Approved: ………..
CEO: /Ch. Marinov/
Date: ……………....

PROCEDURE FOR PREPARATION OF AGRONOMICAL PRESCRIPTIONS, RECOMMENDATIONS AND AN INDIVIDUAL STRATEGY UNDER THE "CARBON FARMING" PROGRAMME

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PR0107 Monitoring report from on-the-spot inspection.

I. SUBJECT

This procedure regulates the order and manner of implementing good agricultural practices among farmers subordinated to regenerative agriculture and its benefits. Targeted agronomic activity will improve the content of organic matter in the soil, help increase greenhouse gas capture and achieve permanent greenhouse gas storage. Regenerative agriculture is a system of agriculture, which is based on several different principles and practices, such as minimum tillage, use of cover crops and active crop rotation, use of organic fertilization, healthy management of crop residues and reduced fuel use, stimulation of the introduction of rotational grazing in places where livestock breeding is developed. Overall, these practices help improve soil health and lead to increased amounts of carbon captured and its sustainable storage in the soil. The activities contribute to reducing the carbon footprint and at the same time stimulate and accelerate the process of sequestering carbon in the soil. The procedure is applicable to a wide range of activities and productions, from small-sized farms with a low level of land management to industrial production that uses a variety of tools and approaches to improve soil organic carbon (SOC).

II. PURPOSE

The purpose of procedure PR01 is to implement good and proven agricultural practices that can help to improve soil health and lead to an increase in the amount of captured carbon and its sustainable storage in the soil on the one hand, and on the other hand they can lead to an increase in the yield of crops grown and optimization of production costs for farmers.

III. PRINCIPLES

In applying this procedure, the officials responsible concerned shall be guided by the following principles:

1. Objectivity and impartiality.
2. Honesty and autonomy.
3. Legitimacy and loyalty.
4. Professionalism, responsibility, and accountability.

For non-compliance with the principles referred to in paragraph 1 and/or with the rules established by this procedure, the responsible employees shall be liable accordingly.

IV. NATURE AND TARGETING OF FARMING PRACTICES FOR THE BENEFIT OF THE CLIMATE AND THE ENVIRONMENT

This procedure will provide information on practices aimed at protecting the environment and climate, noting both some of their advantages and weaknesses. Each of the practices addresses a specific problem, but in many cases, it is expected to have a beneficial impact on several of the components of the environment and on biodiversity. **The main objective of agricultural activity is the production of the necessary amount of food (food supply security), not threatened by the expected increased consumption.** In order to ensure the sustainability of agricultural activity over time and the viability of farms, the practices applied need to integrate ongoing natural processes and ecosystem services as a basis for development and mitigation of climate impact through practices that sustainably keep Carbon in the soil.

V. PRODUCTION AND MANAGEMENT SYSTEMS FOR ON-FARM TREATMENTS CONTRIBUTING TO SOIL CARBON SEQUESTRATION

This part presents generalised farm management systems which incorporate a broader set of interrelated practices that would require a new organisation of the applied farming system on the individual farm. Their successful implementation requires a fundamentally different approach related to the management of the specific agricultural production. For example, direct sowing requires the application of other agrotechnical activities that would lead to the preservation of organic matter, to the reduction of erosion processes and other environmentally friendly actions. The aim is multifaceted: improving soil structure, increasing organic carbon content and avoiding increased use of herbicides. It is necessary to review and, if needed, to introduce changes to the crop rotation plans, to use the advantages of mulching, etc. Another example is the application of organic production methods, which, besides the additional costs associated with growing crops, require planning of additional resources and efforts in the period of transition before certification of production. Its implementation requires additional logistics and marketing resources.

1. Conservation agriculture. Treatments aimed at preserving the soil resource.

Conservation tillage is any cultivation or crop growing system that, after sowing, leaves at least 30% (or more) of crop residue on the soil surface after sowing to reduce water erosion. Any soil cultivation system that maintains at least 90-100 kg/ha of crop residue (stubble) during a critical wind-erosion period is considered to be conservation treatment. Effective conservation agriculture is based on three basic principles:

- minimal mechanical disturbances of the soil (i.e., without tillage) by direct placement of seeds and / or fertilizer.
- permanent soil organic cover, with at least 30% with crop residues and/or cover crops.
- diversification of crops grown successively and/or in association.

By reducing treatments, they can save between 30 and 40% of the labor time and petroleum fuels needed for mechanized activities compared to conventional farming. This would have a positive impact on the emissions of gases - pollutants of the atmosphere. Conservation agriculture also has the following advantages:

- A sustainable agricultural system, (not only conservation), which improves the quality of natural resources, increases soil biodiversity, (flora and fauna, including wildlife) and at the same time does not confront the desire to obtain higher yields.
- Uncultivated (unploughed) fields act as a landfill for carbon dioxide (CO_2) and applied globally, can be important in controlling atmospheric pollution in general, and in particular in influencing global warming.
- Soils treated through conservation practices have better infiltration ratio and reduced surface runoff, which significantly reduces erosion.

The practices for minimum mechanical disturbances of soils can be divided into two more general groups – with minimal treatments and without tillage (direct sowing).

No tillage - Direct sowing in living roof vegetation or mulch. Direct sowing without plowing in the previously available roof vegetation – living or destroyed, e.g., mulch.

