C.A.N.A.P.A.

Coltiviamo Azioni per Nutrire, Abitare, Pulire l'Aria (Cropping up Actions for Feeding, for Living and for Cleaning Air)

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Abstract: The action aims at reintroducing and re-thinking hemp cultivation, with the purpose of sustainable recovery of highly polluted agricultural land surrounding ILVA, the huge steel plant in Taranto (Italy). Hemp (*Cannabis sativa*) can be used to reclaim the soils using an innovative, eco-friendly and low-cost technique called phytoremediation. Phytoremediation is the direct use of plants, and their associated microorganisms, to stabilize or reduce contamination in soils, sludges, sediments, surface water, or ground water. Hemp is suitable to be used to recover soils, since it easily grows under different pedo-climatic conditions, hemp can be re-introduced in current cropping systems. Hemp produces high exploitable biomass for the non-food sector. For this reason several experiments have started in order to test industrial hemp and the real ability to recover soils. The experimental data actually encourage to use hemp to reclaim soils contaminated with heavy metals, dioxins, PCBs. It would be necessary to extend the test for collecting definitive data on its effective use to remediate contaminated soils with inorganic and/or organic pollutants.

1 INTRODUCTION

The concept of green economy conveys the idea of a new development model based on the potential of the common interest to contribute to the fulfillment of the need to bring back the problems of global pollution within the limits of sustainability, in general, and those of the contrast to the climate changes, in particular. The concept of environmental sustainability, or sustainable development, was introduced, by the so called "Brundtland Report" written in 1987 by the World Commission on Environment and Development, which gave the following definition:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

The C.A.N.A.P.A. project connects directly to the issues of environmental sustainability, global pollution and the common interest.

1.1 Motivations

Hemp (*Cannabis sativa* L.) is an annual plant that takes a year to complete its life cycle. The peculiarity of annual plants is to ensure the propagation of the species through the production of seeds during the final stage of their cycles. Furthermore, *Cannabis sativa* is a dioecious plant, however the monoecious cultivars are highly appreciated in agronomy. Hemp presents a rich root system made of abundant secondary roots and a taproot, which allow the plant to tolerate temporary dought stress in the soil and to contribute to keeping the stems upright. Hemp canopies normally attain 3 - 4 meters in height. The leaves are palmately compound or digitate, with serrate leaflets and are mostly opposite, with 3-9 lanceolate, sharp, serrated and pubescent segments.

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1.1.1 Phytoremediation

Phytoremediation is the ecological science that uses cropping systems (annual species or trees) to remove heavy metals and other toxins from contaminated soil. Using specific plants and trees (called hyper-accumulators) in polluted areas, contaminants can be considerably reduced. Why hemp is superior to other phytoremediators? Hemp grows rapidly producing consistent amounts of above-ground biomass, reaching full crop development in just 180 days and produces roots extending deep into the soil up to 2.5 meters. At that level, the pollutants can be up-taken without removing the contaminated soil of the top layer, thus avoiding the expense of transportation to off-site disposal plants. Moreover hemp is the best of "remediators" because:

- its ability to grow not affected by toxins accumulated in the plant;
- its fast absorption rate and its ability to bind air and soil contaminants compounds;
- Hemp actually removes CO_2 from the air as well as removes heavy metals and other pollutants from the soil.

1.1.2 Direct and Indirect Environmental Benefits

- Hemp cultivation requires low amounts of chemical treatments such as pesticides or herbicides;
- Within the sustainable cropping systems, hemp plays a positive role because it regenerates the soil making it more fertile thanks to its properties (weed reduction) and thanks to its root system, which works the soil in depth (up to 2 meters), leaving it in excellent condition for the following crop in the rotation scheduling;
- It grows fast (up to 10 cm/day) preventing weeds from developing, and as a consequence use of herbicides decreases. Moreover, thanks to the allelopathic substances contained in the leaves, reduces the growth of weed species;
- It helps to mitigate climate change. The result of a study conducted at the University of Edinburgh, highlights the ability of hemp to sequester atmospheric CO_2 into the soil.

1.2 Objectives

1.2.1 The "Green Belt"

The green belt in the United Kingdom is a rule governing the control of urban development. The idea is that it should be kept, around the towns, a green band occupied by forests, farmlands and outdoor leisure places. Moving from this idea, the final objective of the action is the remediation of soils surrounding the Taranto 'ILVA' steel plant. The project consists in cultivating 3 hectares of hemp at the farm "Masseria del Carmine" located in Taranto (Southern Italy - Apulia region). The farm is a pilot company in Taranto; the project includes certified chemical and physical analysis of the polluted (by heavy metals and hydrocarbon compounds, as the dioxins) soil before sowing, during the vegetative phase of the plant, and after the seeds and fibres harvest. This action is a useful input data for the research and development of other species to employ in the cropping systems of the area. In the medium to long term, to build a farms network (green belt), identified in the areas surrounding the steel plant, adopting the project as "best practice". The companies involved in the project will be properly identified by the trademark "Masseria Verde" (Green Farm).

