

# organikanova

The Nature's Way

## MANUAL FOR RAISING CALIFORNIAN RED WORMS







Worms are first mentioned 5000 years ago by the ancient Egyptians. According to their laws, it was strictly prohibited to take out worms from the valley of the river of Nile, since the secret regarding the fertility of that region was connected with the large concentration of worms in the river's sediments.

In nature, worms produce 40 kilograms of fertile humus soil at 1 m<sup>2</sup> for a period of one year or 40 000 kg per year per hectare.

In only 200 years, people have managed, with their behavior, to irreversibly destroy significant part of the humus soil produced by the worms for thousands of years. If this surface humus layer destruction pace shall continue, the production of food for us and for the future generations shall be endangered.

One of the methods for restoring the quality of the already degraded soils is the raising of Californian biohumus-producing worms.

Regarding the industrial biohumus (vermicompost) production, people have managed to raise special worm species recognized as Californian red worms (*Eisenia foetida*), which, during the manure processing, were singled out in terms of quality and processing speed. The Californian red

worm is singled out with respect to other worms due to the following features:

- increased resistance to significant temperature oscillations,
- 4 times longer lifespan,
- smaller living area (25 cm from the surface, whereas other worms live at depth of 2 to 6 meters),
- 6 times faster reproduction compared to other worms

As a result of the physiological potential of this species of worms, people have managed to develop an entire system of raising of Californian red worms for the purposes of:

1. biohumus production for soil fertilization,
2. own business creation.





# BIOHUMUS

## - produced by Californian Worms

Biohumus is manure processed by the Californian worms. Californian worms-produced biohumus is one of the most quality natural organic fertilizers on the planet. In recent times, with the organic production growth, there is high demand for this manure with stable purchase price, thus creating the opportunity for good agribusiness.

Biohumus is microbiological fertilizer. Biohumus microorganisms naturally transform unavailable forms of the elements of soil and air into easily accessible forms for the plants. In this manner, there is no need for additional plant nutrition supplements such as the chemical fertilizers.

Biohumus of average quality contains: 5 times more nitrogen, 7 times more phosphorus, 11 times more potassium and 3 times more magnesium compared to livestock manure.

Livestock manure which was not processed by Californian worms can transmit several types of weeds, plant diseases and nematodes.

Biohumus is universal replacement for mineral fertilizers and is suitable for production of organically clean food for both people and animals.

It quickly decomposes plant residues (lignocellulose) and during the decomposition process, it balances the ratio between carbon (C) and other elements N, P, K (below 20:1), so that plants could be able to use these elements.

For a period of one year, at an area of one hectare of air and soil, it synthesizes and retains 120 to 140 kg of nitrogen in the soil (one bag 15:15:15 N, P, K has only 7.5 kg nitrogen).

It increases the coefficient of utilization of phosphorus and potassium from aluminosilicates and releases large quantities of such elements from dead bacteria.

For a period of one year, dead bacteria leave 10 tonnes of organic matter on an area of one hectare.

Out of the total weight of their body, dead bacteria contain about 30 % phosphorus.

It biosynthesizes soluble and insoluble polysaccharides, improves soil structure and regulates the water-air regime.

It synthesizes phytohormones (cytokinin, auxin and gibberellin) which improve sprouting, rooting, growth and development of plants, whereas the plant maturation time is reduced by 8-10 days.

It reduces the use of chemical protective means during vegetation, increases the plant resistance with the rapid organic matter decomposition, thus eliminating diseases resulting from such biomass form.

It has the capability to synthesize the mucilage matter in soil which prevents compaction, that is, gluing of the micro-aggregate, contributing to the formation of fine and loose soil structure, thereby contributing to significant saving in terms of ploughing and soil cultivation.

It produces vitamins of the "B" group and antibiotics which protect plants against phytopathogenic bacteria, thus reducing the need for use of fungicides.



# TECHNOLOGY FOR RAISING OF CALIFORNIAN WORMS

## mini-farm of 100 beds

### Basic information:

The new worm farmer shall have land at disposal of minimum 1500 m<sup>2</sup>.

Manure should be available near the future farm.

The land shall be fenced and supplied with clean water.

