Assessing the effect of human urine in composting

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Outline of the presentation

- Introduction
- Objectives of the study
- Methodology
- Findings
- Conclusion
- Acknowledgement
Introduction

• Solid waste management is taken as one of the burning issue.

• Among solid waste, more than 80% is organic. Hence effective Composting can be the best option for it’s management.

• ECOSAN, a new toilet system in a field of sanitation has contribution in SWM.
ECOSAN

- Urine and faeces diverting toilet
- Concept of reusing human waste as a resource.
- Fertilizer value
Out of the human excreta i.e. faeces and urine, urine has high nitrogenous fertilizer value than faeces.

Despite the fertilizer value of urine, it has several challenges to replace chemical fertilizer in the farmland:

- Urea in urine degrade rapidly to the gases NH$_3$ and CO$_2$.
- Urine is too strong to apply directly in the field and should be diluted in order to apply directly in the plants.
- Urine is in liquid form and thus is not easy to transport it as of chemical fertilizer.
Introduction (contd..)

- From study done in other countries,
  - Nutrient value of urine can be trapped through organic composting.
  - Urine applied compost accelerated the composting process as well as enhance the quality of the compost.
- In case of Nepal Compost using human urine has just introduced. Hence detail study has to be done.
Objectives of the research

Main Objective
- To assess the effect of human urine in composting process.

Other specific objectives
- To test the quality of compost with and without urine application
- To assess the appropriate dose and splits of urine application.
Methodology

Materials required

- 10 litre buckets
- Vegetables
- Straw
- Ash
- Soil
- Old compost
- Human urine

- Each bucket was filled with shredded composting materials.
- 2/3rd volume i.e. the weight of 0.35 kg was filled with straw and 1/3rd volume i.e. 1.3 kg by vegetable waste, ash and old compost
**Application of urine dose according to different application phases.**

<table>
<thead>
<tr>
<th>Dose</th>
<th>Splits</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>1 split</td>
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<tr>
<td>10% (1 L)</td>
<td>1000 mL</td>
</tr>
<tr>
<td>15% (1.5 L)</td>
<td>1500 mL</td>
</tr>
<tr>
<td>20% (2 L)</td>
<td>2000 mL</td>
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</tbody>
</table>

NPK value of 0.48 % N, 0.015% P and 0.07% K
Methodology (Contd...)

10 set of experiments including one controlled sample
3 replications of each sample,
30 set of experiments.
Methodology (Contd…)

- Compost was turned in every 15 days
- Temperature was measured daily.
- Quality testing
  - Physico chemical analysis
  - Maturity test
Findings
Adding urine to the compost gave higher temperature in shorter time compared to that of without urine.

Among all the treatment, the highest temperature of 46.9 °C on the 8th day was observed in compost with 20% urine in 3 splits.

The highest temperature in the compost without urine was observed to be 44.2 °C only on the 10th day.

In all the treatments, temperature slowly increased to certain level and slowly decreased after about two weeks and then reached around the ambient temperature.
Temperature Pattern

Graph I: Temperature pattern in 10% urine

Graph II: Temperature pattern in 15% urine

Graph III: Temperature pattern in 20% urine
Physico-chemical analysis of mature compost
NITROGEN CONTENT IN COMPOST

- The best result i.e. 3.23% was obtained in compost with 20% urine by volume in 3 splits.

- The lowest Nitrogen content i.e. 1.57% was found in compost without urine.

- Significant differences were seen in Nitrogen content among the treatments.
• Statistically no significant difference of phosphorus content was found among the treatments with different splits

• Mean P content was taken without considering the splitting of the dose

• Lowest content of Phosphorus was observed in compost without urine dose

• Highest result was found in 20% urine application, which was followed by 15% and then by 10% dose of urine
POTASSIUM CONTENT IN COMPOST

• Statistically no significant difference of potassium was found in all the treatments with diff. splits.

• Mean Potassium content of mature compost in different dose is showed in the figure.

• Potassium content was recorded to be 2.2% (highest) in compost without urine.
MOISTURE CONTENT IN COMPOST

Optimum MC = > 30%

- Highly significant difference in moisture content was found
- All the treatment, except compost without urine application, attained the standard moisture content.
- 1 split in 10% and 15% were slight below the standard value
- MC in compost without urine is far below the standard value
Compost with germination index up to 80% is accepted as the mature compost

- Urine dosing of 15 and 20% showed GI above 80%.
- Compost with 20% urine with 3 splits showed maximum GI compare with other treatments.
- Compost without urine-application was recorded to have only 65.47% of GI, which is below the maturity standard.
Conclusion

- Urine facilitated the composting process.
- Urine enriched the quality of compost.
  - due to presence of high Nitrogen and Phosphorus content
  - with optimum moisture content
  - More mature product
- Potassium content decreased with urine dose.
20% of urine by volume in 3 splits showed the best result in almost all parameters.

However, 20% dosing may varied with

- Nutrient content of urine
- Materials used in composting

Considering Nitrogen concentration up to 0.8%, 10 to 20% of urine dosing is recommended.

Hence urine composting can be one of the appropriate option for improving quality of compost and managing organic solid waste.
Acknowledgement

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