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Design and construction of a unit for the production of vermicompost from cattle-equine organic waste

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ABSTRACT

Today human's organic waste discarded reaching municipal disposal; inadvertently while they are wasting, nutrients for better crop management using natural techniques, void the chemicals that are killing our making them infertile lands. Therefore the vermicompost is a natural technique to exploit; we discard these nutrients in homes, and its final destination in landfills. The California red worm is what contributes to the production of vermicompost, digestion by leachate from the degradation of organic household refuse, thereby generating humus obtained at a given time can be screened debugging or for composting, with excellent macro-nutrients called mineral micronutrients.

Keywords: Unit Production, residual cattle-horse, california red worm, and Organic Fertilizer

INTRODUCTION

In the late twentieth century, dramatically community faces two major challenges to their intelligence. On the one hand, natural resources are increasingly limited to meet the needs of a growing world population [1]. This limitation stems mainly from intense and uninterrupted process of gradual depletion and systematic destruction of agricultural land [2]. Moreover, the increasing production of waste, waste or rubbish of modern life and the consequent overwhelming presence of pollution, deteriorating quality of life and hábitat of man. Modern man is waking up and evolves to change the concept of waste by the resource. In the XXI century man faces an inexhaustible source of waste in order to transform it into wealth. It is a technological, economic, social and environmental challenge [3]. As for organic waste man has discovered appropriate to recycle such waste technologies, and thus produce materials useful to mankind.

In several parts of the world, the worm that creature of God [4], beautiful humility, an animal prodigious [5], qualified man in the lowest scale of living beings [6]. It is playing an important role in the process of recycling organic waste [7], producing vermicompost, which is a biological fertilizer, organic fertilizer, an energizing soils and high value protein [8].

In confined spaces by relatively fast processes, with investments of moderate value, the worm works day and night to transform organic waste underutilized by man [9], helping to restore what can be considered the greatest wealth that humanity has fertile soils [10].

At present, production and breeding of worms has been technically demonstrated in a variety of municipal and agricultural wastes and potentially any organic waste [11].

A variety of British companies, French, German, Dutch, Italian, Spanish, Israel, Japanese, Canadian and United States have established profitable businesses vermicomposting and some authorities have tried vermicomposting system in a way, more efficient and more effective that through other means [12].

MATERIALS AND METHODOS

The design and construction of the worm production unit are from the following análisis, whereas a worm in the adult weighs 1gr.

a = 3 m long
b = 1 m height
c = 1.6 m wide

Volume = 4.8 m³ of organic waste to treat and per
Core worm = $2000 \ \frac{worms}{m^3} = \frac{2000\ gr}{m^3}$

Input = $\frac{15\ kg\ of\ organic\ residue}{m^3.\ 15\ days} = \frac{1\ kg}{m^3.\ day}$ theory

HEURISTIC RULE
Each adult worm consume daily 2 gr of organic waste

For 2000 worms are required $\frac{4000\ gr}{day}$

Therefore in practice the input is $\left[\frac{60\ kg}{m^3.15\ days}\right] \Rightarrow \left[\frac{4\ kg}{m^3.day}\right]$
There upon required

60 kg ----------- m³ $\Rightarrow$ x = $\frac{288\ kg}{15\ days} = \frac{576\ kg}{30\ day}$ to 4.8 m³
X ---------- 4.8 m³

Approximate costs required for the acquisition of the calculated weights for the construction of the worm drive estimated production inputs are in Table 1.

Fixed	Costs		Variable costs	
Amount	Concept		Concept	
3	Cement cuvettes	$47.00	Garbage colleted, homogeneized	$9.85
3	Gravel trays	22.5	Seedstok californian earthworm	25.93
1	Shovel gardener	50		
1	Zapapico	50		
1	Sand	80		
2	Containers	60		
2	Sieves	100		
2	idlers	100		
1	Bale cardboard sheet	170		
10	Blocks handmade	125		
1	Pruning shears	40		
1	Physicochemical analysis	2,250.00		
1	Roman scale	200		
Subtotal		$3,294.50	**Subtotal**	$35.78

Table 1 economic balance with the costs daring design and construction of the planter to produce compost and worm cores California. [13-15]

RESULTS AND DISCUSSION

Classification of population:
LA= Adult worm
LJ= Juvenile earthworm
H = Cocoon or capsule

The population density is defined as the number of individuals present per unit area and can reach a maximum when the conditions for its development are optimal, in image 2, the construction of the production unit indicated, in image 3, filling production unit indicated, with residuals organic, cow and of horse, illustrated using traditional mesh or burlap as a means of separating, in the upper distribution of organic waste, bottom, production of organic fertilizer and worm California part, called cores worm [16]. When in a small area there is high population density, food is scarce and the living space is reduced [17], dominate the strongest and best adapted individuals in this case can be seen migrating adult populations, shortage of cocoons and abundance of juvenile worms. As shown in figure 1, calculating the population density and the area of the production unit. The images 6, 7, and 8 illustrate the manual method separation of compost and worm nuclei in the production unit or stonemason [18].

The sample population was performed with a cylindrical container, as indicated in Figure 2, the sample collector is introduced at the surface, and the sample is removed and placed on a clean surface for the count of the population [19].

