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COMPOST AND VERMICOMPOST

Production Facility Project Presentation


Rivo's Technics
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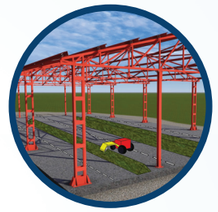

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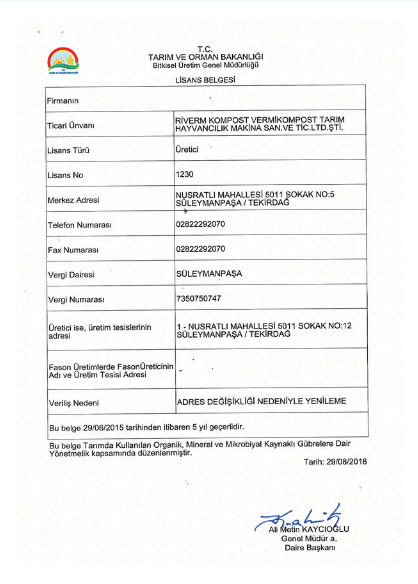

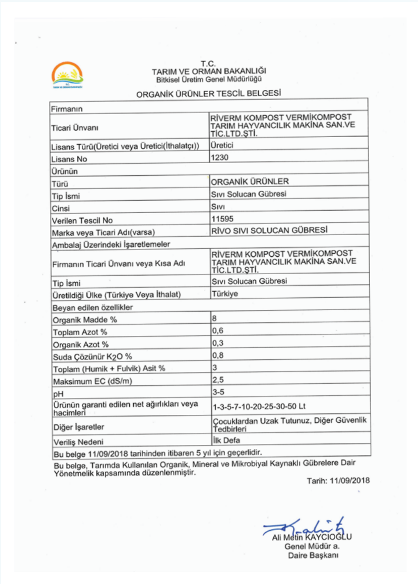

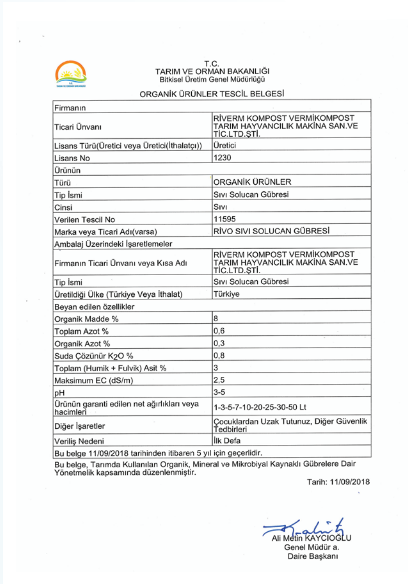

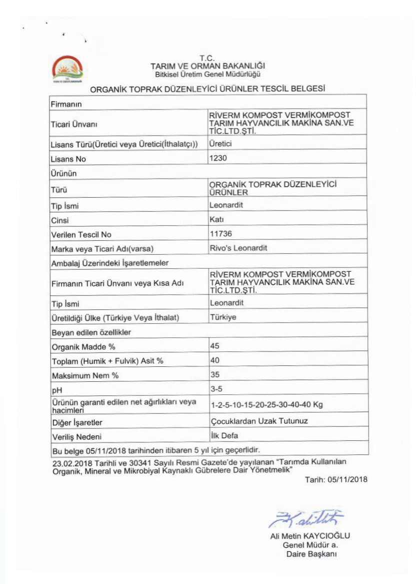

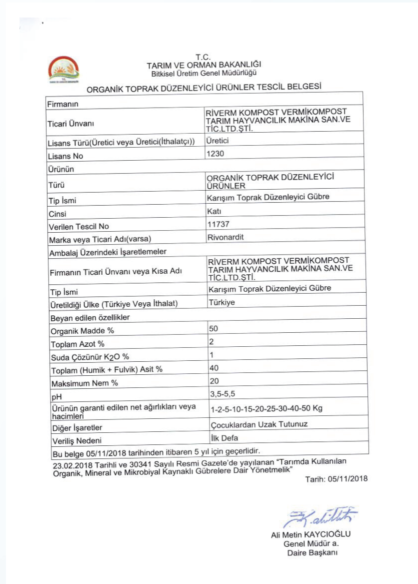

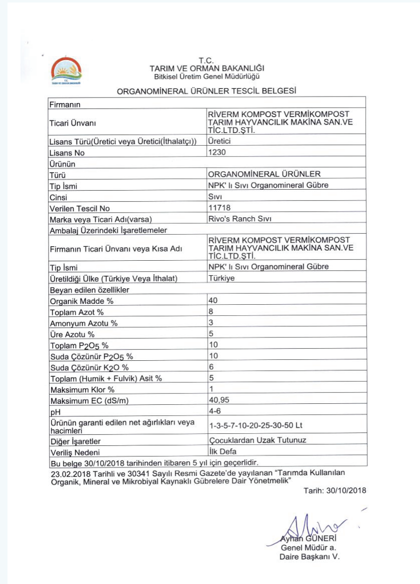

SECTION 1

Things To Consider in The Facility Installation

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Things To Consider in The Facility Installation:

* Growth (capacity increase, etc.)
* Transportation
* Raw material supply opportunity
* Environment and conditions
* Appropriate infrastructure
* Slightly sloping terrain
* Flood risk etc.

1.1. WORM FORAGE PRODUCTION UNIT

* The decomposition of plant and animal wastes in a humid-oxygenatedenvironment into organic fertilizers is called composting
* Worms feed by eating rotten waste.
* **Composting (rot) isn't worm bait.**
* It is formed by the aerobic decomposition of organic substances by microorganisms
* Under controlled conditions.
* Microorganisms such as bacteria and fungi also; produce carbon dioxide, water, heat, minerals and organic matter by burning organic compounds.
* In this process, the temperature rises and pathogens (disease-causing microorganisms), weed seeds and harmful insect species are destroyed.

Highlights of the Composting Process:

* C/N ratio (average 30%): For growth and microbial activity
* Sufficient oxygen: For the aerobic organism
* Humidity level: For aeration effect
* Appropriate temperature
* Appropriate environmental conditions

