Mncl Glrcpl_rgml_j Slgtcpqgrw md
Fsk_l Bctcjmnkclr ^Sip_glc%

NGO 'Permaculture in Ukraine'

NGO 'Organic Farming Club'

INTENSIVE MODULAR FOREST GARDEN
based on
Warm Rozum Beds

Open International University of Human Development 'Ukraine'

NGO 'Permaculture in Ukraine'

NGO 'Organic Farming Club'

Movchan V. O., Rozum V. M.

INTENSIVE MODULAR FOREST GARDEN based on Warm Rozum Beds

Guidelines

Kyiv
Talkom
2022

Content

INTRODUCTION

In our challenging time, when mankind, this irrational child of the Nature, is ruining its home and actively destroying the very background of its welfare — fertile soil — it is becoming vitally important to provide schoolchildren with practical training in methods of countering these devastating processes. Soil is the planet's skin, the system managing the living world, therefore restoring, sustaining and promoting the soil fertility is the basis for our ability to live on this planet in peace and harmony with it.

Methods of nature-friendly farming have been developed as early as at the end of the previous century by the permaculture founders, an Australian scientists Bill Mollison and David Holmgren, and active development of these methods goes on nowadays in all parts of the world, including Ukraine. A part of this experience's development is very briefly summarized in the present Guidelines, and the authors hope that it will aid schools in acquiring and teaching methods of permaculture.

It is essential to remember the three permaculture ethics: Earth Care, People Care and Fair Shares (leave 30% of the yield unharvested for the free-living creatures and give part of the surplus yield to those who need it). It is also important to follow this golden rule: use 80% of time and energy for planning, and only 20% for implementing the plans. For creating a forest garden, you need time, energy and resources, but once created, it continues living independently, almost without your efforts.

We will be grateful for your feedback for further improvement of the method and of these guidelines.

GLOSSARY

BIOCHAR is a specific **wood charcoal**, made of biomass by means of low-temperature pyrolysis, significantly improving soil quality: regulating acidity, improving water retention, augmenting nutrient retention and humus formation. Its pores are actively populated by microorganisms that establish symbiotic relationship with the plants' roots. Biochar has a long-term positive effect (that can last for centuries).

HUMUS or black soil is a complex of relatively stable **organic matter** bound with mineral substances, the most valuable and biologically active part of the soil that ensures its **fertility**. The more humus there is, the better access to nutrients plants have, and the better they grow. The Earth's humus contains **four times as much carbon** as the whole atmosphere in the form of CO_2 has. The main humus-forming agents are earthworms consuming plant residues that have been partially decomposed by fungi and bacteria.

WOOD CHARCOAL is a microporous product with high carbon content, originating in the course of wood pyrolysis in an anaerobic environment. Wood charcoal improves soil fertility.

EARTHWORMS — (Latin 'Lumbricina') is a common name denoting a range of **segmented worms** of Polychaeta class, of which Charles Darwin wrote in 1881: "It may be doubted whether there are many other animals which have played so important a part in the history of the world, as have these lowly organized creatures." They have a unique ability **to form**, sanitize, ameliorate and structure the soil. This function is not carried out in parallel either by other animals or by any soil conservation methods. Earthworms account for 50–70% of the total biomass of the soil invertebrates. Their biomass can be approximately a hundred times as high as the biomass of terrestrial animals. They make tunnels in the soil, thus ensuring better access of air and water to the plants' roots, loosen the soil, mix its different layers, and the soil that has passed through the earthworms' digestive system, is enriched with bioactive substances and beneficial microorganisms that promote root growth. In the fields **earthworms** annually process for the soil up to 6 tons of dead organic matter per hectare, while in the forests this figure is up to 9 tons.

EM-BOKASHI is **a microbiological preparation**, a culture of effective microorganisms cultivated on wheat bran. It is used to ensure a special process of composting organic matter. This method differs from the conventional ways of composting: here the input substances are fermented by the special bacteria and not decomposed; as a result, almost all the incoming carbon, energy and nutrients make it into the soil's nutrition chain and not into gaseous form.

EFFECTIVE MICROORGANISMS (EM) are symbiotic **cultures of beneficial microorganisms** with prevalence of photosynthetic, lactic-acid bacteria and yeast.

FOOD FOREST — also a Forest Garden — is an ecosystem formed by us, a diverse planting of edible plants that attempts to mimic the forest ecosystem, with its multiple layers, biodiversity and self-sustainability.

