

Good shit? Household effects of ecological sanitation in Mali

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Ecological Sanitation (EcoSan)

- Improved sanitation
- Reuse of excreta as fertilizer

Our study

- Are farmers gaining economically from their reuse of human excreta as fertilizer in rural Mali?

Why is this interesting?

- The reuse is supposed to be profitable but it has not been proved
 - A major part of the EcoSan concept
 - Basically no previous studies on economic impacts of EcoSan
- If reuse is profitable it would make people earn more
- It could also help spread EcoSan and its other positive effects

The studied EcoSan programme

- Programme run by CREPA-Mali in rural Mali
- In the small town of Fana and in surrounding villages
- Urine Diverting Dry Toilets (UDDT's) in households and public places
- UDDT's were built in 163 households during 2006-2009

Implementation of the programme

- Toilets were subsidized
- Village council chose beneficiaries
- Eligibility criteria:
 - Own contribution of materials/labor
 - Be active farmers
 - At least 10 in household
 - Unobservables..

Our data

- 618 households interviewed March-April 2011
- 155 had received a UDDT
- Demographic data
- Economic data
- Farming data

- Samples of sanitized excreta

Theoretical potential

- We estimate a household to produce nutrients amounting to 20-30 % of their average outlays on artificial fertilizer

The actual use of human fertilizer

- 106/150 farming EcoSan households reported reuse (71 %)
- Most use it on a small part of their fields
- Main crop(s): maize (sorghum, cotton)
- In general non-optimal use of human fertilizer (compost)
- The reported quantities of reused excreta corresponds to only a small fraction of potential
- → low expectations of economic impact

Analytical method

- No baseline → compare EcoSan households with control households
- Match EcoSan households with controls using propensity scores
- We then compare the outputs of the EcoSan households with their corresponding control households

Variables of interest

- Output variables that we look at:
 - Farming yields; Do EcoSan households have higher yields?
 - Fertilizer use; Do EcoSan households use more or less artificial fertilizer?

AIT, yields

| | TTEST | OLS | M1to1NR | M1to1CR | M5to1CR | Kernel | LLR |
|--------------|---------|----------|---------|---------|---------|---------|---------|
| Avg. yields | -4506 | -2114 | 43.07 | -3446 | -1858 | -1519 | -1874 |
| Std.error | 6872 | 6781 | 8760 | 10256 | 8405 | 8585 | 8343 |
| N treat/ctrl | 138/434 | 138/434 | 137/137 | 137/101 | 137/301 | 134/405 | 137/101 |
| Feedmonth | 0.0609 | 0.0387 | 0.290 | 0.384 | -0.0383 | -0.111 | -0.0135 |
| Std.error | 0.278 | 0.276 | 0.386 | 0.492 | 0.354 | 0.303 | 0.304 |
| N treat/ctrl | 139/449 | 139/449 | 138/138 | 138/101 | 138/299 | 135/415 | 138/101 |
| AQ cotton | -73.22 | -95.73 | -165.6 | -148.3 | -15.71 | -57.06 | -58.30 |
| Std.error | 93.34 | 89.73 | 99.55 | 133.5 | 112.5 | 107.3 | 107.2 |
| N treat/ctrl | 57/222 | 57/222 | 56/56 | 56/43 | 56/139 | 56/177 | 56/43 |
| AQ millet | 63.42 | 67.12 | 118.6 | 138.3 | 85.46 | 71.29 | 64.16 |
| Std.error | 79.20 | 82.44 | 122.7 | 102.4 | 107.7 | 119.7 | 117.8 |
| N treat/ctrl | 81/278 | 81/278 | 80/80 | 80/61 | 80/176 | 79/245 | 80/61 |
| AQ maize | 191.7** | 212.5*** | 201.1** | 263.5** | 218.1** | 212.3** | 214.6** |
| Std.error | 76.70 | 79.54 | 83.91 | 121.8 | 105.5 | 106.7 | 103.9 |
| N treat/ctrl | 94/318 | 94/318 | 93/93 | 93/72 | 93/227 | 90/295 | 93/72 |
| AQ gr.nuts | 239.4** | 214.8** | 173.2 | 164.4 | 195.5 | 196.2 | 211.6 |
| Std.error | 104.5 | 106.0 | 150.4 | 215.0 | 172.8 | 158.0 | 161.3 |
| N treat/ctrl | 50/154 | 50/154 | 49/49 | 49/43 | 49/115 | 49/135 | 49/43 |
| AQ sorghum | 25.04 | 20.99 | 32.31 | 55.72 | 29.82 | 26.03 | 19.09 |
| Std.error | 51.33 | 51.71 | 68.86 | 81.53 | 59.91 | 60.13 | 58.78 |
| N treat/ctrl | 123/356 | 123/356 | 122/122 | 122/92 | 122/263 | 119/333 | 122/92 |