1.1.1. WASTES TO BE PROCESSED IN THE FACILITY (Raw Material)

* It is foreseen to use 70% (usually) cattle manure and 30% organic waste in the forage facility. (This ratio varies according to the carbon nitrogen ratio).
* The physical and chemical properties of the cattle manure to be used in the facility are shown in table 1.

Table 1. *Properties of cattle excrement passed through the separator to be used in the forage facility*

PARAMETER	CATTLE MANURE
Dry Matter [%]	14
Organic Dry Matter [%]	85
N [%]	2,6
C [%]	40

* If the daily manure production of a cattle is calculated as 0.029 tons and it is assumed that there are 600 cattle on your farm: 600x0,029= 17,4 t/day
* In this case, 17.4 tons a day of cattle feces will be used.
* The collectability ratio of manure from cattle has been accepted as 1/2. The coefficient of gathering depends on the duration of the animals in the barn, the time the feces pass to the facility and the climatic factors.
* The dry matter ratio of cattle excreta was evaluate as 14%.

Table 2. *Characteristics of the cattle manure to be used in the forage facility*

	Number of Animals	Daily Waste Generation (t/day)	Daily Waste Generation (t/day)	Collectable Fertilizer Amount (t/day)	Fertilizer Collected in 60 Days (t/60 days)	KM of Material Collected in 60 Days (t/60 days)
Cattle Feces	600	0,029	17,4	8,7	522	73,08

* The content of 30% domestic organic wastes to be used in the forage facility consist of green wastes (domestic organic wastes, gras, tea, coffee grounds, etc.) and brown wastes. (sawdust, paper, cardboard, etc.).

1.1.2. CREATING A STACK

* 8.7 tons of separated manure can be obtained from a cattle farm with 600 heads per day.
* The forage formation process will be carried out in heaps and the waiting time in heaps will be around 60 days .