Benefits: Reduced costs associated with pre-sowing treatments not carried out. Reduction of threats from wind- and water-caused soil erosion. Reduction of soil compaction and increased bioactivity. Reducing evaporation and excessive soil moisture loss, often critical for crop development. Less development of weeds in the long term, leading to less use of herbicides.

Disadvantages: Difficulties for effective control of weeds, cover vegetation and mulch. Increased costs associated with mechanical weed control. Need for special machines, such as a seeder for direct sowing and other specialized machines.

Minimum treatments - Reduced soil treatments. This is a soil cultivation system in which by combining several operations, the number of agricultural machineries passes in the field, the degree of soil compaction, the time limits for carrying out the treatments and the cost of growing crops is reduced, while maintaining soil structure and soil fertility. Herbicides are used to control weeds (but in a transitional period, after which the amount per unit area decreases due to the adaptation of the soil), allowing to reduce mechanical operations.

These "conservation treatments" include:

- Strip-Till (treatment in strips) – in this treatment the soil remains untilled from the harvesting of the previous crop until sowing the next one except for strips 1/3 of the row width.

- Ridge-till – (tillage of beds)– in this tillage the soil remains untilled from the harvesting of the previous crop until sowing the next one except for strips 1/3 of the row width. Sowing takes place on the crest of the bed and usually involves removing its tip. Crop residues remain on the surface between the beds. Weed control is carried out by chemical means, sometimes combined with mechanical treatment, during which the beds are restored.

- Mulch-till – (mulching treatment) – this is the management of the quantity, orientation, and distribution of residues (plant-stem mass) of cultivated and other types of plants on the soil surface all year round as plants develop. What is specific for the system is that while in no-till and strip till treatments where a small part of the field surface is processed (up to 30 %), in mulch till a merged surface treatment is applied.

- Opti-till or Minimum-till - They are characterized by minimal, partial, merged soil treatments, one, two or three in number depending on the type of soil and the specific climatic conditions. This is a technology in which deep soil treatments are replaced by the construction of a biological soil eco-system. In it, microorganisms, roots and other soil fauna take over the functions of processing and balancing nutrients. Minimal treatments preserve carbon in the soil, protect it from water and wind erosion, prevent compaction, improve soil fertility. Soil fertility (nutrients and water) is regulated by managing the soil cover from the previous crop, partial soil treatments and weed control. They are used certified seed because certified seed is healthy, large with good germination energy. Covering the soil with plant residues from the previous crop retains moisture in the soil, which contributes to biological activity in the so-called living soil, thus carbon is preserved in the soil and used as food for the next crop. In these treatments, the amount of chemical phosphorus and chemical nitrogen is greatly reduced, due to the improved biological activity of the soil, which becomes food for plants. An appropriate crop rotation shall be observed. Bacteria are introduced into the soil, which on the one hand decompose residues and on the other contribute to soil fertility. The good biological activity of the soil contributes to good immunity of plants, thus reducing the use of chemicals to 50% of the corresponding dose. Immediately after harvesting, a needle cultivator enters the field - this is a treatment of 2-3 cm, which is aimed at distributing the straw evenly over the soil and closing the soil capillaries; when re-entering the field with the needle cultivator, weeds and self-seedlings are destroyed without having to spray with herbicides. The next entry into the field is with inventory for minimal, merged, partial treatments - cultivator, rollers, etc., after which the crop is sown with a direct seed drill. Merged minimal processing is easier to practice because it requires less costs and less investment in digitalization, but for its successful implementation a high degree of awareness and exchange of experience of good practices is needed. For the introduction of Opti-till or Minimum-till in a farm, a high degree of training is not necessary, and it can be applied regardless of the field shape.

Conclusions:

• During the repeated passage on the surface of the soil for cultivation, its volumetric density changes within the horizon 10 cm up to 80 cm and reaches values of 1.68-1.70 t/m3, and in some cases even higher. To put it in other words, the soil is compacted.

• With a reduced number of soil cultivations, the bulk density and resistance to solid penetration into the soil increases, which does not lead to an optimization of the air regime in the first two or three years of application, but leads to an increase of organic matter in the surface layer by about 0.15 - 0.20% per year.

• With this type of soil cultivation and using water storage materials, the amount of water absorbed by the soil increases sharply, and water erosion is reduced. With a slope of 3% and after contour cultivation, the soil can absorb up to 90 mm/m of water in intensive rainfall without activating water erosion. In real conditions, one to two waterings can be saved, which is the biggest advantage of these ways of soil cultivation.

• The soil temperature in the surface 8-10 cm layer is lower at zero soil tillage, as a result of which sowing should be carried out when reaching a temperature of 8 C at the depth of seed laying.

• When tilling the soil with the introduction of mineral fertilizers in the depth of cultivation, there is a 30% better development of the root system, 21-32% better water absorption and an increase in yields by 12 - 30%.

• In this type of processing there is a reduction of energy and labor costs by 12-15%.

• The application of natural water storage materials does not lead to a change of pH and chemical properties of soils.