One bed of Californian red worms shall (provisionally) contain:

- 30 000 fully mature worms,
- 30 000 young worms and
- 30 000 cocoons (worm eggs).

The area required for a single bed of Californian worms is 2 m<sup>2</sup>.

For a period of a single year, they process 1 tonne of manure, producing 500- 600 kg biohumus.

In Macedonia, the price for 1 tonne of manure is between 15 to 20 Euros (including transportation), and the price for 1 tonne of biohumus is about EUR 250.

Two workers are required to raise 120 beds, who would work 5-6 hours per day. The activities are reduced in December, January and February (or no work is executed).

Worms reproduce at the fastest rate at temperature of 18-21 degrees.

Single bed of Californian beds in the Republic of Macedonia cost EUR 150. Outside of Macedonia, the cost is minimum 250.

The cattle-breeder with 10-13 cows can raise 100 beds of Californian worms with their livestock manure.

## PRODUCTION TECHNOLOGY

Manure is purchased following the selection of the plot. In the beginning, the manure could be cows'. The manure should have rested for about 10 months, should be without any yellow color, no scents and no flies when tipped over with a pitchfork. It should be chipped with a pitchfork or two-wheel tractor (motocultivator), well soaked in water, and left to rest for 15-30 days. Manure moisture is considered as good if when squeezed with hand it would drain a few drops of water.

### Organization of composting bins (composters)

It is most practical for the single composting bin (composter) to be with the following dimensions: length of 8 meters, width of 2 meters, and height of 40 centimeters. The composting bin bottom (basis) is made from a concrete slab with thickness of about 5 centimeters without any reinforcement. The land to be concreted shall be levelled and well compacted so as not to cause any cracks in the slab. The slab shall be about 5 centimeters above the soil surface so as to prevent intrusion of water in the composting bin in case of heavier rainfall.

It is rather important for the slab to be with mild length- and width-wise slopes so as to prevent water from staying at the bottom of the composting bin, and to be further drained. It is advised that while performing the concrete work, in the places where metal poles shall be placed (which hold the board sides), wire to be placed in the concrete which shall

afterwards be used to fasten the vertical reinforcement holding the boards. Such reinforcement is with thickness of 16 millimeters and length of 70-75 centimeters. They are compacted in ground at about 30-35 centimeters so as to hold the pressure of the sides without any problem throughout the year, when the composting bin shall contain as much as 5 tonnes of manure.

Once the bottom shall be dried, sides shall be made from boards (fenced area) with height of about 40 cm, width of 2 meters and length of 8 meters. According to the experience so far, placement of boards on the sides has proven to be most cost effective and most practical. In parallel, during the development, at the bottom of the composting bin, boards shall be prepared which are to be coated with used engine oil so as to increase their duration. Such board sides shall last up to ten years.

After installation of the sides, nylon shall be placed to cover the boards. The nylon shall be with width of 70 or 80 centimeters. It is nailed to the edge of the board with small screws so as to cover the entire height of the board and 20 to 30 centimeters from the concrete base. The nylon is perforated (holes are made with the pitchfork at the angle between the bottom of the composting bin and the board side for facilitated water draining). Finally, the medium part of the composting bin should be free, from where the excess water shall drain. Prior to placing the worms and the manure, one





layer of cardboard chops shall be scattered over the entire composting bin. Cardboard fragments can be of any dimension (for example 50x50 cm). Afterwards, the cardboard is sprayed with water. The cardboard serves as a buffer

**\*Useful tip: upon finishing the composting bin, do not fasten the last short 2-metres side since it will serve as a place where you could easily bring with a cart the first 10-centimeter layer of manure together with the worm beds**

In case of excess water, the cardboard shall absorb the moisture, and if the manure is dry, worms shall find their shelter in the moist cardboard. The eight procured worm beds are placed in the prepared composting bin.

Once the worms shall be placed in the composting bin, they should be sprayed with water (in rain droplets, and not with a hose water jet); however, not too much and not too little. Moisture is checked with our hands. Manure is taken in your hand (with a glove) and squeezed. If three-four drops are squeezed, it means moisture is good. It should not be too liquid, water should not be running.