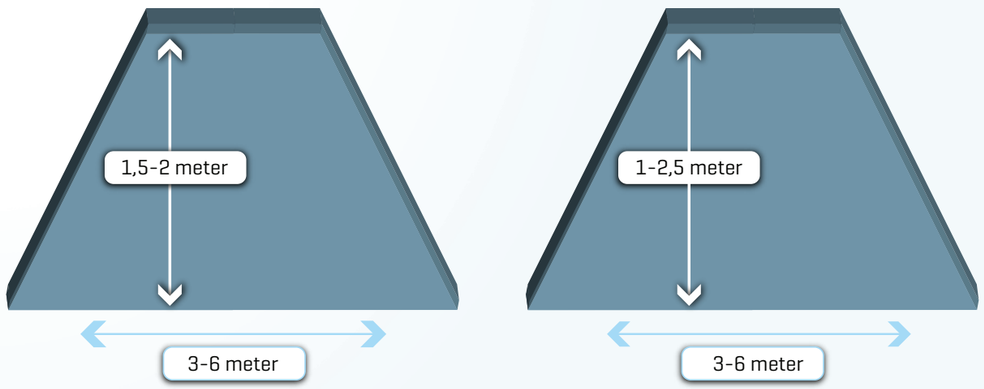


Figure 1. *Stacking Dimensions*

1.1.3. FORAGE PRODUCTION

* The forage production process will be carried out on the concrete floor. The concrete floor can be expanded according to the required capacity.
* Drainage channels will be established on the concrete floor for the evacuation of leakage water.
* The piles placed on the ground will be regularly mixed with the forage mixing machine and aeration will be provided. When necessary, it will be moistened for the continuity of the microbiological process.
* Stack mixing will be done every day for the first week. It will be performed 2 or 3 times a week in the ongoing process.
* It is necessary to have a water tank in order to control the humidity during mixing.
* After 60 days of processing, it is planned to produce 4-6 tons of ready-to-use compost from 7-8 tons of bovine manure passed through a separator.
* The facility area (concrete section) to be used can be evaluated as 800 or 1,000 m2.
* In this case, the shape and length of the stack can be 25-50 m (optionally), the stack width can be 3-6 m. The distance between the line lengths should be such that the equipment to be used for mixing can pass.
* There must be a tractor and front loader at the facility in order to create the stack. (Figure 2)
* A compost mixing machine must be located in the facility in order to mix the stack at the proper ratio . (Figure 3)

Figure 2. *Tractor and a front loader to be used in the forage facility*

Figure 3. *Compost mixing machine to be used in the forage facility*

1.1.4. INDOOR SYSTEM

* It is the combustion process of manure placed in a closed area, the lower part of which is arranged in such a way that the airflow is transferred.
* The air given from below provides aerobic respiration in the man.
* The fertilizer placed in the indoor system is formed in 4 to 8 months.
* It provides benefits to production areas in terms of space savings. (Figure 4)

NOTE: *It isn't recommended to use this system in forage production. It can be used mostly for compost production.*

1.1.5. RESTING ON AIR FORAGE

* Since the reaction doesn't end completely, the forage with a high temperature should be kept until it cools completely (no smoke). It is recommended to cover the forage pile with canvas.

Forage Content:

	REASONABLE RANGE	PREFERRED RANGE
C/N	20:1-40:1	25:1-30:1
Moisture Content	%40-65	%50-60
Amount of Oxygen	>%6	%16-18,5
pH	5,5-9	6,5-8,5
Temperature	40-60	55-60
Particle Size	5 cm	Changeable

* C (carbon) and N (nitrogen) are essential and important nutrients.
* During forage production, microorganisms use carbon for energy and growth, and nitrogen for protein and reproduction.

Carbon-Nitrogen Ratio
Nitrogen Source:

Horse Manure	852:1
Pig Manure	563:1
Cattle Manure	442:1
Grass Clippings	80:1
Vegetable Waste	35:1

Carbon Source:

Newsprint	852:1
Cardboard	563:1
Sawdust	442:1
Leaf	80:1
Vegetable Waste	35:1

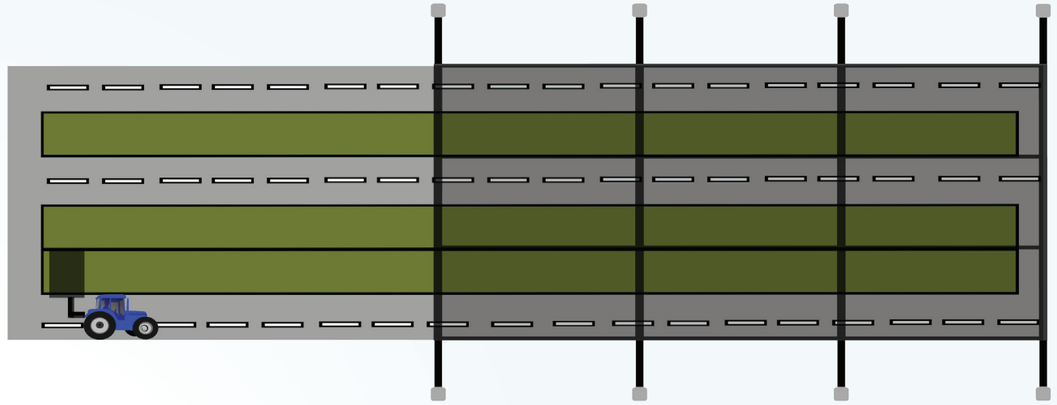
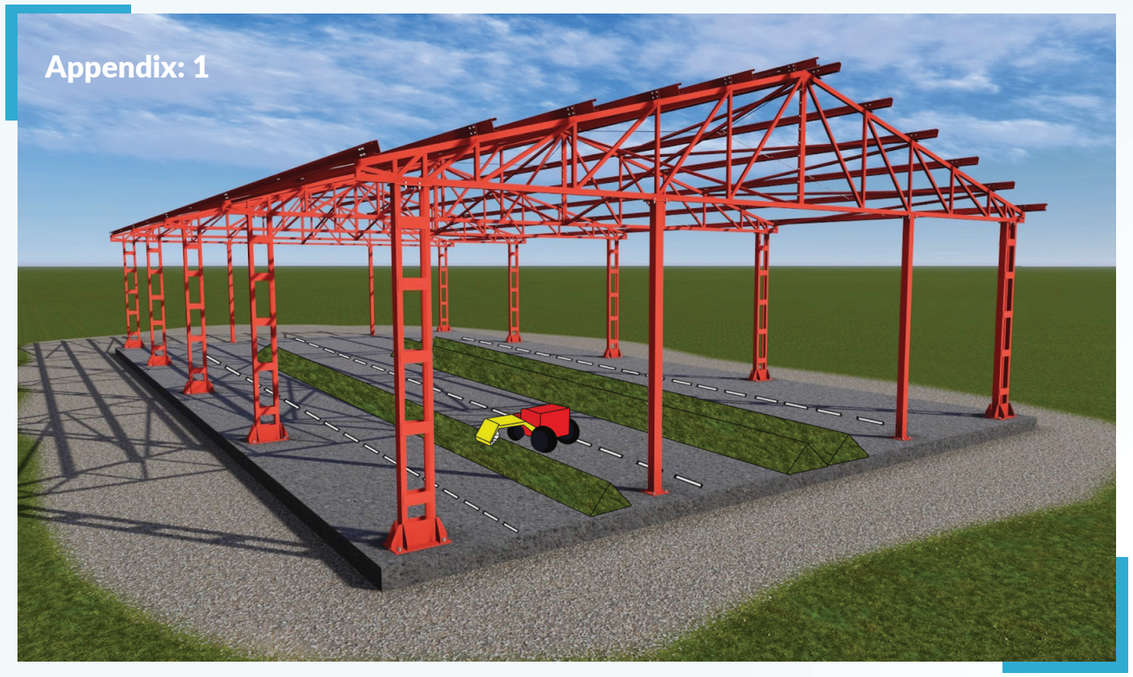


