per farm irrigated with untreated river water (in each of communities five and six within Bamako, where lettuce samples were more contaminated by faecal coliform population compared to other study sites) were combined to obtain a composite sample (Hayes, 1995).
- Five commonly used vegetable disinfectants in Mali and bleach/vinegar combination were used in this study based on three consecutive washing protocol recommended for vegetables in Mali (MHS, 2005).
- Faecal coliform were determined by the method of NFV 08 060 (2009), *Escherichia coli* by the method of ISO 16649-2 (2019) and *Salmonella* spp. by the method of ISO 6579-1 (2017) and the biochemical confirmation was done by API 20E gallery.
- Bacteria populations data were log-transformed and subjected to ANOVA and Turkey's HSD test ($P < 0.05$) in GenStat 11th Edition.



Fig. 1. Organic manures (arrowed) used by vegetable farmers in Bamako (Mali).

Conclusions

- All chemical disinfectants including tap water at 15 min reduced faecal coliform populations below the undesirable ICMSF (2018) level (1000 CFU/100 g wet weight).
- All chemical disinfectants and tap water, reduced *E. coli* populations on lettuce and completely eliminated *Salmonella* spp. on lettuce regardless of the concentration and contact time.

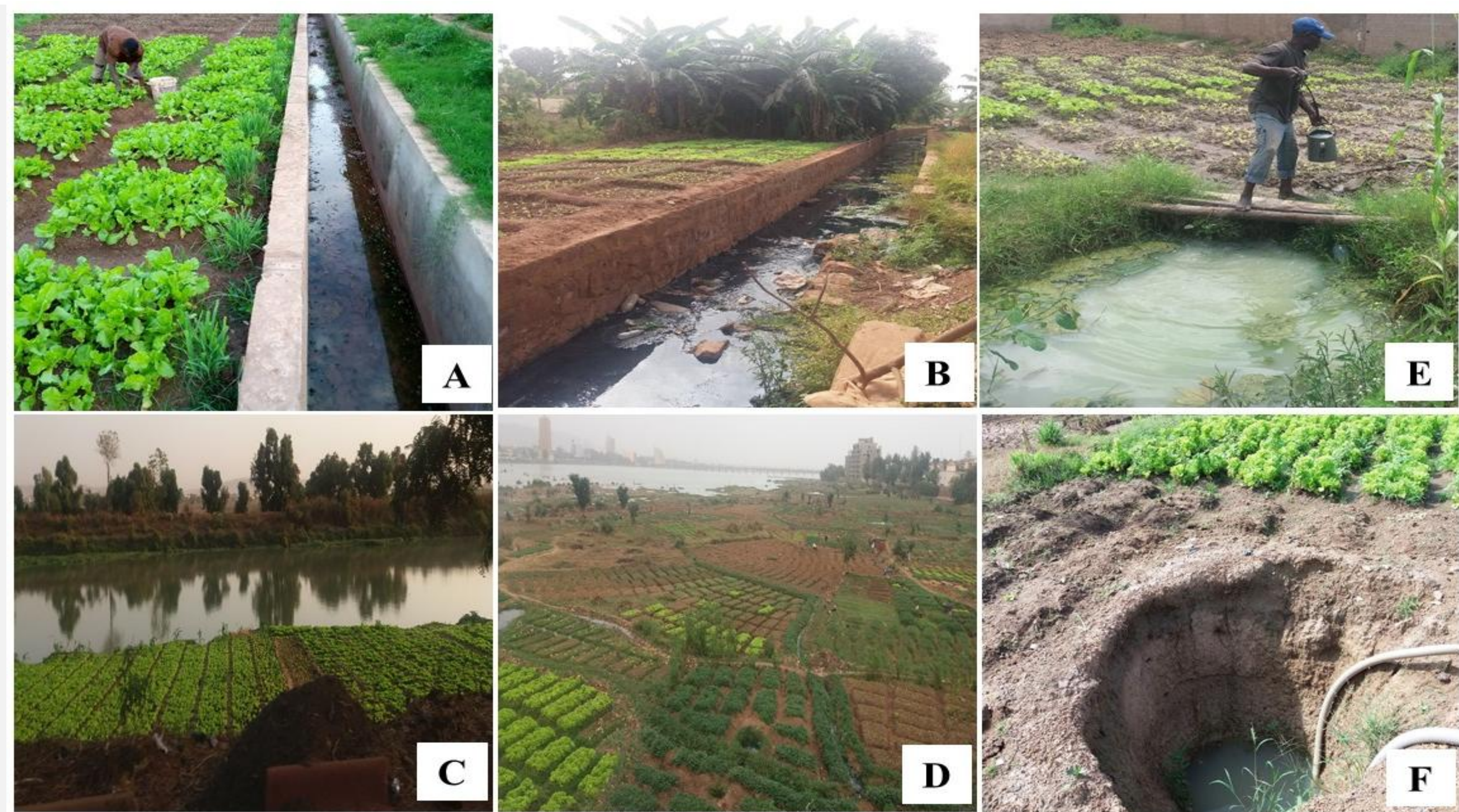


Fig. 2. Untreated irrigation water sources used for vegetable production in urban areas in Bamako: drains (A and B), rivers (C and D), stagnant water (E) and well (F).

Results

Table 1. Faecal coliform and *E. coli* populations and Log reduction on lettuce cultivated using untreated water from river in Bamako and washed with some vegetable disinfectants at different contact times.