The heuristic rule states that a $1in^2$ must have 40% of adult worm, then there will be 60% of juvenile worm. 500 cocoons per square inch approximately [20].

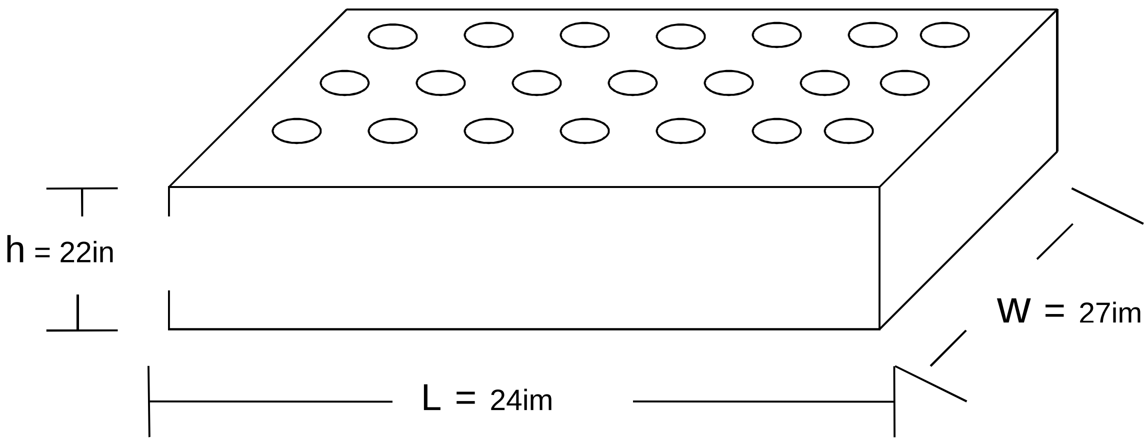


Figure 1 Area drawn trench for calculating population density

h = 22 in
A = 24 in x 27 in = 648 in^2
V= A x w= 648 x 22 = 14256 in^3

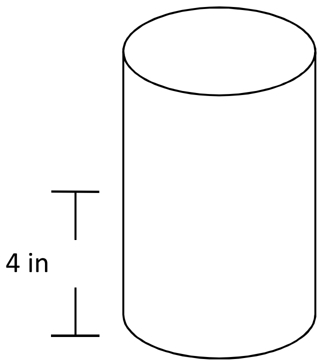
$$\frac{30\ kg \text{ organic waste}}{14256\ in^3}$$

Design equation: $F = \frac{1\ in^2}{a}$

From where: F = factor worm
a = area of vessel

Calculation of population density
Area of circle: $A = \pi \times r^2 = \pi\ (1.5in)^2 = 7.68in^2$

Figure 2 Sample collector for calculating the density of population



$$F = \frac{1550\ in^2}{7.68\ in^2} = 202$$

F = 202
F = 202 X 6 = 1,212 LA.
F = 202 X 10 = 2,020 LJ.

$$\Sigma = 3{,}232 \text{ Worms}$$

3,332 ⟶ 100%
1,212 ⟵ 37.5 % LA.

3,232 ⟶ 100%
2,020 ⟵ 62.5 % LJ.

$$\Sigma = LA + LJ = 100\% \text{ Worms}$$

3 buds ⟶ 7.068 in^2
657 buds ⟶ 1550 in^2

CONCLUSION

The production unit needs to be filled with the amount of residual organic fine crazing doing this every 15 days, I mentioned in the first report of calculation, this is placed the breeding herd of red wiggler california, which are 2000 individuals in adult and juvenile state and in a period of 2.5 to 3 months may be held on first population count shown in the second memory calculation, this is from the beginning production of organic fertilizer healed by art techniques is carried out the separation as indicated in the above publication in the Journal of pelagia, EJEB-2012, 2 (1):pp199-205 and EJEB-2014, 4(5):pp16-23

For the determination of physicochemical parameters in the organic manure produced on the production unit, as shown in pictures 1 and 2, the Handbook of Chemical Analysis techniques for vermicompost was used, prepared by the Soil Institute of the Ministry of Agriculture of Havana Cuba and the NOM-NMX-FF-109- SCFI 2008 vermicompost SEMARNAT.

The analysis for the finished compost product is divided according to the following groups:

- Physical Findings: organic matter, ash, moisture, pH and temperature.
- Chemical determinations: macronutrients N, P, K, Na, and Mg. Kjeldalh using the method for the determination of total nitrogen.
- Parameter total phosphorus color development was determined method. The team called colorimeter with blue filter.

- Determinations of K, Ca and Mg. were carried out in the atomic absorption spectrum air-acetylene mixture, using for each lamp parameters and building calibration curve measured in ppm units.
- Chemical determinations micronutrient Fe, Cu, Zn, Mn and Ca in the atomic absorption spectrum using air-acetylene mixture lamp for each of the parameters and building calibration curve measurement in ppm units [21-25].

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Image 1 Front view of the production unit

Image 2 Production unit loaded with cattle waste and horses

Image 3 The separcion are Illustrate through the mesh of the nuclei, the worm california

Image 4 Aerial view of the production unit with the final product

Image 5 Separation of the finished product, natural organic fertilizer in production unit