Figure 5. *Sample Compost Facility Drawing (See Appendix: 1 and Appendix: 2)*

Figure 6. *Forage production and/or compost facility*

Appendix: 1



Appendix: 2

SECTION 2

Vermicompost Production Facility

2.1. VERMICOMPOST PRODUCTION FACILITY

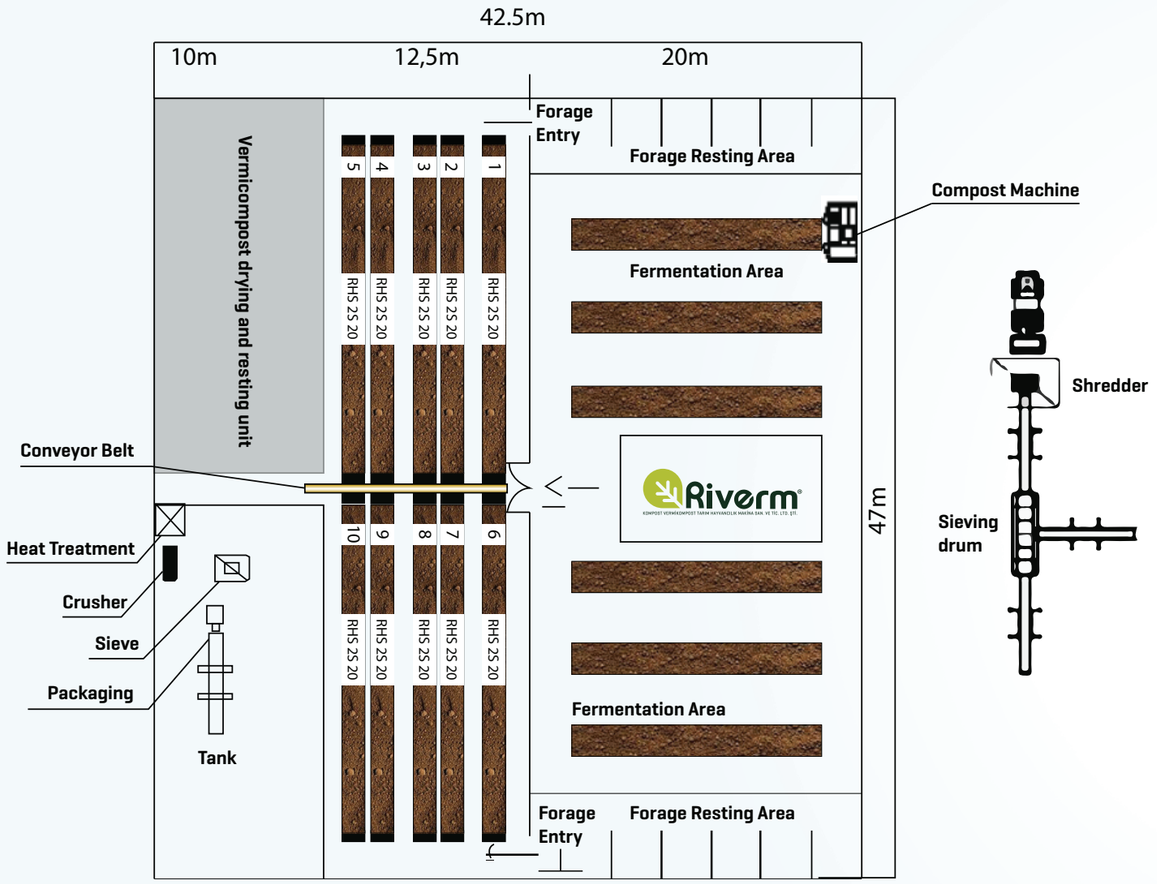
2.1.1. RESTING ON AIR FORAGE AREA

* The worm bait is taken to the resting area to be kept in a hygienic environment until it cools down to be given to the worms.

2.1.2. WORM AND VERMICOMPOST PRODUCTION AREA

* In the production area of worm and vermicompost, which is designed separately from the holding room, in 10 20 m Vermicompost Harvesting Systems (Rivo's Harvesting System RHS-2S/20),initially 250,000 to 375,000 adult worms are foreseen for each bed.
* The number of production systems can be increased according to the need. (See Appendix: 4) 2.1.3. FEEDİNG
* A mixture of semi-rotted (fermented) cattle excrement and a certain amount of domestic waste (we call it worm forage) is given to the beds at certain periods for 90 to 120 days to forage the worms and ensure that the beds are fully filled.
* The amount of forage to be given in this process is estimated as 15 to 17 tons for each Vermicompost Harvesting System (Rivos's Harvesting System RHS-2S/20).
* At the end of 90 to 120 days, the Vermicompost Harvesting System will be harvested from below and the first crop will be taken (Necessary training on this subject will be given by us.)As the first harvest, around 1 to 2 tons of vermicompost will be obtained.
* In the following periods, 2 feedings and 1 harvest will be done every week and around a thousand kilograms of vermicompost will be obtained from each bed .

TECHNICAL DETAILS AND STANDARD SPECIFICATIONS	
Producer	Rivo's Technics
Model	Rivo's Harvesting System (RHS-X)
Blade	Laser cut (Chain-lifted monobloc)
Chain and Equipment	Double-sided traction system with fertilizer isolation
Board Specifications	Electronically controlled; digital temperature and moisture measurement; light and sound warning
Security	Three emergency stop buttons
STRUCTURAL SPECIFICATIONS	
Skeleton	Welded metal profile
Side Plates	PPM plastic
Design	3D CAD-based modular; multiples of 2.5 m
Sizes Between Outer Sides (RHS-2S/20)	13 m (w) x 20.9 m (l) x 1.2 m (h)
Colour	RAL 6005 moss green
CAPACITY	
Suggested Initial Worm Capacity (RHS-2S/20)	250,000
Full Worm Capacity (RHS-2S/20)	1,000,000
Total Vermicompost Capacity (RHS-2S/20)	18.5 cubic metres (±10%)
First Harvest	Within 3 to 6 months
Monthly Vermicompost Capacity (RHS-2S/20)	4.5-5 metric tonnes (moist)
OPTIONAL FITTINGS	
Conveyor Belt	41-m long (RHS-X/20), 2.5-mm thick rubber coating
Board Specifications	Remote monitoring, remote control through computer and mobile phone, PLC touch screen, temperature and moisture control system