Once the composting bin is filled with worms, cardboards are placed over the entire surface of the bed, from one end to another. Cardboards regulate heat during summer, i.e. they prevent overheating of the composting bins, and retain heat during winter. In addition, cardboards protect the worms from the birds.

In the summer period, composting bins are open, and in the winter period, small greenhouses are made with reinforcement. In winter, during sunny days, air temperature in the greenhouse is between 40 and 50 degrees Celsius, whereas the worm-holding manure temperature (their habitat) is about 20 degrees. The number of young worms produced in this time of the year is an indication of whether the temperature is suitable for the worms in such winter conditions. By covering the beds in this manner, worms work in them throughout the year. Moreover, during the winter period, unless covered in this manner, the worms shall hibernate, and there shall be no reproduction and processing of manure.

Upon placing the worms, their first feeding, or first placement of manure, shall be after one month. This is the period re-

quired by the worms at the beginning, so as to establish their habitat. Following the first feeding, subsequent feeding shall be at every 10 to 15 days. The surface is the best indicator of the time for the next feeding.

This method of placement of a new layer of 5 centimeters of food (manure) in a single composting bin lasts throughout the year. Once the composting bin is filled up to the top (full up to the height of 40 centimeters), worms shall be taken to a new composting bin so that only biohumus shall remain.

The worm composting bin removal procedure is carried out in several phases. First, during a period of one month, worms are not fed, so as to starve them. The next step involves placement of 7-8 centimeters of manure (food). During a period of 5-10 days (depending on the external temperature and the quality of manure) 90% of the worms shall enter the upper layer. After they enter such layer, they are relocated to a new composting bin created for the worms.

About 5 tonnes of biohumus shall be produced from a single composting bin for a period of one year. The biohumus from the composting bin is initially grounded with a pitchfork (inside the composting bin), followed by removing it from the composting bin on a previously prepared area, and shall be well dried. Regarding the drying, it is best to create a greenhouse in the yard which shall dry the manure in ten days with occasional mixing. Finally, biohumus is sifted through a 4-milimeter sieve, after which it is ready for placement. It is interesting to mention that biohumus placement is, to a certain degree, guaranteed, because of the increasing market demands for such product.



**\*Upon placing another layer of manure, the one shall be entirely with lumps. After seven to ten days, the upper layer shall be levelled. When it is observed that the upper layer is levelled, it shall mean that the worms have eaten that manure layer and another food layer can be added [manure].**

# FINANCIAL CALCULATION FOR RAISING OF CALIFORNIAN WORMS START WITH 8 BEDS

1 COMPOSTING BIN with length of 8 m, width of 2 m and height of 40 cm

## 1 YEAR

1. Procurement of 8 beds of Californian worms x 150 Euros .....	1.200 евра
2. 10 tractors of manure (20 tonnes) x 40 Euros (including transportation) .....	400 евра*
3. Construction cart .....	30 евра
4. Pitchfork 2 x 10 Euros .....	20 евра
5. Shovels 2 x 6 Euros .....	12 евра
6. Water hose with sprinklers 25 meters .....	12 евра
7. Consumed water 20-30 cubic meters .....	10 евра



After 6 months, we create another 8-meter composting bin  
for 8 new beds, only material, no manpower .....

150 евра



After 12 months from the procurement of the  
first 8 beds we shall make another

8-meter long composting bin for new 8 worm beds, manpower not included .....

150 Euros

**TOTAL COST AT THE END OF THE FIRST YEAR.....1,984 Euros**

*\*In case of livestock farm, the cost for manure shall be deducted (-400 Euros)*



**AT THE END OF  
THE YEAR 1 –  
ACHIEVED:**

1. Stabilized 24 beds of worms (3 composting bins of 8 meters),
2. Produced 4 tonnes of biohumus.

From the biohumus sale – 4  
tonnes per 250 Euros =  
**PROFIT of 1,000 Euros**

## 2 YEAR

1. Procurement of manure 20 tractors x 40 tonnes, for the entire year .....	800 Euros *
2. After six months as of the last composting bin from the first year creation of 2 new composting bins of 8 m .....	300 Euros
3. After 6 months, creation of 3 new composting bins .....	450 Euros
4. 60 cubic meters of water .....	30 Euros
5. Bags for biohumus packaging .....	70 Euros