MYCORRHIZA is a **symbiosis** (synergy) of fungal mycelium and roots of higher plants. Thanks to fungi, the absorbing surface of the roots increases hundred- and thousandfold, fungi mineralize organic compounds, foster phosphate and nitrogen compounds uptake, synthesize vitamins and growth activators, in return uptaking some other substances (carbohydrates in the first place), phytohormones, amino acids from the higher plant's roots.

MYCORRHIZATION is **"**populating" planting material and soil with fungi capable to form mycorrhiza.

AN INTENSIVE FOOD FOREST (MIFF) MODULE is a

hexagon-shaped structure in which trees, bushes and other plants are knit together by the Warm Rozum Beds (**WRB**), creating for them optimal soil conditions, providing for interaction between the plants and formation of microclimate within a very short time frame.

MODULAR INTENSIVE FOOD FOREST is a food forest formed by **MIFFs**, where all elements are linked through close food (trophic) and informational networks inside each module and between the neighboring modules. The food forest formation by separate hexagonal modules allows to create a forest garden in a quick and efficient way, gradually expanding its space by adding new modules that demonstrated its efficiency or being improved after initial trial, and allows to get higher yield per acre within a set time, as compared with a conventional forest garden.

MONOCULTURE is continuous cultivation of **a single** agricultural crop on one land plot within a few years.

MULCH is material for covering the soil surface with the view to protect it from weather effects, to preserve moisture and increase fertility. Mulch can be either organic (plant residue, paper, cardboard) or inorganic (PET-film, stones, ceramsite, etc.).

ORGANIC AGRICULTURE (eco-, bio-) is the way to carry out agricultural production with deliberate minimization of the application of synthetic fertilizers, pesticides, plant growth regulators, feed additives. Various soil cultivation and other methods (such as crop rotation, organic fertilizers (cattle manure, compost, post-harvest residues, green manure, etc.)) are actively used to increase yield, provide crops with minerals, control pests and weed.

PERMACULTURE (permanent agriculture) is an approach to the design of sustainable systems and the system of farming in harmony with natural processes with minimum labor inputs and without causing damage to the environment; arranging all human activities in compliance with the environmental laws; one of the most environmentally friendly practices of organic farming.

WRB — Warm Rozum Beds — is a patented **technique** of environmentally safe crop cultivation with soil fertility improvement. Plant residues are composted in a bed where optimal conditions are established for the soil biota that consumes and decomposes residues into plant nutrients and humus.

1. WHAT IS A FOOD FOREST?

Food forests have been known since long: they were created by grafting cultivated plants to wild plants in natural forests, e. g. garden apples to wild apple trees growing in the forest. We can do it in the same way, and if there is not enough natural rootstock, we can just grow cherry, apple and other fruit trees near birch trees, add currant, strawberry and other bushes to the middle layer, plant strawberries, carrots, beet roots, pumpkins, etc. in the bottom layer, without breaking the complex forest structure. Because it is just the viable structure of the **broadleaved** or mixed multilayer forest that ensures its stability and self-sufficiency: it forms fertile soil for itself, closing the nutrient cycle. Fallen leaves, mortmass, plant root secretion and other secretion and residues of forest organisms are processed by soil biota and become plant nutrients. All matter required by the system is being produced by the system itself. We have to create our food forest, taking forest as an example, so that it could produce its own fertile soil. Usually it takes around 20 years, but we can do it during one season.

2. THE AIM OF CREATION OF FOOD FORESTS

The main aim of food forest creation is **getting yield** with minimum investment of efforts, time and resources, and without damage to the environment. As the forests are the most ancient self-sufficient and self-supporting ecosystems that have been providing humankind with air, water, food, building material and favorable climate throughout history, we should learn from the forests. We should learn how to place the plants we need, so that they would provide nutrient circulation, not suppress but support each other, not need our permanent hard efforts and give sufficient yield.

Besides growing food, especially in the epoch of climate change, we should keep in mind that in the process of photosynthesis the forests absorb carbon dioxide from the atmosphere and preserve it in their organisms and, most importantly, in the soil humus. It was one of the primary mechanisms of maintaining stable concentration of this **greenhouse gas** in the atmosphere in the previous epochs and created a mild climate for us. The forest also **provides its own water** through retaining rainfall, condensing dew and pumping water up by roots. This moisture saturates underground aquifers, feeding their adjacent territories. Thus, by mimicking forest principles when designing our farm, we restore water balance of the territory and counter global warming and climate aridization.

