

Comparison of the Effectiveness of Fertilizer Produced from Tannery Waste with Synthetic Fertilizer for Plant Growth

H.L.T. Asangika, A.M. Samaraweera, H.M.S.K. Herath
Uva Wellassa University, Badulla, Sri Lanka

and

W. Wickramasinghe
Ceylon Leather products PLC, Mattakkuliya, Sri Lanka

Introduction

Tanning is a process by which hides are converted into leather. There are large amount of waste generated during leather processing. Among them fleshing waste, the removed flesh parts from the limed skin during fleshing operation are produced in large quantities (Rach *et al.*, 1997). Animal fleshing, generated from pre-tanning operations constitute about 50 to 60% among tannery solid wastes that are high in protein (50.9%) and collagen (3.5%) (Anim, 2013). Conversely, nitrogen is the most important nutrient which is required for plant growth (Abubakar *et al.*, 2004). Therefore, animal flesh can be used as a good source of nitrogen for the plant growth and this research was carried out to produce liquid nitrogen fertilizer from fleshing waste generated in the tannery.

Methodology

Flesh samples were collected from Ceylon Leather Products PLC at Mattakkuliya in Sri Lanka. Enzymatic and Alkaline hydrolysis were done separately to hydrolyze the flesh using Erhavit DMC (a proteolytic enzyme) and carbide lime, respectively. Carbide lime (6%), Erhavit DMC (0.4%) and water (200%) were used according to the weight of the flesh (5 kg each) for hydrolysis at 11-13 pH and 37 C and 5 g of bactericide was added to each mixture. Three replicates were done for each treatment and liquid extracts were collected on day 2, 4, 6, 8 and 10 to measure the Soluble N % using kjedhal method. Liquid extracts which gave the highest nitrogen content (%) were selected from each treatment as liquid N fertilizer. According to the trials liquid extract from day 6 alkaline hydrolysate and day 10 enzymatic hudrolysate were selected.

Selected alkaline and enzymatic hydrolysates, urea (positive control) and without any N fertilizer (Negative control), were applied to 14 days old lettuce plants (*Lactuca sativa*) to check the effectiveness of fertilizer. Equal quantities of phosphorous and potassium were added to all treatments considering the nutrient requirement of the lettuce plant. Four treatments consisted three replicates including three lettuce plants per replicate. Complete Randomized Design (CRD) was conducted and data was analyzed using analysis of variance (ANOVA) and mean comparison was done by Tukey test.

Results

There is a significant difference among the four treatments and number of leaves of the plant ($p < 0.05$). According to the Figure 1 treatment one was the best because it gave the highest mean value (12.967) compared to other treatments while treatments. Similarly, there is a significant difference among the four treatments and height of the plant in the experiment. According to Figure 2 treatment two was the best because it gave the highest mean value (22.600) compare to other treatments.