2.1.4. FEEDING

* The forage obtained from decomposed cattle feces is given to the beds at certain intervals for 120 to 180 days, ensuring that the worms are fed and the beds are filled.
* In this process, the amount of forage has been estimated as 15 to 17 tons for each system (Rivos's Harvesting System RHS-2S/20) .
* At the end of 90 to 180 days, the worm bed will be harvested from below and the first crop will be taken.(Necessary training on this subject will be provided by Riverm Ltd.) As the first harvest, around 1 to 2 tons of vermicompost will be obtained.
* In the following periods, 2 feedings and 1 harvest will be made every week and around one and/or two tons of vermicompost will be obtained from each bed.

Note 1: Based on 38 weeks (first 14 weeks preparation and feeding period) at the end of the first year, approximately 38x1.5 tons = 57 tons of vermicompost will be obtained from a 20 m worm bed. If we start with 375,000 worms in the first year, considering the deaths and births, it is predicted that the number of worms in the bed will reach full capacity and the number of worms will increase to around 1,000,000.

Note 2: For the second year, around 78 tons of vermicompost will be taken from the same worm bed and since the number of reproducing worms will increase, the old worms will be trapped and taken out, and left to the culture beds for the continuation of reproduction.

SECTION 3

Heat Treatment - Drying

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3.1. HEAT TREATMENT - DRYING

3.1.1. HEAT TREATMENT

* Putting Heat Treatment at the exit in the resting room of the facility is by the relevant legislation of the Ministry of Agriculture. In other words, the product should be kept at 70 degrees for 1 hour in Heat Treatment in a clean area before entering the packaging.
* Our recommendation is to apply this application to the semi-fermented worm forage so that the forage will have a range of pathogens and be free of weeds or seeds etc.
* Heat Treatment capacity is recommended as 500-1000 kg. [Figure 7]

Figure 7. *Heat treatment machine to be used in vermicompost facility*

TECHNICAL DETAILS	
Producer	Rivo's Technics
Model	Rivo's Tray Heater (RTH-1)
Oven Net Dimensions	1.500 x 3.750 x 1.500 mm (± 20 mm)
Oven Outer Dimensions	1.850 x 4.250 x 2.250 mm ± (50 mm)
Oven Max. Operating Temperature	75 °C
Oven Power	380 V 100 kW
Oven Inner and Outer Coating	Galvanized Slab
Product Capacity	(~) 500 - 1.000 kg / hour
Control	PLC Record Control System
Electric Control Panel	It is mounted on the oven. Temperature control is provided by an electronic digital display thermostat. PLC system and computer connection are made. There is a timer that allows setting the heating time inside the oven. There are two heat probes for the oven heat system. While the first probe is for oven temperature control, the second probe is placed between the material in the tray. (Optionally, the number of probes can be increased.)
Heating the Oven	Air is blown between each shelf. There is a shelf system inside the oven. There are 10 compartments and 50 trays on the shelves. Each shelf can carry 100 kg and 5 trays can be placed. Heat is supplied to the interior of the furnace in a pressurized manner through the steam system (steam generator). Heat is protected by an insulation system. The oven door is insulated on both surfaces and locked from the center.

SECTION 4

Resting – Packaging - Storage

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4.1. RESTING – PACKAGING - STORAGE

4.1.1. RESTING AREA

* The vermicompost obtained is taken to the holding room which is designed separately from the production room and it is kept here for approximately 30 to 60 days (until the humidity reaches the maximum level of 35%), the moisture is tried to be removed.

4.1.2. CRUSHING AND FERTILIZER MILL (& SIEVE)

* The particle size of the product is reduced by taking vermicompost, which is rested and freed from excess moisture, into the crushing unit.

SEMI WET METERIAL CRUSHER

TECHNICAL DETAILS
Capacity: 1ton/h
Voltage: 380 kW
Engine: 5.5 kW 3000rpm
Packing in Wooden Case (Dimensions)
620mm X 1580mm X 1830mm / 245 kg

CRUSHER

TECHNICAL DETAILS
Capacity: 1.5 tons/hour
Voltage : 380 kW
Engine : 5.5 kW 1500 rpm

4.1.3. SIFTING UNIT

* Vermicompost with reduced particle size is passed through 0-3, 0-5 mm drum or vibration sieve.