A food forest also helps solve the problem of **organic residue disposal** that turns into fertilizer without the need for separate composting.

3. DESIGNING A WRB, STEP-BY-STEP INSTRUCTIONS

If we want our food forest to become a sustainable system immediately and not in 20 years, we will have to create the respective soil quality: remember how soft and moist, how full of life it is under the cover of the fallen leaves in a natural forest. The most feasible and fast method for it is the patented Warm Rozum Beds technology (WRB, fig. 1) developed by Volodymyr Rozum, a Ukrainian engineer and innovator[1].

The basis for WRB fertility is efficient arrangement of functional zones with placement of organic matter and other essential components in the **organic pathways** where organic matter is decomposed by the soil biota in the ditches, right in the rhizosphere, which allows immediate consumption of the organic decomposition products by the plants. This process is going on non-stop all year round with minimal loss of nutrients, as plants penetrate the ditches from below with their roots, capturing all organic decomposition products, while mycorrhiza impregnates this organic aggregation (it should be kept in mind that **plant nutrition is greatly provided by mycorrhiza).**

Between the growing seasons, when the plants do not absorb nutrients, the latter are accumulated by biochar and bentonite clay at the bottom of the ditches, and the plant roots further take nutrients up in spring or in summer. Moisture-retaining mixture in the ditches of organic pathways in WRB (biochar-bentonite-biohumus-compost) is efficient all year round, as it does not leach out of the ditches and significantly improves water availability in dry climatic conditions, while the wood residues in the bottom layer ensure air permeability.

Step 1: Mark out the bed — its overall width (120 cm), location of the central ditch (60 cm) and two rigged feeding beds (planting strips) 30 cm wide.

Step 2: Remove plants on the whole of the marked area.

Step 3: Take the 3–5 cm of the most fertile surface soil layer off the 60-cm wide central strip and put it aside.

---

1 https://www.permaculture.in.ua/index.php/en/navchannia-en/rozumbedspermaculture-en

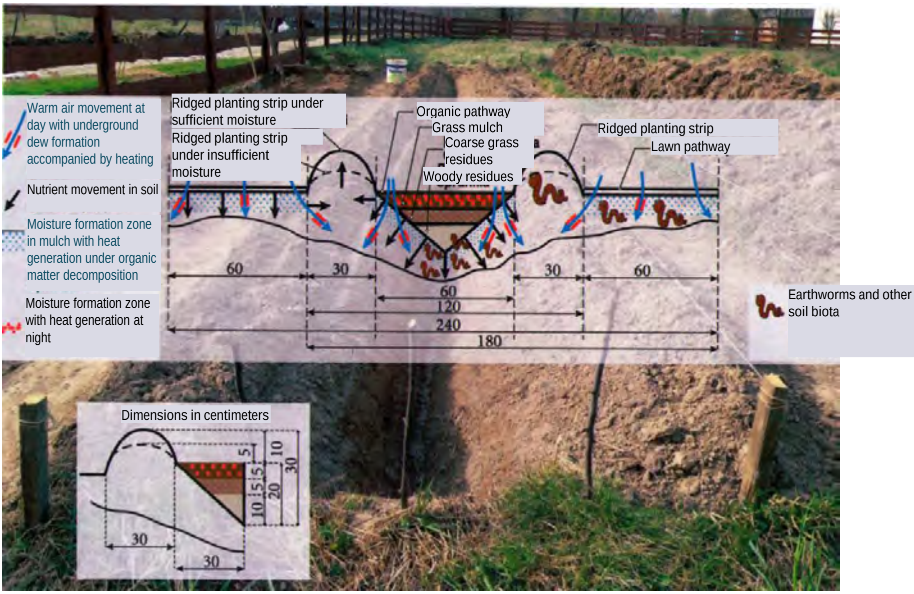

Fig. 1. Warm Rozum Bed layout

Step 4: Make a V-shaped 60 cm wide and 30 cm deep **ditch** in the soil.