**TOTAL COST AT THE END OF THE SECOND YEAR.....1,650 Euros**

*\*In case of livestock farm, the cost for manure shall be deducted (-800 Euros).*



**AT THE END OF  
THE YEAR 2 –  
ACHIEVED:**

1. 8 composting bins of 8 meters or 64 beds of Californian worms,
2. Produced minimum 8 tonnes of biohumus

From the biohumus sale – 8  
tonnes of biohumus x 250 Euros  
= **PROFIT of 2,000 Euros**

3

## YEAR

1. Procurement of manure 30 tractors x 60 tonnes, for the entire year.....1,200 Euros \*
2. After six months as of the last composting bin from the first year creation of 3 new composting bins of 8m.....450 Euros
3. After 6 months, creation of 3 new composting bins.....450 Euros
4. 80 cubic meters of water.....30 Euros
5. Bags for biohumus packaging.....100 Euros

**TOTAL COST AT THE END OF THE THIRD YEAR.....2,230 Euros**

*\*In case of livestock farm, the cost for manure shall be deducted (-1200 Euros).*

**AT THE END OF  
THE YEAR 3-  
ACHIEVED:**

1. 11 composting bins of 8 meters or 88 beds of Californian worms,
2. Produced minimum 25 tonnes of biohumus.

From the biohumus sale – 25 tonnes of biohumus x 250 Euros  
= **PROFIT of 6,250.00 Euros**

4

## YEAR

1. Procurement of manure 60 tractors x 120 tonnes, for the entire year.....2,400 Euros \*
2. After six months as of the last composting bin from the first year creation of 3 new composting bins of 8m.....450 Euros
3. After 6 months, creation of 4 new composting bins.....600 Euros
4. 80 cubic meters of water.....40 Euros
5. Bags for biohumus packaging.....130 Euros

**TOTAL COST AT THE END OF THE FOURTH YEAR.....3,620 Euros**

*\*In case of livestock farm, the cost for manure shall be deducted (-800 Euros).*

**AT THE END OF  
THE YEAR 4-  
ACHIEVED:**

1. 15 composting bins of 8 meters or 120 beds of Californian worms,
2. Produced minimum 35 tonnes of biohumus.

From the biohumus sale – 35 tonnes of biohumus x 250 Euros= **PROFIT of 8,750.00 Euros**  
11 composting bins x 5 tonnes = 55 tonnes x 250 Euros= **PROFIT of 13,750.00 Euros**

5

## YEAR

**IF THE FARM IS STABILIZED AT 120 BEDS OF WORMS, THE COSTS SHALL BE AS FOLLOWS:**

1. Manure 60 tractors x 40 Euros.....2,400 Euros\*
2. Water.....60 Euros
3. Bags.....220 Euros

**TOTAL COST.....2,680 Euros**

*\*In case of livestock farm, the cost for manure shall be deducted (-2,400 Euros)*

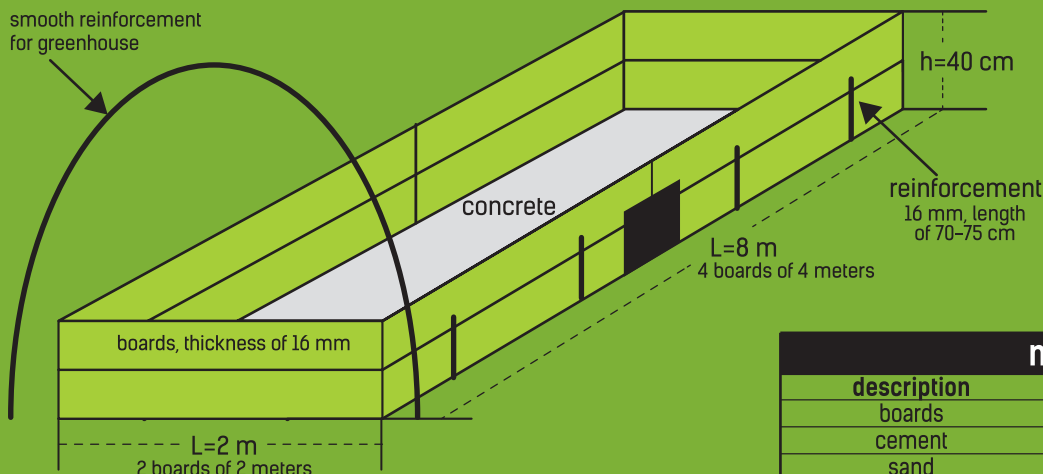
- biohumus production of 60–70 tonnes.
- 60 tonnes of biohumus x 250 Euros = 15,000 Euros,
- worm reproduction and consumption of manure depends on the quality and preparation of the manure and the weather conditions,
- the entire calculation was performed in case of most unfavorable weather conditions, when worms' reproduction is at minimum,
- in case minimal favorable temperatures are created during the year, this calculation shall be realized in the fourth year.