AIT, fertilizer

| | | | | | | | |
|--------------------|---------|----------|----------|----------|----------|----------|----------|
| Art.fert. (exp/ha) | -674.6 | -1527 | -2140 | -1582 | -2126 | -2260 | -1680 |
| Std.error | 1191 | 1202 | 1737 | 2058 | 1455 | 1748 | 1592 |
| N treat/ctrl | 131/401 | 131/401 | 130/130 | 130/98 | 130/280 | 128/373 | 130/98 |
| Art.fert. (k/ha) | -4.256 | -7.392** | -9.903* | -9.647* | -9.245* | -9.121** | -7.972** |
| Std.error | 3.790 | 3.748 | 5.628 | 5.248 | 4.818 | 4.274 | 4.052 |
| N treat/ctrl | 145/448 | 145/448 | 144/144 | 144/106 | 144/314 | 141/415 | 144/106 |
| C.coton (k/ha) | -2.140 | -2.914 | -3.925 | -3.376 | -3.463 | -4.162* | -2.970 |
| Std.error | 2.103 | 2.091 | 3.176 | 3.791 | 3.040 | 2.466 | 2.307 |
| N treat/ctrl | 146/448 | 146/448 | 145/145 | 145/106 | 145/314 | 142/415 | 145/106 |
| C.cerea (k/ha) | 1.356 | -0.126 | -0.145 | -0.489 | -0.682 | -0.0280 | -0.367 |
| Std.error | 1.498 | 1.446 | 1.870 | 2.436 | 1.685 | 1.918 | 1.284 |
| N treat/ctrl | 145/449 | 145/449 | 144/144 | 144/106 | 144/315 | 141/416 | 144/106 |
| Urea (k/ha) | -3.376* | -4.247** | -5.771** | -5.933** | -5.032** | -4.802** | -4.497** |
| Std.error | 1.749 | 1.769 | 2.490 | 2.885 | 2.188 | 2.012 | 2.021 |
| N treat/ctrl | 145/449 | 145/449 | 144/144 | 144/106 | 144/315 | 141/416 | 144/106 |