Step 5: Examine the soil. A simple examination will be enough: take the slightly wet soil and compact it in your hand as if making a snowball. If the soil breaks up, which means that it is sandy, **clay** should be placed on the bottom of the ditch (with **bentonite** being the best choice) in a continuous 10–20 cm wide and 3–5 cm thick stripe. The dryer the ambient conditions, the more clay you will need. If the soil retains its ball shape, it is either clay or organic-rich black earth, in this case you will not need to add clay.

Step 6: Place around 1 kg of **biochar** for every 2 running meters of the bed on top of clay (if added). The dryer the conditions are, the more biochar you will need.

Step 7: Place a 5–7 cm layer of rough woody organic matter (twig pieces, thick stems of herbaceous plants) on top of biochar.

Step 8: Place 5 cm of a finer organic matter (leaves, grass) on top of it and sprinkle it with **EM-bokashi** (or another preparation of effective microorganisms) at a rate of around 50 g per running meter of the bed; water it all and tread it down.

Step 9: Repeat the procedure described in Step 8 with finer organic (e. g. fresh grass clippings) until the ditch is filled with organic matter and the **organic pathway** (see fig. 1) is formed.

Step 10: If you have enough organic matter, add it over and over again in the same manner until you have a 30–50 cm high **compost ridge**. After the last organic layer is added, sprinkled with EM and watered, the surface has to be mulched to protect EM from direct sunlight.

Step 11: On both sides of the **compost ridge,** the most fertile soil that has been previously taken out of the ditch (see Step 3) shall be placed now, forming 30-cm wide **ridgy feeding beds (planting strips)** that should be higher where there is enough moisture, and lower (or no ridge at all) in dry environment.

Step 12: Beside the planting strips, 60-cm-wide **lawn pathways** shall be marked, freed from plants, the soil is slightly loosened, scattered with white clover seeds, watered and covered with 1–2 cm thick mulch layer. You can also mulch this pathway instead of sowing clover on it.

Step 13: In two or three weeks, when the humus formation process starts, the planting material of vegetables and other herbaceous crops shall be mycorrhized following the preparation instructions and planted or sown in the planting strips **very densely**, approx. 10 times thicker than normally recommended.

Step 14: After sowing, mulch the soil lightly (1–2 cm thick layer only), as it is necessary to protect the soil from exposure to weather while ensuring that the seeds can sprout. The mulch layer around seedlings should be at least 5 cm thick.

Step 15: As the organic pathway and compost ridge decomposes, new organic matter (grass clippings, leaves, straw, plant kitchen waste, paper, unlaminated cardboard) should be added on top. In the first year, **EM** are added now and then to the new lots of organic matter, watered and mulched each time to protect them from direct sunlight.

For WRB to provide stable yield, it should be ‘fed’ regularly, adding organic waste on top of the pathway.

Garden WRBs and WRBs near the trees (fig. 2) differ from the classical WRB by bigger ditch size: a ditch can be dug with an excavator bucket and can accommodate more organic and other matter (1), no ridgy planting strips are arranged, and trees and bushes are planted along the compost ditch instead of vegetables.

Circular (10) and hole (11) WRBs differ from the classical WRB only in their shape.

High WRB in boxes (fig. 3) can also be convenient for people with disabilities.

4. A STEP-BY-STEP INSTRUCTION FOR CREATING AN INTENSIVE MODULAR FOREST GARDEN

Unlike in a garden or a conventional forest garden, in an intensive modular food forest (fig. 2), that integrates all the plants, it takes months, not years, to have an efficient mycorrhiza-root network established and integrate plants into a healthy community capable to protect itself from diseases and pests and grow at a very high rate, starting to yield earlier than usual, while revitalizing the soil and improving its fertility, exactly as in a natural forest. A microclimate is quickly established to protect the more fragile center plantings. The area of higher fertility (7) is developed due to the soil's meso- and microfauna. The module's hexagonal configuration allows to add similar modules with an adjusted set of plants.

Step 1: choosing the right place. This will certainly depend much on what you already have on your land parcel. If possible, choose a round horizontal spot not exposed to wind, with at least 16–20 m diameter.

Step 2: examining the soil (see above).

Step 3: making the list of plants and other materials. Depending on the soil type and plant selection, calculate the amount of clay, biochar, EM-bokashi, rough and finer wood, mulch, mycorrhizal preparations and planting material that you will have to prepare.