Benefits:

• possibility to activate microbiological activity in soil

in the development of the root system of plants and the absorption of nutrients;

• bringing agroecosystems closer to natural ecosystems at higher reproduction of organic matter and preserving and/or enhancing soil fertility;

• preservation of several layers of organic residues on the soil surface – decomposed, semi-decomposed and fresh, which fulfils at least two extremely important conditions – protection of the soil from water and wind erosion and the possibility of reducing water stress when plants are grown without irrigation and with tendencies for extending the dry periods;

• creating preconditions for fuel and energy savings due to the periodic elimination of the heaviest and costliest basic and seedbed cultivation and hoeing during the growing season.

Disadvantages:

• Deterioration of the water-physical properties of the soil, especially in the first 2-3 years, due to compaction caused by the reduced number of cultivations and expressed in low hydraulic conductivity and aeration of the soil;

• Adverse influence of large amounts of crop residues present on the soil surface on plant germination and growth;

• In the absence of appropriate equipment - inability to deeply apply organic and mineral fertilizers and subsequent weak effect on plant nutrition;

• Increase in populations of pests inhabiting the soil, whose numbers are regulated by soil cultivation.

2. Organic farming.

Organic farming is an aggregate agricultural management and food production system that combines best environmental practices, maintains a high level of biodiversity, conserves natural resources, applies highly humane animal treatment and welfare standards and production methods tailored to the preferences of some consumers for products, produced using natural substances and processes. For compliance with the requirements of the applicable European legislation, annual control is carried out and the production is subject to certification after the transition periods have passed. Organic farming is a production system that prevents or completely excludes the use of synthetic fertilizers, pesticides, growth regulators and additives to animal feed, and in which crop rotations, plant residues, manure, green fertilization and biological plant protection are relied on to maintain and improve the soil diet.

3. Integrated production of plants and plant products.

Integrated production is a certified quality system for the production of crops that supports environmental protection through integrated pest management (IPM) and reducing the use of PPPs (plant protection products). Unlike organic farming, which excludes the use of PPPs or mineral fertilizers, in integrated production they can be applied, but under certain conditions. Integrated production makes use of advances in technology in the cultivation and protection of crops and combines different methods and means of pest management. Each farmer can apply integrated pest management by including a number of preventive measures to limit the spread of pests – such as crop rotation, use of appropriate agricultural machinery, balanced fertilization and watering, sanitary and hygienic measures, protection of beneficial organisms, resistant / tolerant plant varieties and standard/certified seeds and planting material, etc. Systematic monitoring of pests is carried out. When controlling them, preference is given to biological, physical, biotechnical and other non-chemical means, as well as to low-risk PPPs.

General principles of integrated pest management:

The prevention of harmful organisms and/or their containment should be achieved or supported mainly by:

(a) crop rotation.

(b) carrying out appropriate agrotechnical measures (e.g., pre-preparation of seedbeds, time and density of sowing, periodic renovating sowing, optimum crop spacing, anti-erosion treatments, sanitary measures and pruning).

(c) the use of suitable tolerant/tolerant plant varieties and of standard/certified seed and propagating material.

(d) application of balanced fertilisation, liming, irrigation and drainage practices; (e) preventing the spread of harmful organisms by applying sanitary measures (e.g., by regularly cleaning machinery and equipment);

(f) the conservation and maintenance of beneficial organisms (e.g., by applying appropriate plant protection measures or by using environmental infrastructures inside or outside cultivated areas).

Pests should be monitored by appropriate methods and means.

Such methods should include science-based warning, forecasting and early diagnosis systems, as well as the use of professional advice.

Based on the results of the monitoring, the professional user must decide whether and when to apply plant protection measures. A determining factor in decision-making is the established thresholds of economic harmfulness. Before treatment, economic hazard thresholds, specific areas, crops and climatic conditions must be taken into account where possible.

Sustainable biological, physical and other non-chemical methods should be preferred to chemical methods when they provide a satisfactory level of pest control.

Plant protection products applied must be objective-selective and have minimal adverse effects on human health, beneficial organisms and the environment.

The use of plant protection products and other forms of intervention should be limited to the extent necessary, such as using lower doses, reduced numbers of treatments or partial treatment (e.g., flap or outbreak) where it is considered that the degree of risk to the crop is acceptable and that the risk of pest resistance does not increase.

Where there is a risk of sustainability, but the conservation of the crop requires the repeated application of plant protection products, in order to maintain the effectiveness of the products, the strategies available against the development of sustainability must be applied. This may include the use of several plant protection products with different mechanisms of action.

On the basis of data on plant protection products used and pest monitoring data, the professional user checks the success of the plant protection measures applied.

4. Precision farming practices

Precision agriculture or farming is based on the use of a wide range of technologies that allow the collection of data from treatments, monitoring and analysis of crop development, as areas are adequately treated to increase efficiency. This management system is based on decision making, based on variable characteristics and obtaining maximum yields, according to the specifics of the site. The main benefits are associated with reduced use of water, fertilizers and pesticides, depending on specific data on conditions and a set of necessary agrotechnical measures. Precision agriculture should also be developed to support the development of precision technologies for sustainable agriculture in a clean and secure environment.

For this purpose, the following are developed:

- Intelligent systems and technologies to reduce the negative impacts of agricultural machinery and applied technologies on agro-ecosystems and the accompanying unique natural resources.