4.1.4. PACKAGING UNIT

* The vermicompost, whose all production processes are completed, is transferred to the packaging unit for filling in the desired weight or volume.

4.1.5. STORAGE UNIT

* The properly packaged vermicompost is transferred to the storage unit ready to be put on the market.

! Issues to be Considered During Production:

* Adjusting the humidity of the manure passed through the separator during composting
* Ensuring the C / N ratio
* It is necessary to apply a healthy heat treatment
* Minimizing the risk of pathogen contamination after the heat treatment process
* Ensuring proper humidity in bedding systems
* Providing the temperature
* Providing proper pH
* The number of worms should be proportional to the size of the worm bed.
* Appropriate and periodic feeding should be done
* The desired moisture should be caught after cutting
* Adjusting the particle size before packaging
* Storage should be suitable

Figure 9. *Packaging unit to be used in vermicompost facility*

SECTION 5

Vermicompost (Worm Fertilizer)

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5.1. VERMICOMPOST (Worm Fertilizer)

5.1.1. PROPERTIES OF VERMICOMPOST

* It is a highly productive type of fertilizer obtained from the excrement of worms such as Red California and European Nightcrawler, which are fed with bovine droppings and certain amounts of organic wastes.
* It resembles black soil and is odorless.
* It contains all the enzymes required for the development of the plant, soil antibiotics, vitamins and growth hormones.
* Due to it is organic, it contains 5 times more nitrogen and potassium, 7 times more phosphorus and 2 times more calcium than chemical fertilizers.
* It contains about 40 million microorganisms per gram. The most important are : Azotobacter, Clostridium, Nitrobacter, Nitrosomonas, and nitrosococcus.
* It doesn't contain any chemicals.
* It doesn't have any toxic effects on plants, animals and humans.
* Absolutely free of pathogenic substances, parasite eggs, weed seeds and heavy metals.

5.1.2. BENEFITS OF NATURAL VERMICOMPOST

* It ensures the continuity of sustainable agriculture by enriching and revitalizing the soil in organic matter care.
* It is an organic product that regulates the pH balance, biological and physical structure of the soil.
* By increasing the water holding capacity of the soil saves up to 40% of water and thus greatly reduces the risk of erosion.
* When used regularly, the improvement process of the chemicals in the soil begins rapidly.* By balancing the micro and macro elements in the plant, accelerates the productivity and crop efficiency and increases the product yield up to 70%.
* It positively changes the color and flavor of the plant by increasing the nutritional value of the plant. In this way, it provides safe, natural and ecological products.
* It increases the plant's resistance to frost and protects from disease.
* It prevents the contamination of underground water by keeping the washable plant nutrients by organic substances.

SECTION 6

What is Vermicompost Tea?

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6.1. WHAT IS VERMICOMPOST TEA?

Vermicompost tea is the transfer of the extract and microorganisms in the worm fertilizer to the water.

Includes:

* Enzymes and amino acids
* Bacteria, fungi, protozoa (unicellular organisms) and beneficial nematodes
* There are water-soluble nutrients and organically bound nutrients.

6.1.1. BENEFITS OF VERMICOMPOST TEA

* These beneficial microorganisms and nutrients nourish and strengthen the plant .
* It protects the roots and leaves of the plant against pests thanks to the bio-film layer formed on the plant.
* Increases the feeding power of the plant and the yield of the crop.
* It increases the drought resistance of the plant and reduces water use.
* It regulates the soil and helps it return to its natural structure.
* It increases the water-holding capacity of the soil.

!Note 1: The number and diversity of microorganisms depend on the quality of the vermicompost and tea machine used. If this system isn't used, the extract and microorganisms in the worm manure cannot pass into the water, cannot reproduce and survive.

!Note 2: It can be applied easily with drip irrigation, sprayer or back pump. Owing to the filter system, all particles and residues are collected and don't cause clogging.

6.1.2. VERMICOMPOST TEA MACHINE OF (Rivo's Compost Xtractor) TECHNICAL SPECIFICATIONS

* With its high-quality stainless steel structure, it is suitable for long-term commercial use. It is the most advanced system among the existing systems.
* Owing to its design, it is easier to use and clean than other methods.
* Business doesn't require power, the whole process can be performed by one person.
* Owing to its durable structure and engine, it can work 24/7.
* The electrical system is designed for city electricity suitable and can be used anywhere.
* It is designed for maximum efficiency. 7.5 kg of worm manure is sufficient to produce 850 liters of Vermicompost Tea.