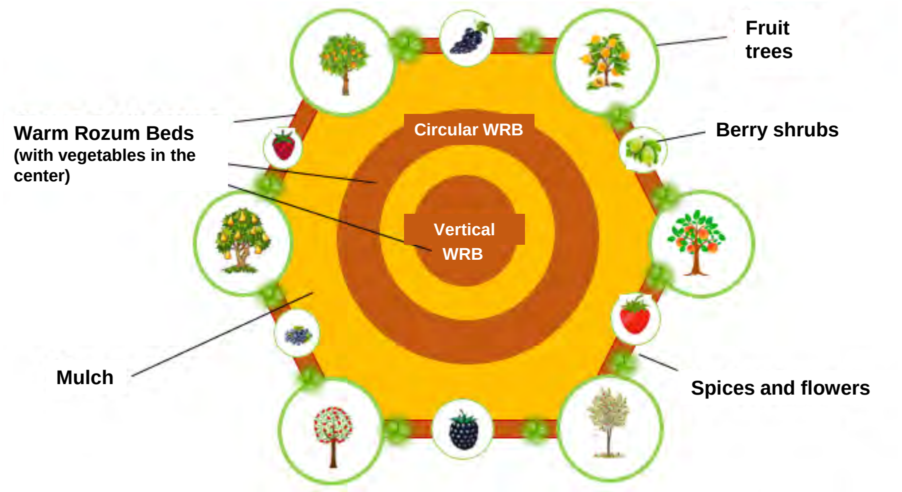

Fig. 2. An Intensive Food Forest (MIFF) Module

Step 4: marking the territory.

A) Using two pegs and a rope, draw a circle with 6 m radius and divide it into 6 segments.

B) Draw a hole for a circular WRB in the center of the module.

C) Mark places for planting trees and bushes.

Step 5: prepare the planting places.

A) Using an excavator bucket (or manually), dig ditches in the center of the module for a circular and hole WRB.

B) Dig outer ditches for garden WRBs and WRBs around a tree, dig planting holes for trees and bushes as marked.

C) Fill the ditches and arrange your WRB as described above. Place clay, biochar and compost into the ditch.

Step 6: planting your plants.

A) Before planting, inoculate your planting material with a mycorrhizal preparation.

B) Plant trees and bushes.

C) Plant (sow) vegetables and other herbaceous crops in the WRB as described above.

Step 7: arrange shelters for insects, birds etc. Like a natural forest, a food forest should have shelters for pollinating insects, birds, etc. These can be cane pieces placed loosely inside the PET bottles with bottlenecks cut off, nestboxes, butterfly shelters, a heap of dry branches for various small animals, etc.

Step 8: place information plates, so that everyone knows what they see and what its function is.

5. MAINTAINING AND USING THE FOOD FOREST

After planting, the soil around your plants shall be **mulched** and no longer disturbed, neither dug nor weeded. **Maintenance is harvesting**: e. g. after harvesting onion, sow salad or another crop on the same plot and add another thin layer of mulch. If the whole shoot part of a plant is harvested, the root system **shall be left in the soil** to die away and to be decomposed; it softens the soil and establishes a channel for air and moisture to penetrate the deeper layers. Post-harvest residues should stay here as mulch or go to the organic pathway for being further composted and transformed into a manure. As part of organic matter is taken away with the yield, this loss has to be compensated to ensure sustainable nutrient circulation.

You can apply kitchen waste of plant origin, cardboard, paper and water plants from a nearby water body (removing about 1/3 of water plants per season prevents silting).

Monoculture is not allowed: a planting strip shall not be used for one crop only, it's best to plant one row of each crop, alternating vegetables with spices, herbs and flowers (basil, marigold, Moldavian dragonhead, origanum, etc.) that deter and confuse pests.

It is extremely important to make sure that the soil is never left bare: it should either be covered with plants or mulched. **Mulch** protects it from erosion, UV damage, overheating, leaching-out; shades it, thus creating conditions for dew condensation, captures rainwater and serves as nutrition for the soil biota that decomposes it into plant nutrients. The main role of the mulch is to protect the soil surface, as without it a large part of organic decomposition products is weathered or leached out from the soil surface.

Biological and chemical processes going out in WRB and in a modular food forest provide material for laboratory and field studies that can help consolidate the knowledge obtained at school and become the basis for the pupils' first scientific papers for the contests held by the Junior Academy of Sciences.