- Integration of biological models in intelligent management systems for Natura 2000 sites in the development of services in argoecosystems and other economic activities in them.

Proactive technologies provide different possibilities for decision making in each stage of their realisation, i.e., in each stage of plant development or the state of resources used. Therefore, the proposal for a successful solution will depend not only on whether farmers have already accumulated knowledge and experience for the correct application of good practices in the different stages of growing crops, but on the analysis of the data in the processing of which a decision proposal is made.

Precision farming is an integrated agricultural management system incorporating the following technologies and tools:

- ➢ Precise digital maps of the distribution and characteristics of the soils on the farm, contoured agricultural plots and arrays, digital technological maps by crops, etc.
- ➢ GPS devices with high accuracy for management, control and localization of changes.

- Mobile devices for analysis of the medium, imported preparations and yield obtained.
- Optimization of the use of water resources (calculation of irrigation water needs, irrigation rates and frequency and time / hour of irrigation);
- Geographic Information System (GIS for analysis, modeling, visualization and response).

The application of precision farming principles requires that farmers have at their disposal specialized software for processing the data from the above-mentioned tools. It implements the individual steps of precision agriculture: mapping (outlining of blocks), visualization and analysis of processing data (soil harvesting, sowing, fertilizing, spraying, harvesting, etc.), which can be transferred and stored in real time. Thus, it can track the quality of the processed (overlapped and uncovered parts), as well as the norm and quantity of the materials used. The data from the treatments are maintained: sowing, fertilizer norms for each block, harvest, yield obtained, etc. The farmer can analyze the strong and weak areas of the blocks and isolate the reasons for this, and this information will subsequently serve him to make important management decisions. The software can also be used to draw maps with prescriptions for variable fertilization – this step can provide the farmer with higher yields at lower costs in the next season.

The application of precision agriculture requires an individual approach, and the implementation of new technologies and systems supporting decision-making largely depends on the qualification and the possibility of acquiring additional skills by staff.

VI. PRACTICES IN CROP PRODUCTION

1. Practices related to the selection and consistency of cultivated crops along with activities related to the improvement of the soil condition.

Globally, in the short term, changes in the natural cycles of crops are expected, such as earlier tree flowering, longer vegetation in vineyards and others, which will affect final yields. In cereals, further contraction of interfacial periods from flowering to ripening is expected. A shorter reproductive period would also mean less time for grain pouring, which would have a negative impact on yields.

- Selection of suitable varieties, selection of varieties adapted to climate change. Inclusion of bacteria to counteract pathogens.

The use of crop varieties resistant to diseases and pests and well-adapted to the soil and climatic characteristics of the different regions leads to a decrease in the use of pesticides and a reduction in losses from drought, low and high temperatures. The rotting of sprouts and seedlings, root and base rot in later phases of the development of grain crops with fused surface are among the diseases of great economic importance. The main causes of these diseases are soil-dwelling, phytopathogenic fungi. The use of resistant varieties as well as stimulating the development of appropriate microflora by mixing seeds with bacteria can have a deterrent effect against a wide range of soil phytopathogens.

Benefits: Sustainability and improvement of yields, pest control in reduced use of PPP and fertilizers.

Disadvantages: Accessibility of the technology and additional costs of using the technology.

➢ Crop diversification - is the cultivation of several different crops on the farm in order to avoid monocultural production, which can lead to a decrease in soil fertility, increasing problems with protection from diseases, pests and weeds, which in turn is a prerequisite for greater levels of fertilizer input and plant protection products.

On a farm with arable land between 10 ha and 30 ha (inclusive) the farmer must provide at least 2 different crops. The main crop should not cover more than 75% of the arable land. A holding with arable land above 30 ha should have at least 3 different crops. The main crop should not cover more than 75% of the arable land, and the two main crops should not be more than 95% of arable land. The diversification requirement shall not apply where:

- More than 75 % of arable land is used for the production of grasses or other herbaceous forage, sown with legumes, set aside or combined with these uses and, if it is permanent grassland, for the production of grasses or other herbaceous forage or for the production of crops underwater.
- Arable land on the farm is up to 10 ha.

➢ Crop rotation and crop rotation management.

Integration of different agricultural crops into agricultural areas, including cover crops. Rotation means the science-based rotation of crops at time and place over a given area of a holding. Alternation in time consists in changing crops during successive years on the same field. The alternation of place is the successive passage of each crop through all fields. The alternation must meet the requirements of modern agronomic science, be rational, provide an economically viable crop structure for the farm, be consistent with the ecological requirements of the crops and meet the terrain and relief conditions. Prolonged cultivation of the same crop in one place causes a gradual decrease in soil fertility, an increase in the concentration of diseases and pests. This can be avoided if the crops are grown in rotation. In this way, biological factors are most effectively used to maintain and enhance soil fertility. In order to ensure the rotation of crops in time and place, it is necessary to divide the total crop rotation area into separate fields (most often 4-6). Arable area parcels which are occupied by one or more crops (when aggregate fields are formed) and which have approximately the same dimensions are called rotation fields.

Advantages and benefits: Reduced use of PPP and fertilizers through the inclusion of legumes.

Reducing the threats of wind and water erosion of the areas occupied by roof.

