

Title	Use of urine in commercial orange and papaya tree production
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Introduction

“La Troje” is a small organic farm (no use of agrochemicals) and fledgling permaculture center in Southern Morelos, Mexico, with approximately 100 varieties of crops (fruits, vegetables, herbs, grains, flowers, trees) planted on four hectares.

What is permaculture

Three hundred twenty-seven (327) Valencia orange trees were planted in September, 2004. Fifty papaya trees were planted in October. The cultivation of perennial crops imply less risk and lower costs (especially labor) than annual crops. The use of locally produced organic inputs (fertilizers, soil improvers and mulches) provide a healthier soil, thus healthier plants, and also can lower costs. These are key strategies within a permaculture design, especially apt for this site (savannah ecosystem- semi-arid, 900 masl), and taking into account climate change and increased energy costs (with the eventual disappearance of fossil fuels) with its impact on the cost of synthetic fertilizers.

Although the usefulness of human urine has been demonstrated on the family level and on grain crops, there is little documentation of its use on perennial crops for commercial production in savannah eco-systems, and even less-so regarding the advantages and opportunities v the disadvantages and barriers within this context. The purpose of this paper is to identify those opportunities/barriers, especially regarding costs, labor requirements (preparation and application), and transportation of the fertilizers/soil improvers/mulches. Societal norms and individual attitudes in the area regarding this practice will also be assessed.

Plant growth will be assessed comparing the fertilizers and soil improvers (human urine, compost, bokashi, synthetic fertilizers).

Trees were planted on furrows which follow the contour of the land (roughly on a north-south axis), lined up in rows which follow the east-west axis. Thus, distances between furrows vary (according to the contour) from 4 to 8 meters, and distances between the trees along the furrow also differ – varying from 3.5 to 5 meters. Applications of compost, bocashi, and nothing were applied to the 40 rows of trees upon planting. A volume of approximately one liter of these soil amendments were placed in the bottom of the hole, then covered with the same amount of soil before planting the tree. In the case of those with no soil amendments,

the same size hole was dug, which was then backfilled with soil. Once all trees were planted, the same soil amendment was applied to the soil surface before covering with several layers of moistened newspapers, and afterwards a leaf mulch. Those without soil amendments were covered with the moistened newspapers and then the leaf mulch. Synthetic fertilizer will be applied in the future to some of the rows without soil amendments (thus leaving others as controls).

Urine will be applied to 75% of the furrows, thus creating a grid pattern where the following combinations will occur: urine with compost, urine with bokashi, urine alone, synthetic fertilizer alone and the control. The amounts of both the synthetic fertilizer and the urine will be calculated in the immediate future, but applications will be such to apply the same amount of nitrogen from those two sources to the plants.