6. WHAT CAN YOU DO IF THERE IS NOT ENOUGH SPACE NEAR THE SCHOOL TO ARRANGE A FOOD FOREST?

In this case WRBs can be arranged as raised beds in boxes up to 1-meter-high, exactly following the technique described above. It should also be noted that every 10 cm above the ground is like traveling 100 km south, that's how the temperature mode changes. Such beds will need to be watered more. If there is at least a minimum plot of land with access to soil, use the box without a bottom; if the whole area is paved-over, put cardboard, drainage material and soil into the box.

Fig. 3. WRB can be created in boxes

Fig. 4. WRB in a box with light-reflecting coating that protects it from overheating; on the territory of the University “Ukraine” (Kyiv, 23, Lvivska Str).

SUMMARY

1. By creating a forest garden based on the permacultural principles, we grow clean food, restore water balance in the area and counter global warming and climate aridization.

2. The fastest way to create fertile soil for intensive food forests is to use the Warm Rozum Beds technology.

3. Besides providing children with clean food, intensive food forests at schools provide material for laboratory and field studies that help consolidate the knowledge obtained at school and become the basis for the pupils' first scientific research.

4. WRB can be also arranged in boxes, as a mini-version of an intensive food forest, which is the optimal variant for urban environment.

ANNEXES

Fig. 5. Rozum's Exoskeletal hoe-subsurface tiller ПР-2 (used for making WRBs)

Fig. 6. Moving pattern when using the Rozum's exoskeletal hoe-subsurface tiller ПР-2

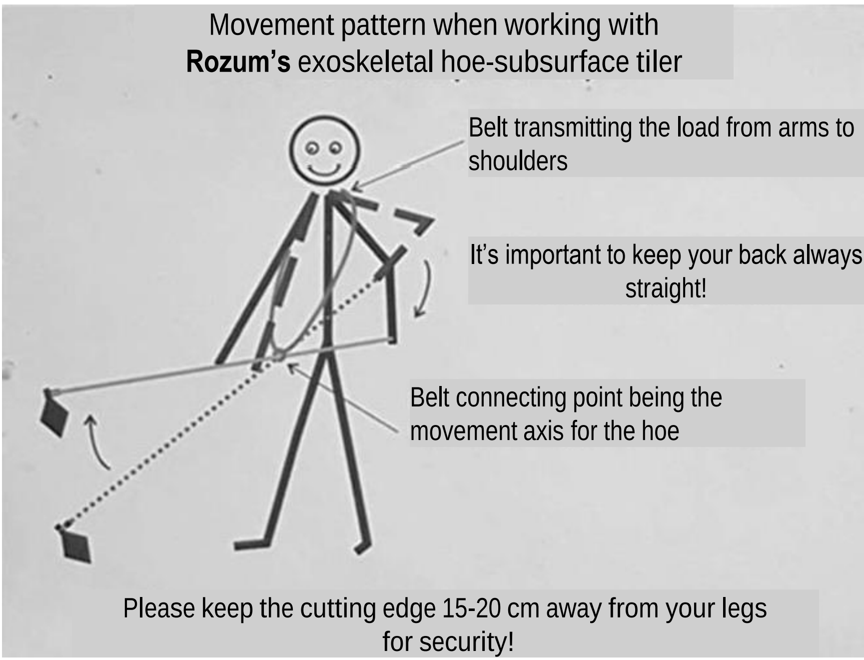

Fig. 7. Placing the biochar in the WRB

Fig. 8. Earth works on establishing an Intensive Food Forest (MIFF) Module

Fig. 9. Strawberry WRB


Fig. 8. Dense planting on borscht WRB.

Educational edition

Valentyna **MOVCHAN**
Volodymyr **ROZUM**

INTENSIVE MODULAR FOREST GARDEN BASED ON WARM ROZUM BEDS

Guidelines

Digital layout: Dumanetska S.S.
Cover design: Babynets N.A.
Translation: Nataliia Lysova
Scientific and layout editing of translation: Pavlo Ardanov

Signed to print on October 19, 2022.
Format 60´84/16. Ref. print. sheet 1.1.
Print run 100 copies.

Publisher: "Talcom" LLC.
Kyiv, 23 Lvivska str.
phone/fax (044) 424-40-69, 424-56-26.
E-mail: ukraina.vdk@email.ua.
Publisher certificate: ДК № 4538 dated 05.07.2013

Contact information: greendragoness16@ukr.net (Valentyna Movchan)