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EMRO 134

Lecture No.15

The Composting Process and Marketing

A. The Composting Process - primitive form

Has been practiced by farmers and gardeners throughout the world for centuries. Vegetable matter or grass and leaves and animal manures are placed in piles in some open space, or thrown into pits and allowed to ferment until ready for application to the soil. This process requires six months to a year and involves no control. Possibly the mess is covered with soil or is turned once or twice during the year.

1. This is the anaerobic method: without oxygen.
   a. Requires a long time period
   b. Objectionable odors released if the crust is broken into before complete composting.
2. The Indore Method (Sir Albert Howard - India - 1926)
   a. Organic wastes such as garbage, straw, and leaves alternated in layers with night soil, sewage sludge or animal manures were put in trenches 2-3 feet deep or piled on open ground about 5 feet high; turned twice during 6 months.
   b. Bangalore Method: some modifications to above - turning the material more frquently to hasten the action (addition of oxygen-aerobic) and to lessen the odors.

B. The Composting Process - modern developments

1. Beccari Process (patented - Italy 1922)
   a. Anaerobic (without oxygen) fermentation in enclosed cell to prevent escape of foul odors during initial breakdown of organic matter.

b. Later vents opened to admit air; decomposition proceeds under partially aerobic (with oxygen) conditions.

2. Verdier Process provided for recirculation of gases or drainage liquors

3. Bordas (1931) sought to eliminate the anaerobic stage

4. V.A.M. (Netherlands - 1932) - van Mannen process

a. Essentially an adaption of Indore process to compost municipal refuse

b. Original method: dumping refuse in long, high piles with no treatment other than periodic sprinkling with recirculated drainage liquor during composting periods. Decomposition required 4 - 8 months; it was then taken to a plant to be screened and pulverized.

c. Later method at Schiedam (population 70,000)
First: grinding, then into compost piles and turned frequently as required to maintain aerobic conditions. Composting requires 3 to 6 weeks in summer, longer in winter when refuse contains considerable ashes.

5. Dano Process (Biostabilizer)

a. Refuse fed into a single, slowly revolving horizontal cylinder that holds the material from one to five days; then windrowed with or without turning for 2 to 4 weeks.

6. University of California experiments

a. Non-compostable materials removed from a belt conveyor

b. Shredding or grinding

c. Placed in windrows (in open) 5 to 6 feet high

d) Turned 3 times in 15 to 21 day composting periods

7. Multiple deck process

a. Removal of non-compostables and grinding

b. Material moved by pan-type conveyors through 6 decks, permitted material to fall from one deck to next

c. Remains on each deck about 24 hours.

C. Factors for successful processing

1. Can be produced from components of municipal refuse such as garbage, organic rubbish, and other organic litter; from organic industrial wastes such as food processing wastes, saw-dust and wood chips; and from sewage sludge.
2. Removal and salvage of most non-compostable materials.
3. Shredding or grinding.
4. Carbon to nitrogen (C/N) ratio important; C/N of 30 to 1 desirable. Satisfactory operation at higher ratios but longer time required. Sewage sludge may be added to lower C/N ratio. At lower ratios nitrogen may be lost.
5. If C/N ratio of finished product exceeds 20 to 1, compost continues decomposition and if used as soil conditioner will rob soil of nitrogen.
6. Optimum moisture content - 40 to 60 percent by weight. Higher content acceptable with adequate aeration.
7. An initial rapid rise in temperature followed by levelling off and slow decline without fluctuations; (b) no putrefactive odors; (c) a progressively darkening color.
8. Aeration is necessary for aerobic process to obtain rapid, nuisance-free decomposition.
9. Time required depends on operation: from 5 days to 6 weeks.
10. Special inocula not required.

D. Why compost?

1. As refuse disposal method
2. To provide a needed agricultural product

E. Disposal of total product

1. Percent of non-compostable material
   a. Twenty years ago 15 to 20 percent
   b. Today 30 to 50 percent (The Netherlands)

2. Percent of compost (46 percent raw refuse)

3. Problem of storage of compost

   a. During season of no demand

   b. Of excess production

4. Study of "Composting Municipal Refuse in Europe and Israel" by George J. Kupchik, American Public Health Association, 1965

Production and Sale of Compost

System	Plant No.	Population served	Raw refuse processed (US tons)	Compost Produced (US tons)	Compost sold (US tons)
Dano	1	700 000	99 000	66 000	33 000
	2	170 000	46 500	25 800	25 800
	3	80 000	18 800	13 200	9 900
	4	54 000	9 900	4 500	4 400
	5	210 000	32 400	5 300	4 300
		1 214 000	206 600	114 800	77 400
Dorr-Oliver	6	700 000	199 000	74 200	37 400
	7	130 000	26 400	18 100	17 600
	8	75 000	17 700	13 200	13 000
		905 000	243 100	105 500	68 000
Others	9	27 000	9 300	5 500	5 500
	10	90 000	16 800	10 100	0
	13	100 000	18 800	8 800	8 800
	14	800 000	162 000	55 000	57 200
		1 017 000	206 900	79 400	71 500
Total (12)		3 136 000	656 600	299 700	216 900

I. Compost produced = 299,700 tons
   Compost sold = 216,900 tons

F. Marketing Compost

1. Agricultural value

   a. Good but should be determined by Federal Agriculture Department based on analysis of product; good for all soils?

b. Compost is not a fertilizer (article in India)

c. Compost will generally complement chemical fertilizers

2. Costs of transportation of compost to point of use

a. Does farmer have means of transportation?

b. How far is economical?

c. Market area may be limited to radius of 25 miles from point of production.

3. Total annual tonnage demand from a given plant

a. This should limit the size of the plant

b. What to do with balance of refuse

4. Creating demand for compost

a. Requires proper publicity and advertising

b. Sales organization

c. Subsidy by government

5. Costs of processing raw refuse - Study by Kupchik

four different methods: (in U.S. dollars per U.S. ton)

	First Method	Second Method	Third Method	Fourth Method
Capital Cost	1.64	1.45	1.86	3.29
Operating Cost	2.45	2.27	3.27	3.27
Total Cost	4.09	3.72	5.13	6.56
Income				
Salvage	0.42	0.08	0.17	0.02
Sale of Compost	1.18	1.15	1.56	0.70
Total Income	1.60	1.23	1.73	0.72
Net Cost	2.49	2.49	3.40	5.84

6. Avoid comparisons of compost cost to fertilizer

a. Volume and weight to be hauled and comparative costs

b. Cost of discing excessive amounts of compost into fields