1.2.2 The Brand "Masseria Verde"

It is an action of promotion, awareness and encouragement of measures aimed at the gradual reintroduction of hemp cultivation in the polluted lands. It will be made a brand "Masseria Verde" (Green Farm) (Figure 1) which will be submitted for approval by Apulia Region. It will be a quality brand for the more virtuous farms; in fact, the brand will be assigned to the farms through preparatory awareness actions and following verification activities. Awareness of local stakeholders requires the direct involvement of farmers, in particular those following the project activities, in the most suitable sites for cultivation.

Figure 1: "Masseria Verde" logo (draft).

1.3 Interrelations with Existing Technology

The hemp cultivation is perfectly integrated with

cropping systems already used in the area, except for small adaptations depending on the vegetative characteristics of the plant. Preliminary tests carried out in this area on limited surfaces have provided the first evidences about the type of cultivars to adopt in this environments and the main agro-thechniques.

2 PRESENTATION AND ANALYSIS OF THE SECTORAL AND/OR TERRITORIAL CONTEXT

2.1 Supply and Demand Analysis

The economic and financial crisis is contributing to accelerate the redefinition of the economic world with a clear disadvantage to Italian growth and the consequent risk for the country to remain outside the "head group" of modern countries. In particular, the Province of Taranto in response to environmental and labor issues caused by the massive impact of the industrial area and maritime traffic, linked to the presence of the Navy, the merchant fleets and oil tankers, requires urgent interventions and concretely sustainable actions to restore the quality of life on European levels.

There are numerous opportunities related to the intervention, as well as the positive impact in the employment and business, including:

- The protection and enhancement of the hemp farmer, a nearly extinct traditional craft, but the bearer of a high degree of professionalism and sustainability; around the Taranto harbor the hemp spinning was a popular activity because the request of hemp cordage from the navy;
- the stimulation to the generational change, also through the use and transfer of skills acquired by old hemp farmers during their professional existence;
- The incentive to learn traditional creative activities; unnamed tailors of the region commonly works for the couturiers of the made in Italy: the availability of a natural material, as the hemp yarn, locally produced, gives opportunities for new activities;
- Support the emergence of new micro craft enterprises related to hemp derivatives (paper, textile fiber, chipboard for furniture, bio-bricks, etc.);
- The development of so called "Niche products" direct to a selected market;
- The introduction of principles, techniques and biocompatible and environmentally sustainable materials in the food sector (seeds, oil seeds and flour) and entrepreneurship in general (biofuels, plastics, green building, etc.).

2.2 Location

The project started in Masseria del Carmine (Figure 2) in 2014, a fully functional agricultural reality until the year in which the industries took possession of the land and surrounding the farm, determined the forced restructuring first and finally forced the farm to the conversion into a "horses pension" and olives production company. The disastrous impact of the steel plant on the surrounding area, in fact, prevents any other crop and livestock activities, typically and traditionally linked to wine and food production in this area.

Figure 2: Masseria del Carmine - Taranto.

2.3 Threats and Opportunities

2.3.1 Threats

The main threats from the external environment, can be summarized in criminal actions and/or accidental/natural actions, because of the small number of competitors the success of the project is practically assured. In this case the threats are identified as follows:

- Parasites: in modern cultivation there is no significant pests damage. In the past, when the crops were very large and concentrated, were reported borer attacks;
- Drought: hemp has a spring-summer cycle and in any Mediterranean area rainfall is not enough to balance the crop water requirements. An irrigation system for

supplemental irrigations will be set-up;

- Theft: there may be the theft of some plants especially in the flowering phase;
- Fire: it is known the danger caused by the fires in all wooded, cultivated, bushy, arboreal pasture areas and in the entire region especially in summer;
- Prejudices: only 100 years ago, vast hemp fields decorated the Italian countryside, along with cereals, vineyards, orchards and olive trees. Italy was the second world producer of excellent textile fibres and the first in the world for quality. In parallel with the development of synthetic fibres, with the use of cellulose fibres from trees in paper mills, with exploitation in criminal aim of the infamous "marijuana", hemp has been completely eradicated from the fields and from the Italian tradition culture. It is time to transform the prejudices on hemp cultivation that slow down the continuation and dissemination of knowledge and techniques, to make effective information on the subject.