Vegetation.

Disadvantages: Additional costs due to the greater number and difference of crops grown (technical equipment, logistics and marketing and planning).

- Co-cultivation of more than one crop.

Growing a crop in the inter-row areas or growing more than one crop in parallel on the same area. This is applied mainly by smaller farms, but the selected crops must be consistent with the climatic characteristics of the area.

Benefits: it increases the productivity of the land because it saves area. It reduces the influence of weeds and pests. It improves the nutrient content of the soil when growing legumes.

Disadvantages: Limitations in technical harvesting equipment.

The choice of crops is based on the agroecological characteristics in the area.

- Nutrient management and fertilization practices.

Nutrient Management (NPK) - nutrient balance. The introduction of mineral fertilizers should be carried out taking into account the needs of the planned crop, which will be grown on the basis of analyses carried out for the presence of a number of trace elements and residues of nitrogen, phosphorus and potassium in the soil. When calculating the fertilization rate, a number of indicators are taken into account: soil species and mineral composition, ancestor crop, ratio between N/P/K. The quantities of mineral fertilizers and nutrients are imported only on the basis of a precisely calculated fertilizer rate. The practice of applying only nitrogen fertilizers has been categorically denied. The required balance minimum between N/P/K calculated for the specific crop and the specific field on which it will be grown is sought.

Variable Rate Fertilization (TPN). Fertilization can be fixed (with a uniform norm for the whole plot) or variable (according to the need of plants in separate zones). It is based on the different condition and development of plants. There are two approaches to apply – to equalize yields from different zones and to increase yields from strong zones. In the first, the rate of fertilization in the weak zones increases, and in the strong it decreases. There are known studies that show that yields from weak and strong zones do not always equalize, because weak zones can be the result of other limiting factors – soil acidity, degree of soil moisture retention, lack of other nutrients, etc. In the second approach, more fertilizer is added to the stronger zones and less to the weaker ones. It is applied to maximize the potential of strong zones. For the application of variable fertilization, according to the needs of the plants, the farmer must carry out a preliminary soil analysis of the areas. Based on the results obtained, a fertilization plan is developed. This achieves a leveling of yields from different zones and increases yields from strong zones.

Benefits and advantages: Balanced use of nutrients by plants, according to their needs. Differentiated plant nutrition. Soil protection from fertilization with norms not higher than necessary. Ability to increase yields.

Disadvantages: Need for technical equipment, as well as stimulation of

the process of precise fertilization through samples and a fertilization plan.

- **Fertilization with microbial fertilizers.**

Microbials or so-called 'live fertilizers' means substances containing live micro-organisms which, when applied to seeds, plant surfaces or soil, colonise the rhizosphere or plant interior and promote growth by increasing the supply or availability of essential nutrients to the host plant. These fertilisers add nutrients through the natural processes of nitrogen.
fixation, dissolution of phosphorus and stimulation of plant growth by the synthesis of growth-promoting substances. It is expected that in the future, microbial fertilizers will significantly reduce the use of chemical fertilizers and pesticides.
Benefits: Reduced use of mineral fertilizers. Improved accessibility of nutrients. Improvement of biological activity and soil fertility.
Disadvantages: Insufficient dissemination and study of the effect of application, Need for consultations and training.

- **Fertilizers of natural origin** – manure and compost materials. Application of manures, which, due to their slower mineralization and accessible form, provide nutrients over a long period of crop growth. Depending on the composition, different types of manure act more or less as organic improvers. Manure maintains equilibrium in terms of carbon stocks in the soil; it helps to improve the buffering and absorption capacity of the soil and has a beneficial effect on the physical and mechanical properties of the soil. In the mineralization of manure, the soil is enriched with carbon dioxide, thus increasing the solubility of a number of nutrients.

Benefits: Reduced use of mineral fertilizers. Reduced risk of contamination of
soil and water. Improvement of biological activity and soil fertility.

Disadvantages: Difficulties in optimizing the available form of absorption of nitrogen compounds. Higher costs for organic fertilizers and compost, including transportation, when they are not a product of the farm. Storage costs when it is a product of the farm.
Quarantine period: Manure can affect the amount of carbon in the soil; therefore a quarantine period must be observed after fertilization - 180 days for rotted manure. For all mineral fertilizers, we observe a quarantine of 40-60 days until sampling.

- **Other carbon sequestration practices /e.g., addition of biochar, waste products and bioresources/**. Biochar is a promising soil improver. Its application to soil is a relatively new approach which leads to an improvement of its physical-chemical properties, its biological status and consequently to an increase in yields. In biochar, carbon is sustainable, difficultly mineralizable form, which is gradually released into the mineral nutrition. The addition of biochar to soils results in the sequestration of CO_2 from the atmosphere, helping to reduce emissions of other more powerful greenhouse gases such as N_2O and CH_4. Unlike other soil improvers, biochar has a long afterlife.
- **Green fertilization (green manure use)** – sowing crops, the so-called green manure as the main crop, which enrich the soil with organic substances. As an independent form of green manure, the crops should occupy the rotation field during one growing season. They can also be used as grass-legumes or wheat-legume cold-resistant mixtures that are mowed and buried in the spring. The practice of sowing arable land in the period between growing and harvesting two crops with grasses or grass mixtures helps both to preserve the active soil layer from exportation and to add carbon dioxide to the soil, thus helping the beneficial microflora to develop and function normally.