ATT, yields

| | TTEST | OLS | M1to1NR | M1to1CR | M5to1CR | Kernel | LLR |
|--------------|----------|----------|----------|---------|----------|----------|----------|
| Avg. yields | 6391 | 7644 | 2972 | 3503 | 10085 | 7172 | 6410 |
| Std.error | 7796 | 7620 | 12619 | 11271 | 8507 | 8985 | 9146 |
| N treat/ctrl | 97/425 | 97/425 | 96/96 | 96/82 | 96/255 | 96/395 | 96/82 |
| Feedmonth | 0.488 | 0.409 | 0.479 | 0.106 | 0.454 | 0.295 | 0.487 |
| Std.error | 0.316 | 0.311 | 0.400 | 0.574 | 0.489 | 0.313 | 0.329 |
| N treat/ctrl | 95/440 | 95/440 | 94/94 | 94/80 | 94/262 | 94/402 | 94/80 |
| AQ coton | -59.69 | -93.05 | -125.3 | -96.85 | -72.37 | -129.6 | -90.83 |
| Std.error | 106.9 | 101.3 | 140.8 | 166.7 | 118.0 | 111.5 | 127.5 |
| N treat/ctrl | 42/219 | 42/219 | 42/42 | 42/37 | 42/138 | 40/191 | 42/37 |
| AQ millet | 119.3 | 111.5 | 203.1 | 202.1 | 123.2 | 135.3 | 127.1 |
| Std.error | 87.86 | 90.85 | 168.4 | 172.8 | 139.0 | 150.1 | 152.0 |
| N treat/ctrl | 60/269 | 60/269 | 59/59 | 59/52 | 59/158 | 59/230 | 59/52 |
| AQ maize | 313.8*** | 326.2*** | 327.3*** | 295.7** | 354.5*** | 312.3*** | 315.3*** |
| Std.error | 82.81 | 85.57 | 111.0 | 138.6 | 106.7 | 120.7 | 119.6 |
| N treat/ctrl | 69/314 | 69/314 | 68/68 | 68/59 | 68/200 | 67/287 | 68/59 |
| AQ gr.muts | 332.3*** | 288.1** | 369.7** | 365.1* | 272.2 | 283.8* | 288.3** |
| Std.error | 118.0 | 118.8 | 175.8 | 222.2 | 213.8 | 147.6 | 140.9 |
| N treat/ctrl | 38/153 | 38/153 | 37/37 | 37/31 | 37/99 | 37/132 | 37/31 |
| AQ sorghum | 81.69 | 63.78 | 16.54 | 15.31 | 45.11 | 66.16 | 53.11 |
| Std.error | 59.34 | 59.10 | 71.01 | 102.3 | 80.74 | 64.89 | 62.57 |
| N treat/ctrl | 87/349 | 87/349 | 86/86 | 86/71 | 86/222 | 86/326 | 86/71 |

ATT, fertilizer

| | | | | | | | |
|-------------------|---------|----------|----------|----------|----------|---------|----------|
| Art.fert. (k/ha) | -2.247 | -6.537 | -8.608 | -11.73* | -6.751 | -7.409 | -7.519 |
| Std.error | 4.441 | 4.352 | 5.597 | 6.923 | 5.441 | 5.674 | 5.656 |
| N treat/ctrl | 100/439 | 100/439 | 99/99 | 99/82 | 99/269 | 99/402 | 99/82 |
| C.coton (k/ha) | -0.512 | -1.701 | -1.617 | -3.081 | -1.298 | -1.523 | -1.449 |
| Std.error | 2.468 | 2.428 | 3.491 | 4.219 | 3.223 | 3.597 | 3.446 |
| N treat/ctrl | 101/439 | 101/439 | 100/100 | 100/83 | 100/269 | 100/402 | 100/83 |
| C.cerea (k/ha) | 1.510 | -0.344 | -1.200 | -2.595 | -0.114 | -0.716 | -0.994 |
| Std.error | 1.725 | 1.652 | 3.442 | 3.470 | 1.804 | 2.093 | 2.259 |
| N treat/ctrl | 100/440 | 100/440 | 99/99 | 99/82 | 99/268 | 99/403 | 99/82 |
| Urea (k/ha) | -3.142 | -4.390** | -5.589** | -6.174** | -5.119** | -5.055* | -4.960** |
| Std.error | 2.052 | 2.061 | 2.568 | 3.043 | 2.392 | 2.672 | 2.456 |
| N treat/ctrl | 100/440 | 100/440 | 99/99 | 99/82 | 99/268 | 99/403 | 99/82 |
| Art.fert (exp/ha) | -233.1 | -1171 | -2062 | -3208 | -1337 | -1971 | -1833 |
| Std.error | 1392 | 1395 | 2366 | 2182 | 2099 | 1958 | 1839 |
| N treat/ctrl | 91/393 | 91/393 | 90/90 | 90/72 | 90/235 | 88/361 | 90/72 |

Conclusions

- Actual use only a small fraction of the theoretical potential
- Seems as if no effect on yields, except quite stable positive effect on maize
- Substitution, not addition, of approx 10-15 % of AF used
- Limited gain, but not only parameter of interest
- As always: more research needed

Thank you