Contact time (min)	Vegetable disinfectant (ppm)	Mean faecal coliforms (CFU/100 g)	Mean Log reduction of faecal coliforms (CFU/100 g)	Mean <i>E. coli</i> populations (CFU/100 g)	Mean reduction of <i>E. coli</i> (CFU/100 g)
5	Unwashed	4.5	-	2.8	-
	Tap water	3.2 ^c	1.3 ^c	0.8	2.0
	NaClO (0.00855)	2.0 ^{abc}	2.5 ^{abcd}	0.7	2.1
	KMnO ₄ (510)	1.6 ^{abc}	2.9 ^{ab}	0.7	2.1
	Vinegar (0.00855)	2.1 ^{abc}	2.4 ^{abc}	0.7	2.1
	NaCl (1500)	2.1 ^{abc}	2.4 ^{abc}	0.7	2.1
10	Tap water	2.9 ^{bc}	1.6 ^{bc}	0.7	2.1
	NaClO (0.00570)	1.7 ^{abc}	2.8 ^{abc}	0.7	2.1
	KMnO ₄ (340)	1.5 ^{ab}	3.0 ^{ab}	0.7	2.1
	Vinegar (0.00570)	1.8 ^{abc}	2.7 ^{abc}	0.8	2.0
	NaCl (1000)	1.7 ^{abc}	2.8 ^{abc}	0.8	2.0
	Tap water	2.6 ^{abc}	1.9 ^{abc}	0.7	2.1
15	NaClO (0.00285)	1.0 ^a	3.5 ^a	0.7	2.1
	KMnO ₄ (170)	1.2 ^a	3.3 ^a	0.7	2.1
	Vinegar (0.00285)	1.3 ^{ab}	3.2 ^a	0.7	2.1
	NaCl (500)	1.1 ^a	3.4 ^a	0.7	2.1

Means within column followed with different letter are significantly different Tukey's HSD test $P < 0.05$).

- At all contact times, the mean log reduction of faecal coliform and *E. coli* populations on lettuce did not vary amongst disinfectants regardless of the concentration and ranged between 2.4–3.5 and 2.0–2.1 log CFU/100 g, respectively (Table 1).
- Mean faecal coliform populations reduction in all chemical disinfectants at 15 min was significantly higher than tap water disinfection at 5 and 10 min.
- The log reductions of faecal coliform population in tap water at 5, 10 and 15 min ranged from 1.3–1.9 log CFU/100 g and did not differ significantly ($P < 0.05$).
- All lettuce samples contaminated by *Salmonella* spp. were disinfected with all disinfectants at all contact times.