



## Physico-chemical Analytic Comparison between Normal Compost, Swift Compost and PSN Compost at Lawngtlai district, Mizoram

Vanlalmalsawmi Sailo<sup>1</sup>, C Lalfakawma<sup>2</sup> and C Rualthankhuma<sup>3</sup>  
Krishi Vigyan Kendra, Lawngtlai District, Mizoram, PIN-796891

### ABSTRACT

The present study was taken to compare the physical and chemical characteristics of three composts namely normal compost, swift compost and Phospho-sulpho-nitro (PSN) enriched compost during *Rabi* of 2023 at Krishi Vigyan Kendra Research farm, Lawngtlai district, Mizoram. The treatments consisted of T<sub>0</sub> Control (normal compost), T<sub>1</sub> (Swift compost) and T<sub>3</sub> (PSN enriched compost). The design followed was RBD and replicated thrice. The result revealed that there is no much physical difference among the three composting processes, however, the nutrients nitrogen and phosphorus content in PSN enriched compost was significantly higher than the other treatments with least CN ratio. Therefore, enriching compost by following Phospho-Sulpho-Nitro composting method could be recommended for farmer's practice.

**Key Words:** Cow dung, Mineral, Pit, *Pseudomonas*, *Trichoderma*

### INTRODUCTION

Composting in India started under Sir Albert Howard's Indore method of composting, sparking interest among agriculturists to come up with improved method thereafter. The main focus of the composting processes has also since gradually shifted to quick multi-nutrient enriched methods as compared to old methods of composting which focused on aerobic or anaerobic decomposition with passive aeration accompanied with infrequent and little turning (Bordoloi *et al*, 2020). Multi nutrient fortification to obtain highly nutritional superior compost is the main goal of today's compost, producing superior quality compost.

In order for plants to thrive and produce good yield, they should have effective access to multiple nutrients and micronutrients from the available pool of nutrients in the soil. These essential elements can be grouped into primary (NPK), secondary (Ca, Mg, S) and micro-nutrients (Cl, Fe, B, Mn, Zn, Cu, Ni and Mo). These nutrients have been heavily supplemented through

chemical fertilizers, however application in large quantity alone does not guarantee adequacy for the crops. Instead they could be present in large amount in the soil, leading to unwanted residual effect in the long run disrupting soil equilibrium (Sanchez *et al*, 2017). There should exist a balanced chemical, physical and biological activity in the soil. Soil microbes play a pivotal role in nutrient transformation and assimilation by crops. A fertile soil is a soil rich in soil microbes. Compost provides an ideal environment for the optimum activity of effective microbes. It also supply all the elements required for a fertile soil, a healthy crop, in the right proportion although may not be adequate.

Compost have the capability to improve soil aggregates, increases the water holding capacity for soil, acts as natural reservoirs of essential nutrients and micro nutrients, produces organic acids that help in making or transforming unavailable form of nutrients such as potassium, phosphorus and micro nutrients in the soil to available form. Compost serves as source of energy and home for soil microbes and small

animals like earthworms and ants which facilitate soil friability. Enriching the compost by incorporating not only multiple nutrients but also through addition of bacteria and other beneficial micro-organism is an important strategy to enhance the nutrient supplying capacity of the compost to crops.

The microorganism are shown to be involved in the transformation of organic matter substrates to inorganic compounds through mineralization and solubilization processes. Inoculation of *Trichoderma* and *Pseudomonas* in compost and its application has shown to significantly increase fruit weight (40%) and increase fruit per meter square (22%) in strawberry yield (Huasasquiche *et al* 2024). Similar findings has also been reported in wheat crop by Kumar and Mahapatra (2014). Bellini *et al* (2023) also reported that using *Trichoderma* statistically reduced disease severity caused by Fusarium wilt from 50 to 70% on lettuce.