Figure 10. *Vermicompost Tea Machine*

TECHNICAL DETAILS	
Producer	Rivo's Technics
Model	Rivo's Compost Xtractor (RWC-2)
Pipe Parts	PPRC Plastic Pipe
Reducer	220 V
Panel and Resistance	Optional
Transfer Pump	Adblue Pump
Framework	Aluminum Profile
Warranty Period	8 Months

SECTION 7

Why Worms?

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7.1. WHY WORMS?

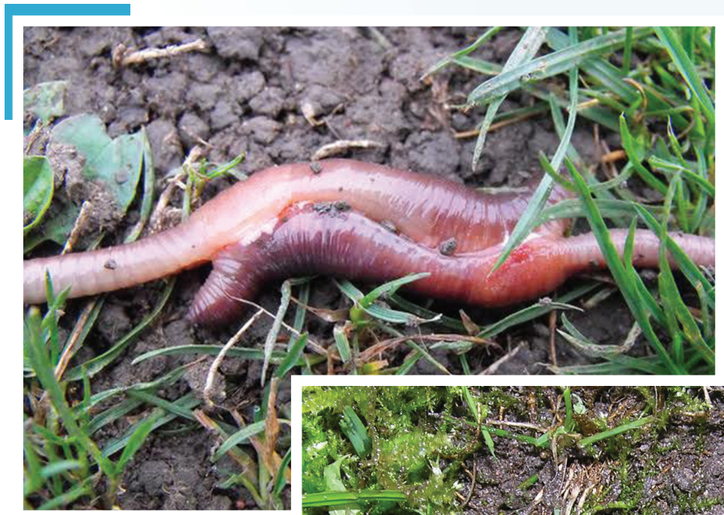
* The first and most important reason why it is preferred in fertilizer production is that its digestive systems are much simpler and smaller than all other living things. Because the smaller the digestive system, the better fertilizer is obtained. This is one of the factors that make worm compost even more advantageous than barn manure.
* Other reasons are that they consume forage quickly, multiply and easily adapt to their environment.
* The feed that comes out of the worm's rectum is in the form of small granule coprolites. Coprolites contain humic substances that improve the aeration and water retention of the soil and increase its productivity by regulating its structure. Coprolites are also a source of continuous replenishment of fresh microbe generations of soil micro fluorine and a center of microbiological activity.
* They progress by digging the soil and eating organic materials (plant and animal residues, soil bacteria, fungi, etc.) that are scattered in the soil. Thus, they enrich the soil in terms of organic matter and produce fertilizers with completely organic structures.
* Earthworms increase the growth of cereal crops by 39%, seed yield by 35%, and the nitrogen content of the seed by 12%.
* In the greenhouse studies, it has been determined that they significantly affect the plant yield and increase the quality of wheat and clover.
* It has been demonstrated through experiments conducted in both laboratory and field conditions that earthworms support plant root development, significantly reduce the rate of root diseases, increase the quality of grains with meadow and crop yields (for example, protein content).

7.1.1. RED CALIFORNIA WORM (Eisenia Fetida)

* They can produce up to 55% of their body weight. 2000 worms can produce an average of 1 kg of fertilizer per diem.
* An average of 20° C is the ideal temperature for fertilizer production and reproduction. The optimal humidity required is 75% to 85%.
* When suitable conditions are provided, they can live for an average of 5 years.
* The number of adult worms increases approximately 10-20 times after 1 year.

7.1.2. EUROPEAN NIGHTCRAWLER WORM (Eisenia Hortensis)

* This worm species is also known as Dendrobaena Veneta.
* It is highly resistant to ambient conditions, especially cold. For this reason, it is the most preferred type of worm by fishermen to hunt fish living in cold waters.
* 15 to 21° C is the ideal temperature for them to live, breed and produce fertilizers. The optimal humidity required is 75% to 85%.
* The most important difference from the red California worm is that when there is no forage left on the surface, they descend deep into the ground in search of forage.
* On average, they are fed as much as their own weight, grinding what they eat in a short time and turning it into fertilizer.
* It has an 81.2% birth success rate. Each adult worm lays an average of 1 to 3 worm eggs per week, provided that ideal conditions are provided.



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