Benefits: Compacting crop rotation, protecting soils from erosion, supplying soil with nitrogen; it stores soil moisture, suppresses weeds and reduces plant protection costs; part of the biomass can be used for feed. In general, it increases soil fertility, with accumulated experience from its application.

Disadvantages: The non-productive use of crops.

Application in permanent crops:

By sowing of crops for green fertilization in the inter-rows, the so-called green manure or cover crops, the soil is enriched with organic matter and nutrients and is protected against erosion during the most sensitive periods of the year. Suitable as cover crops are forage and common peas, vetch, mustards, turnips, rye, winter barley and winter oats. The legume component also helps to attract insect-pollinators. The optimal period for sowing crops for green fertilization is the middle of summer. Sown in summer, especially under irrigated conditions, these crops develop a sufficiently large amount of green mass, which is ploughed in early November. When ploughing in autumn, the organic mass decomposes very well. In non-irrigated areas, sowing is carried out in the autumn, thus guaranteeing the crops good rooting, protecting the soil from erosion in winter, and ploughing is done in the spring of the next year (April or May).

➢ **Catch crops** – A means of compacting crop rotation that allows the use of crops, and their cultivation can be in a period free of other crops, with green mass and plant roots remaining and ploughing. It is also possible to apply in a combined form, as the main yield is used for animal feed, roots and additional growth is ploughed into the soil.

The use of catch crops in agriculture achieves a number of goals related to the prevention of water and wind erosion, especially in periods when there are increased conditions for this, with the improvement of soil moisture retention, helps to retain organic matter in the surface layers of the soil, plays a role by inhibiting the development of unwanted weed vegetation, increases the natural fertility of the soil.

➢ **Cultivation of nitrogen-fixing crops. Nitrogen-fixing crops "**capture" nitrogen from the air and transmit it to the soil. Nitrogen-fixing crops are Alfalfa (alfalfa) - Medicago sativa; Beans (common beans, field beans, non-climbing beans, low beans, peschar) - Phaseolus spp.; Beans (asparagus beans/ vigna) - Vigna spp.; Chickpeas - Cicer spp.; Clover - Trifolium spp.; Broad beans - Vicia faba; Lentils -

Lens culinaris; Lupin - Lupinus spp.; Peas - Pisum spp.; Vetch - Vicia spp. (except Vicia

faba); Esparzeta - Onobrychis spp.; Zvezdan – Lotus corniculatus L; Soybean – Glycine max.

Burczak - Vicia Ervilia; Groundnuts — Arachis Hypogaea.

Benefits: Soil moisture is preserved. Increase soil fertility naturally as a substitute for synthetic fertilizers. Protect the soil from erosion and inhibit the development of weeds.

Stimulate pollinator insects and biodiversity in agricultural areas. Source of additional feed additive for livestock breeding.

Disadvantages: Additional material costs (for seeds) and labour (for sowing and harvesting) of crop production.

- **Mulching.** Mulching is a process in which the soil around plants is covered with various materials regulating the water and air regimes in the surface layer of the soil. Most often it is organic material – peat, compost, straw, tree bark, etc., which is placed on the soil around the stems of plants. It is placed in order to keep the soil moist and regulate the temperature of the soil.

Benefits: It protects the soil from the destructive effects of raindrops; it reduces surface water runoff; it increases water absorption in the soil;

It protects it from evaporation, it helps to preserve the organic substance in it. It does not require additional funds and specialized equipment for application. Mulching greatly contributes to weed control. Regulation of the thermal regime of the soil (i.e., prevention of overheating). Preservation of moisture in the soil. Fuller and more correct use of rainwater – slow and complete absorption of water in the soil. Prevention of soil landslides, i.e., limits water erosion.

Disadvantages: Limited application. Additional material and labor costs.

3. Weed control practices, diseases and plant pests

- Use of organic/natural pesticides. Use of plant protection products (PPPs) whose active substances are based on plant extracts (e.g., pyrethrin-based PPPs extracted from chrysanthemum flowers), extracts based on extracted essential oils or extracts from recycled and processed food industry waste (citrus, fruit, vegetables, woody, shrub and flower species).

Benefits: Reduction or absence of contamination of soils, water or production by chemical synthetic PPPs. Reduction of PPP risks to human health. Allowed for use as a method of plant protection in organic production.

Disadvantages: Variable effectiveness of pest control. Limited

application due to higher cost.

- **Allelopathic plants.** Integration of selected plants into crop rotation. Using the method to select suitable plants that favours the development of the main crop and interfere with the development of weeds. Each organism produces biochemicals called allelochemicals that are released while the plant is alive and in the processes of decay after its death. They can have a positive or negative impact on both the surrounding plants as well as on pests. Thus, allelopathy turns out to be an effective method of mutual protection of plants from pests, control of various types of weeds, a way to stimulate development, etc. This practice is mainly applied in organic plant production and especially in vegetable production.