So, it is important that we supplement the compost using minerals and beneficial microbes to contain proper proportion of the essential nutrient in the compost. Several reports under ICAR co-ordinated research projects have shown that enriched compost meets nutrient requirement of various crops and the cost incurred for fertilizers has markedly reduced, making compost partially able to replace conventional chemical fertilizers. Keeping this in view, the present research has been undertaken to compare Normal compost, Swift compost and PSN enriched compost in Lawngtlai district.

## MATERIALS AND METHODS

The study was conducted at Compost Demonstration unit at Krishi Vigyan Kendra Lawngtlai district, Mizoram during rabi 2023. Swift compost was prepared using cow dung as sole substrate without incorporation of any other substrate to the compost. A pit of 10 x 3 x 2.5 ft was dug which can accommodate approximately 0.5 MT of cow dung. The pit was filled with fresh cow dung until the pit is full at day 1, then a mixture of 250 ml of *Trichoderma spp* mixed with 40 liters of water is sprinkled and mixed well with the cow dung and was left covered for four days. On the

fourth day a mixture of 250ml of *Pseudomonas spp* mixed with 25 liters of water was incorporated to the compost pit and was again covered undisturbed for four days. The above steps were repeated on the 8<sup>th</sup> and 12<sup>th</sup> day respectively. On the 15<sup>th</sup> day the silpauline cover was removed and the compost pit was properly turned. This was followed with proper turning and mixing on day 19<sup>th</sup>. The top 15cm was collected and dried on alternate days since day 21 until it reach day 30 where the entire compost from the pit was collected and dried. These collected and partially dried compost were sprayed with NPK capsule dissolved in 15 liters of water. The finished compost was allowed to shade dry maintaining moisture of 20-25 % and sieved and stored for future use.

Phospho-sulpho-nitro (PSN) enriched compost was prepared by mixing commonly found weed substrate with dry biomass from crop residue. A pit of 10 x 3 x 2.5 ft was dug, this can fit approximately 300 kg of mixed substrate. The base and side of the pit was plastered with mixture of cow dung: soil: compost (1:1:0.5) slurry. The compost was enriched using mineral additives such as Nitrogen @0.5% as urea, phosphorus @1.5% as DAP and Sulphur @0.5% as elemental sulphur. Care was taken to properly fill the pit with the right amount of substrate to bring the CN ratio to optimum level. About 20cm thick substrate was filled at the base of the pit, followed by uniform spreading of the mineral mix and sprinkled with cow dung slurry. Pit was properly filled and moistened approximately 70 %. The top of the pit is plastered using the slurry to prevent water to seep through as well as to increase temperature inside the pit. The pit was opened and turned every 20 days interval for best and fast compost process and then plastered again with the slurry till 100days. The finished compost was collected and dried under shade, it was then sieved through 1 inch mesh and stored in a cool dry place for analysis and further use.

Normal compost was prepared using substrates that are easily available on the farm like weeds and crop residue incorporated with saw dust as carbon source, followed by thin layer of finished compost to hasten the composting

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process. Proper layering of substrates was established. The compost layers were sufficiently moistened with water so that microbial decomposition could progress quickly. It took two months for the compost to mature and complete.

The data had been statistically analyzed using ANOVA under randomized block design using one factor OPSTAT analysis designed by Sheoran *et al* (1998) and Statistical Error Mean (SEm $\pm$ ) and critical differences were computed.

### RESULTS AND DISCUSSION

#### Physical analytic comparison

The maturity of compost can be physically assessed through color. The color of the finished compost in all the three treatments turned black from dark brown/brown. This indicates that the composting process is complete and can either be used or stored for enhancing crop production. Another very important parameter to analyze for a good compost is the odor the compost emits. Unfinished compost will reek of certain unpleasant smell like the smell of decomposing animal dung or decomposing weed. The finished and good compost will have no foul odor in fact it will possess an earthy smell. All the three compared compost exhibit musty odorless smell after the compost is finished. Good compost should not be completely dry, as it will be dusty and irritating to work with, there should be at least 25-50 per cent moisture content. When the compost is too dry, it takes much more time for releasing nutrients to the soil when it is applied to unirrigated soil. The compost should not be too wet either as it will be difficult to handle and will be lumpy and heavy. The moisture assessment in Swift compost shows almost dry compost with moisture content of 25 percent, while the PSN enriched compost exhibit dry and friable compost with moisture content of 30 percent. The moisture content in normal compost is 20-25 percent as compared to 80 per cent moisture content in its initial condition. Swift compost has little to no distinguishable original substrate, as the substrate used here was solely cow dung without other crop residue or weed substrate. PSN enriched compost also possess little to no presence of original substrate at the finished compost. Normal