2.3.2 Opportunities

The opportunities are countless and potentially growing, the most significant, measurable and classifiable at present are the following:

- Soil remediation: reduce the pollution load and allow the agricultural activity in the sites which were contaminated. The economic value of the lands dropped down as a consequence of the pollution.
- Teaching Farm: it is a working farm, characterized by the production and the work of farmers, who really work in it, in which part of the time and part of the company structure is made available to welcome school groups, families, individual consumers, to propose nutrition education and agro-environmental activities;
- Project promotion: on information campaigns at local, regional and national level, will be implemented by means of scientific materials: implementation of a final seminar in collaboration with project partners to give the widest possible dissemination of the results of the project; creation and publication of a diary of the Best Practice summarizing the project contents and the achieved results; making of a documentary as evidence of development of the project, which can transmit values and stimulate useful reflections to form an ecological awareness among citizens. This will promote greater awareness of the importance of hemp in existing cropping systems, even in terms of eco-tourism attraction with economic benefits for the local operators.
- Short chain: Hemp besides being known to man since ancient times can be grown easily and practically everywhere, this means that there would be no need to import raw materials from abroad if hemp cultivation in Italy was fully encouraged. It would thus be a short chain;
- Interest: the return of hemp fields will help the economic recovery in Italy, with energy saving and with the impulse to companies in many strategic sectors: construction, food, cosmetics, textiles, plastics, paper, pharmaceutical, agro mechanic and textile machinery;
- Collaboration: network of partnerships will be strengthened to develop research aimed at soil remediation involving the CRA (Consiglio per la Ricerca e la sperimentazione in Agricoltura) Agricultural Research Council, the National Research Council (CNR), the University of Bari, and associations of professionals and NGO expressing an interest in the project.

3 PROJECT FEATURES

3.1 Period and Seeding Technique

Once the ground is properly prepared with a slight ploughing followed by a harrowing, it is possible to sow. In Southern Italy, the period goes from

Figure 3: Hemp seeding.

February to May. It takes normal grain seeders with a distance ranging from 20 to 50 cm depending on the destination of the product. The seeding density is 20-25 kg per hectare for seed crops; up to 50 kg per hectare for fibres crops/biomass. The seed should be placed at a depth of 1-1.5 cm and come to germination within 8-12 days. (Figure 3).

3.2 Economic Investment

To start a cultivation of one hectare of hemp, consider the following aspects:

- Purchase seed (€ 5.50 + VAT / Kg);
- Soil preparation (ploughing and harrowing);
- Fertilizers (if necessary);
- Sowing;
- Supplemental irrigation (if necessary);
- Harvesting.

In general, the investment to start a crop on an area of 10.000 square meters, can vary between € 400,00 - € 600,00.

3.3 Varieties to Be Used

The selected varieties for colder climates (eg. French), with the typical climate of southern Italy, tend to go bolting by stopping the growth of the plant. With the project C.A.N.A.P.A. is expected to test more varieties and also the old Italian seeds which have been selected for the Mediterranean environments but now are neglected by the great seed companies. The old Italian cultivars can be available from the research centers which collect the hemp germoplasm.

3.4 Fertilization

Hemp requires nitrogen especially in the early stages of development. Depending on the quality of the soil, the right N rate can be scheduled. Certainly, the farmer knows his ground and can set it according to his/her knowledge.

3.5 Weeding

With a dense sowing (for fiber/biomass) hemp does not require weeding since, thanks to its speed of growth, does not give space and light to other weeds. With a sparse sowing (for seed) may be necessary weeding to remove weeds mechanically.

3.6 Biomass Harvest

From August (under the climatic conditions of Southern Italy) it is possible to mow with a conventional mower. We suggest to leave in the field for 7-10 days (depending on weather conditions) for a first maceration and proceed with the round baler. The bales of hemp can be stocked for several years (unlike the straw that goes rotting) or sent immediately to the first transformation. (Figure 4).

Figure 4: Biomass harvest.

3.7 Seed Harvest

Starting from September, according to the maturation of the seed, we proceed to the threshing with a combine harvester specially modified.

3.8 First Transformation

Depending on the product to be obtained, the first transformation may also be in the field, at the same time of collection. Our vision is to have efficient machinery, innovative and accessible by small cooperatives.

4 FEASIBILITY

- The project promotes a system essential to upgrade the territory through a centuries-old Italian tradition. The innovation represented by the Hemp is fully embedded in a historical moment that sees its cultivation returning protagonist of the productive sectors. The project is aimed at giving the recipients an awareness on the question of “sustainable development” and the “local development”. (Figure 5)
  - The feasibility is already guaranteed by the availability of Masseria del Carmine (and its field plots), and minimal economic investment for land preparation, planting, and then the first harvest.

Figure 5: Hemp field – Masseria del Carmine.

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