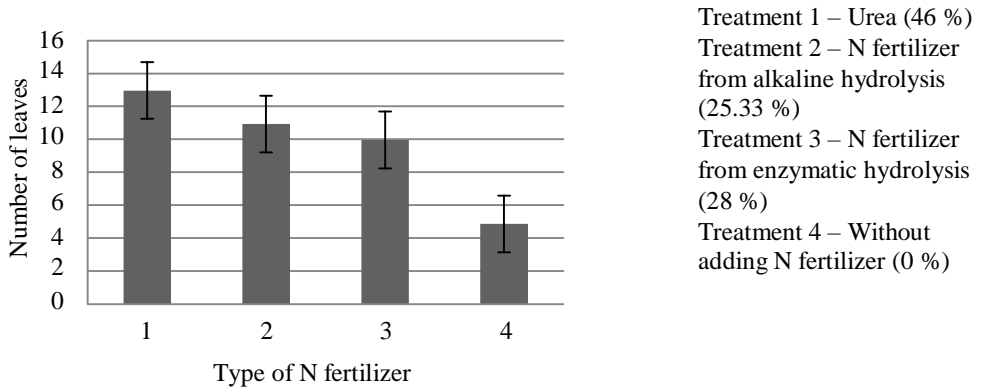


Figure 1. Number of leaves of *Lactuca sativa* plant versus Type of N fertilizer

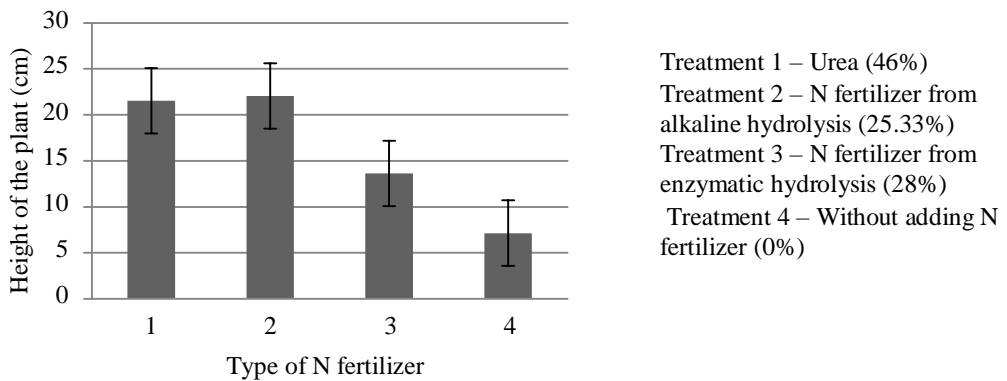


Figure 2. Height of the *Lactuca sativa* plant (cm) versus Type of N fertilizer

There is a significant difference in treatment and leaf area of the plant in the experiment ($p < 0.05$). According to the Figure 3 treatment two was the best because it gave the highest mean value (269.33) compared to other treatments.

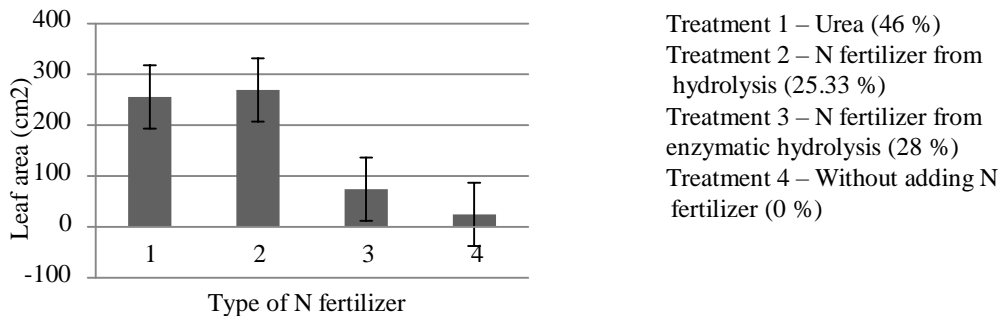


Figure 3. Leaf area of the *Lactuca sativa* plant (cm²) versus Type of N

Discussion

According to the results, the best values for plant growth, height and leaf area were given from N fertilizer produced from alkaline hydrolysis. Alternatively the lowest growth was shown in treatment 4. Moreover, the fertilizer produced from alkaline hydrolysis gave a similar growth even as control. Therefore, it clearly emphasize that N has a greater total influence on plant growth than most of other essential elements (Vasudevah, 2002). Moreover, there was no significant difference between treatment and weight of the plant ($p>0.05$).

Alkaline hydrolysis was done using $\text{Ca}(\text{OH})_2$. Therefore, this liquid fertilizer may contain Ca other than soluble N. Ca is a major component of plant growth and development. Plants need calcium for cell wall development and growth (Albrecht, 1997). Furthermore, flesh is a good nutritious media with lipids (15.6%) and Ash (7.6%) other than protein (Anim, 2013). Thus, this fertilizer may contain important ions required for plant growth other than N. Therefore, considering the results obtained, fertilizer produced from alkaline hydrolysis is the best fertilizer for plant growth. ++

Before applying the fertilizer from enzymatic hydrolysis to the lettuce plants, the fertilizer was neutralized to 6.5 using sulfuric acid. During the first week pH of the nutrient solution was changed from 6.5 to 7.8. Since, the active pH range of the enzyme (Erhavit DMC) was 7 to 13, this pH range may have reactivated the enzyme activity. Moreover, any change in pH or Electrical conductivity (EC) may reduce nutrient uptake and damage plant root (Vasudevah, 2002). This could be the reason for reduced plant growth in nitrogen fertilizer from enzyme hydrolysis.

Conclusion

Fertilizer from alkaline hydrolysis was good as control for overall plant growth and could be used as a good liquid N fertilizer.

References

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