composting however has some left over hard substrate that was not completely decomposed and can be incorporated to the next batch of composting. Both the composting processes viz. Swift compost and PSN enriched compost show full decomposition at 30 days and 100 days respectively. Normal composting duration is 60 days where approximately 98 per cent is achieved. The compost duration in normal composting was lesser than enriched method because it followed aerobic composting, while the quick composting in swift compost was due to usage of only cow dung as substrate (Chowbey and Tiwari 2022, Chakravarty *et al* 2023). The initial volume of substrate in Normal compost, Swift compost and PSN enriched compost were 500 kg each. After the compost has matured Normal compost production is 150 kg, Swift compost production is 300-400 kg while PSN enriched compost production is 160 kg. The high production in Swift compost can be attributed to the substrate which is cow dung alone. Both Normal and Enriched compost produces 30 per cent and 32 per cent of the initial substrate.

#### Chemical analytic comparison:

The value of pH in the three compared compost ranged between 6.6 – 7.7 at compost maturity. The pH of normal compost lies in neutral range at 6.6pH, the pH of Swift compost is 7.7 pH which is slightly alkaline, and the pH of PSN enriched compost is 7.2 pH which lies in the range of neutral. The rise in pH can be attributed to higher pH of cow dung the main substrate used for preparing the compost. The neutral to alkaline compost is beneficial and recommended to be used in acidic soil like soil of North East India for reclamation of acidity.

The total carbon content of Normal compost (39.8%) is significantly higher than Swift compost (18.6%) and PSN enriched compost (24.2%) respectively, probably owing to the inclusion of sawdust as dry substrate. These findings were in line with the finding of Qureshi *et al* (2014).

The total nitrogen content of Normal compost, Swift compost and PSN enriched compost were 0.91%, 1.1% and 2.3 %