4. Erosion threat management practices.

- **Application of Belt Agriculture.** Belt farming is a division of the slope surface into strips of a certain width located on the horizontals of the terrain, or transverse to the slope of the slope on which various crops are grown, such as: cereals, trenches, perennial grasses, etc. The essence of this anti-erosion method consists in successive alternation along the slope of belts of trench crops with belts of crops with a merged surface. This achieves a reduction in erosion processes, while also increasing soil moisture on the slopes. Belts sown with fused crops are an obstacle that reduces the rate of surface water runoff and soil erosion, but also serves as a filter to retain dragged sediments from the upper belt with trench crops.

- **Grassing inter-rows in perennials and vineyards.** turf-mulching system. It is characterized by the fact that the interrow strips are artificially incubated with mixtures of cereals and legume grasses, and intra-ordinary, about 1.2 m wide, are maintained in black fallow by spraying with herbicides or with soil treatments. Grasses are often mowed (at a height of 10-12 cm), leaving them in place in the form of mulch.

➢ **Complete** grassing (maintenance in turf)

Meadow cultivation. Under this system, the natural grass vegetation of the area is allowed to grow freely or mowed and leaves in place as mulch or exported for animal feed. Around the trees the soil is cultivated in circumferential circles or a fallow row stripe is maintained.

Advantages: improvement of soil structure; enrichment of soil with organic matter; reducing soil erosion; Reducing the cost of soil cultivation.

➢ **Conversion of arable land to permanent grassland.** To convert arable land into pasture in order to protect the soil from erosion, the farmer must sow suitable grass mixtures. Subsequently, the pasture must be maintained – by mowing or grazing.
Benefits: Protection of soils from erosion. Activation of restorative soil formation processes. Enrichment of the soil with organic matter. Obtaining grass forage.
Disadvantages: Need to maintain pastures. Reduction of arable land for production of production.

➢ Contour Farming. In contour farming, the main types of agricultural operations – tillage, cultivation, sowing and harvesting of hilly terrains are carried out in the direction perpendicular to the slope or horizontals. This reduces soil losses 3-4 times and increases yields by 30-40%. Contour farming is applied to sloping terrains where annual crops are grown. This practice is most effective on slopes with a length of 30 to 120 m. On slopes with a length of more than 120 m the contours cannot retain the runoff water. Carrying out the soil treatments along the contours of the terrain can reduce soil erosion by more than 50% compared to the soil treatments by slope of the slope.

Benefits: Reducing the losses from the removal of the surface soil. Increasing yields. Protecting the soil from water and wind erosion. Increasing the water retention capacity of the soil and the water security of the plants during their vegetation, which guarantees higher productivity.

Disadvantages: Mechanized treatments are carried out on sloping terrain.

Vertical mulching. This is an anti-erosion agrotechnical method suitable for use on sloping terrains and soils with resistant illuvial horizons. Slots of certain sizes are made across the slope, which are filled with plant residues of wheat straw, stems of corn, sunflower and other organic materials of plant origin. Studies have shown that slits made over a distance of 2 m and a depth of up to 0.50 m increase the water absorption capacity of the soil more than twice, and the raining done on these areas with an intensity of up to 127 mm/h does not cause the formation of surface water runoff. It was also found that the decomposition of the organic substances of the mulch in the slits reduces the density of the soil, its aggregate composition and moisture supply are improved. It has been shown that vertical mulching contributes both to reducing surface water runoff and soil export (up to more than 20 times) and to increase yields of grown crops. The results of the studies conducted in Bulgaria with this soil protection method on slope lands with carbonate chernozem soil with a slope of 5., sown with wheat show that its application leads to a reduction of the surface water runoff formed during erosion rains by 2.4 to 4.5 times.

5. Management of landscape elements and pastures

➢ Integration of seminatural elements. Cultivation and management of strips and hedgerows on plots and on their borders. Creation of small areas or strips of land with permanent vegetation, designed to retain pollutants (this will also help to solve some environmental problems). Sample types of vegetative strips: riparian buffer strips, windshield belts, filter strips, shafts, contour grass strips – near water bodies, forests and in arable land. A practice to prevent/reduce pollution for surface water is to leave buffer strips of trees, shrubs and other vegetation in the border area between arable areas and riverbeds, to capture and degrade pollutants in natural and newly built wetlands.

Benefits: Protection against pollution of surface waters. Interception of potential water pollutants (fertiliser and pesticide residues). Increase natural pest control. Conservation of biodiversity. Improvement of plant pollination. Reduced PPP use. Biomass yield (wood, fruit, animal feed, grazing, etc.)

Disadvantages: Risk of habitat creation and development by pests. effectively reduce the area used and hamper some of the mechanized technological operations. More costs for managing landscape elements.

➢ Management of existing natural landscape elements. Management of hedgerows/strips with tree vegetation and other non-productive landscape elements – individual trees, trees in rows, groups of trees, margins, shelterbelts, canals/open water courses, ponds and wetlands.

Benefits: Pest reduction and PPP use by providing nests of useful water (predators and parasites of harmful insects), water pollution absorption by intercepting surface runoff. Soil protection against wind and water erosion and biodiversity. Preserving ecosystems and ecosystem services.

Disadvantages: Risk of creating habitats from pests. Loss of agricultural land for production. Higher management costs. Need to involve other farmers in the management of the adjacent general landscape.