**THIS CALCULATION IS FOR A STABILIZED FARM OF CALIFORNIAN WORMS OF 120 BEDS. HOWEVER, IN CASE OF AMBITION TO INCREASE THE NUMBER OF BEDS (200/ 300/1000 BEDS), THE CALCULATION SHALL PROGRESSIVELY INCREASE!!!**

*\*The speed of worm reproduction and the speed of manure processing in the bed mostly depend on the preparation of the manure and its moisture, and they less depend on the external temperature. Subsequent relocations are performed every 3-4 months.*



# COMPOSTING BIN FOR RAISING OF 8 BEDS OF CALIFORNIAN WORMS



material		
description	dimensions	quantity
boards	4 x 2 x 0.25 (meters)	10
cement		6
sand		1.5 m <sup>3</sup>
nylon	8.5 x 1 (meters)	2
	2.5 x 1 (meters)	2
bolts (drywall)	length of 5 cm	30
concrete bolts	Ø 7 or 7.5	20
reinforcement	Ø 16, (L= 80 cm)	16
reinforcing wire	Ø 2 or 2.5	2 kg
smooth reinforcement	Ø 10 or 12 (L=4 m)	11
nylon "UV"	12 x 4 (meters)	1

## CALCULATION FOR RAISING OF CALIFORNIAN WORMS FOR A PERIOD OF ONE YEAR (Euros)

#		investments in denars for a period of one year							produced biohumus			profit	
beds	composting bins	material	raw materials			labor	finances	biohumus	bags			gross	net
worms	8x2	bed (€)	manure (t)	# tractors	tractor/price	manpower	Σ	kilograms	€	kg	# of bags	Σ	Σ
1		18	1	0.625	0.625		43	562.5			13.4	141	98
8	81	141	8	5	5		345	4500			107.1	1125	780
16	2	283	16	10	10		689	9000			214.3	2250	1561
24	3	424	24	15	15		1034	13500			321.4	3375	2341
32	4	565	32	20	20		1378	18000			428.6	4500	3122
40	5	707	40	25	25		1723	22500			535.7	5625	3902
48	6	848	48	30	30		2067	27000	12	42	642.9	6750	4683
56	7	989	56	35	35		2412	31500			750.0	7875	5463
64	8	1130	64	40	40		2756	36000			857.1	9000	6244
72	9	159	72	45	45		3101	40500			964.3	10125	7024
80	10	1413	80	50	50	2959	3446	45000			1071.4	11250	7804
88	11	1554	88	55	55	2959	3790	49500			1178.6	12375	8585
96	12	1696	96	60	60	2959	4135	54000			1285.7	13500	9365

## ORGANIKA NOVA

"Organika Nova" is a specialized company for production of Californian worms (+ consultancy for production, TM No. MK/T/2019/868) and organic fertilizers from Californian worms (Orgalife, TM No. MK/T/2019/869). The production of organic fertilizers is a family tradition commenced in 1985 for the purposes of innovating the natural food production process. Our motto is "Best Way is Nature's Way". As business with beds, we have a farm with 150 beds. So far, we have trained more than 30 farmers raising Californian worms and we cooperate with most of them through purchase, sale of biohumus, as well as with technical assistance.

\*The production capacity is registered by Agency of food and veterinary–Republic of N. Macedonia (Approval number YП-1 Бп. 16–4521 + EU TRAcEs Trade Control and Export System–MK ABP 01 12 002, under the production capacity name Intus)

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