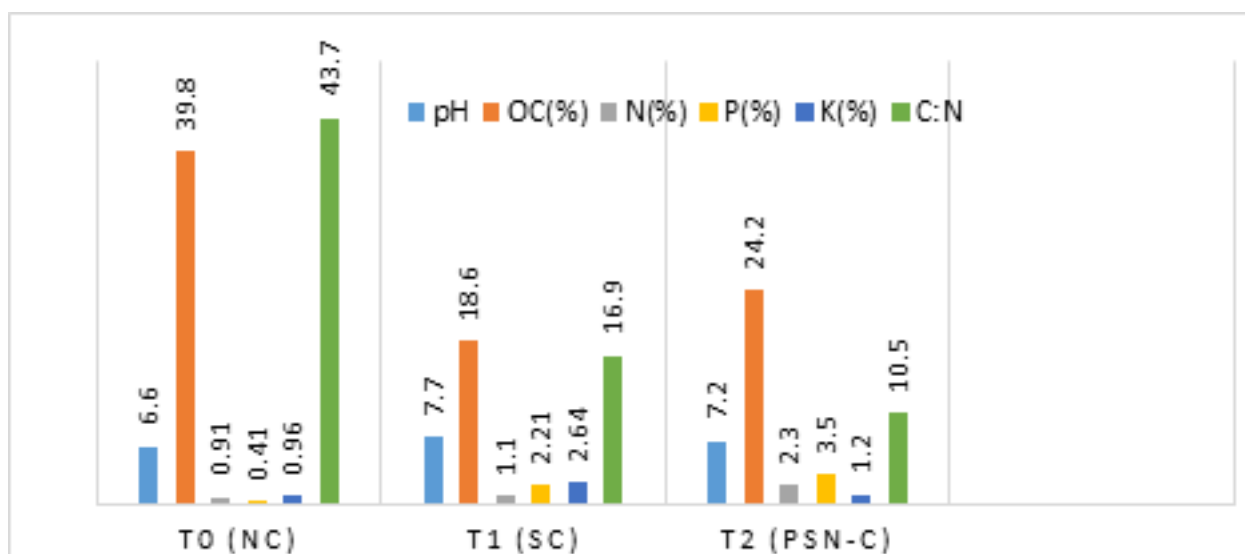


Fig.1. Chemical parameters of Normal compost, swift compost and PSN compost

Table 1. Nutritional variability of Normal compost, Swift compost and PSN compost

| Treatment           | pH   | C (%) | N (%) | C:N   | P (%) | K (%) |
|---------------------|------|-------|-------|-------|-------|-------|
| T0 (Normal compost) | 6.6  | 39.8  | 0.91  | 43.7  | 0.41  | 0.96  |
| T1 (Swift Compost)  | 7.7  | 18.6  | 1.1   | 16.9  | 2.21  | 2.64  |
| T2 (PSN Compost)    | 7.2  | 24.2  | 2.3   | 10.5  | 3.5   | 1.2   |
| SEm±                | 0.29 | 3.43  | 0.28  | 3.85  | 0.44  | 0.30  |
| CD@5%               | NS   | 13.83 | 1.15  | 15.53 | 1.82  | 1.22  |

Table 2. Physical analysis of Normal compost, Swift compost and PSN compost

| Parameters                    | Initial         | Normal Compost                      | Swift Compost       | PSN Compost         |
|-------------------------------|-----------------|-------------------------------------|---------------------|---------------------|
| Color                         | Brown           | Brown to black                      | Brown to black      | Black color         |
| Odor                          | Present         | Absent                              | Absent              | Absent              |
| Moisture                      | Wet             | Almost dry                          | Almost dry          | Dry and friable     |
| Original substrate            | Distinguishable | Coarse and large fragment remaining | Non distinguishable | Non distinguishable |
| Composting (%)                | NA              | 98                                  | 100                 | 100                 |
| Duration of composting (days) | NA              | 60                                  | 30                  | 100                 |
| Compost production (kg)       | NA              | 150                                 | 300-400             | 160                 |

respectively. It showed that the total nitrogen content in PSN enriched compost was highest and this could be due to nitrogen enrichment (Tognetti *et al* 2005; Singh and Ganguly, 2005).

The carbon nitrogen ratio determines the quality of compost. The carbon nitrogen ratio of PSN enriched compost was lowest which was

10.5, followed by Swift compost (16.9). The highest carbon nitrogen ratio was recorded in Normal compost which was 43.7, this finding corroborated the finding of Sharma *et al* (2004).

The total phosphorus content ranged from 0.41-3.5% (NC-0.41 %, SC- 2.21 %, PSN-3.5 %). The total phosphorus content in PSN enriched



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compost was highest, this could be attributed to enrichment of compost using di-ammonium phosphate. Similar results were reported by Singh and Ganguly (2005) and Biswas and Narayanasamy (2006).

The total potassium content of Normal compost was lowest at 0.96%, while the content was 1.2 % at PSN compost. The highest total potassium content was 2.64% in Swift compost which was due to pure utilization of cow dung as substrate. Cow dung has high content of potassium. Similar findings has been reported by Kalemewala *et al* (2012) and Jayapal *et al* (2021).

### CONCLUSION

It can be concluded from the present study that there were not much distinguishable difference amongst the three compost methods considering physical parameters. However, apart from all the chemical parameters taken under study being higher than normal compost, the nutrients- nitrogen and phosphorus content in Phospho-sulpho-nitro enriched compost was comparatively higher than the swift and normal compost. The CN ratio was also lowest at PSN enriched compost and therefore could be recommended to farmer.

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