➢ **Improvement measures in permanent grassland (PPP).**

Cleaning from bushes, trees, stones, alignment, sowing worry,

Fertilization. In order to ensure good productivity and quality of the botanical composition of the concern, the farmer must maintain the PPP in good general condition.

This is achieved by applying a number of techniques such as:

- Cleaning - cleaning from stones, trees and shrubs is carried out in a mechanical and chemical way. Mechanical - by cleaning with special machines - brush cuts, bulldozers, etc. Chemically by using different plant protection products.

- Drainage - by construction of dikes, clear and coastal drains, dense network of open channels to accelerate surface runoff, etc.

- Irrigation – gravity and by sprinkling.

- Weed control and harmful vegetation - water differentiated according to the composition of weeds.

- Fertilization with mineral and organic fertilizers - permanent grasslands are highly responsive to fertilization.

- Sowing - applied to thinning grass and to improve it on sloping terrain. Cereals and legume grass mixtures are used.

➢ Grazing and mowing regulation. The promotion of extensive livestock farming and the maintenance of optimum density of livestock units with which grazing is carried out.

7. Agroforestry

Agroforestry is a form of multifunctional and environmentally friendly use of natural resources, which benefits from the biological interaction created by co-cultivation of tree and/or shrub vegetation with agricultural crops and/or domestic animals by deploying trees for wood, fruit and shell trees along the parcels occupied by other crops, scattered trees in permanent grassland. Combined planting of agricultural crops and perennial species. In semi-abandoned areas and exposed slopes, agroforestry helps control erosion and restore soil fertility, as well as the supply of useful vegetation.

Benefits: Increased land productivity. Reduced nutrient loss and soil erosion. Protection of agricultural crops from wind and sun. Increasing the diversity of plant and animal species.

Disadvantages: Loss of cultivated area. The integration of trees into arable land is an inappropriate practice for small farms that lose yields due to the presence of trees.

VII. DOCUMENTING THE PROCESSES OF THE PROCEDURE

The process starts with an application for registration in the CARBONSAFE PR0201 program, part of PR02. The application describes the main data for the holding – geographical location, areas, types of crops, manners, methods and technologies for growing the respective crops. The technical security of the holding shall also be indicated. The application also provides for a declaratory part in relation to double counting of projects.

The process continues with a visit to the farm by a qualified agronomist of Carbonsafe and the preparation of a **Protocol for assessment of the suitability of the farm PR0101**, according to the current procedure. The protocol is a kind of checklist that lists data on the farm – crop types, areas, cultivation technology, soil treatment types, etc. In case the farm does not meet the requirements for admission to the Carbon Agriculture programme, according to the minimum requirements specified in PR0101, it is completed with a "No" answer and a **Prescription for Steering to Suitability is issued-PR0102**, which specifies measures and activities that should be carried out before being admitted to the system. In case the farm meets the eligibility criteria of Carbonsafe, it goes to the next step – conclusion of an administrative contract for a period of minimum 5 years and registration of the contract in ISACO_2. In parallel with the contract, an **Individual Management Strategy for the used areas on the farm is introduced - PR0103**. The strategy takes into account the existing situation of the farm with regard to cultivation methods, making a brief description of the applied technology and the types of treatments based on visual agronomic assessment on the spot. After familiarization with the results of the base georeferenced soil sample, proceed to the issuance of **Technological map for cultivation by the method of Carbon Agriculture - PR0104**, which values the recommended soil treatments and other operations. Here, the main document under the procedure is issued – **the Agronomic Recommendation PR0105**, which is generated by ISACO_2. For each visit to the holding, a **Monitoring Report of an on-the-spot inspection - PR0107** shall be filled in, which shall record the measures carried out and the copies of documents received relevant to the purpose of the check.

An essential part of the agronomic control is also the monitoring of the CO2 emission of the equipment used in the soil treatments under the project which is based on the methodology of the Ministry of Agriculture fixing individual annual quotas in connection with the application of the State Aid scheme 'Aid in the form of a discount on the excise duty on gas oil used in primary agricultural production'. [1]

VII. ELIGIBILITY REQUIREMENTS

An applicant for participation in the Carbonsafe Programme must meet the minimum requirements described below:

1. **The farm is located on the territory of the Republic of Bulgaria;**
2. **The Participant is a registered agricultural producer, according to ORDER No. 3 of 29.01.1999 on the creation and maintenance of a register of farmers;**
3. **The farm is crop-growing and/or mixed - crop-growing and animal-breeding;**
4. **The farm has the opportunity to implement new production practices;**
5. **The farm has a minimum total area of 200 hectares for grain/ technical/ fodder/ perennial medicinal and aromatic crops/ fallow areas;**
6. **The farm has a minimum total area of 50 hectares for perennial crops;**

[1] Source: https://www.mzh.government.bg/bg/politiki-i-programi/programi-za-finansirane/darzhavni-pomoshti/otstapka-akciz-gaziol/

7. **The candidate is eligible if he meets one of the two conditions specified in item 5 and item 6;**
8. **Plots with a minimum area of 4 hectares/crop are considered eligible;**

For the purpose of scientific research and development (R&D), deviations from the requirements specified in item 7 and item 8 are allowed at the discretion of Carbonsafe.