Participative technologies to improve diets in Mexico and for adaption to climate change Proposal by Chapingo for Maize

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Summary

Some of the most important and significant problems being faced by humankind nowadays, and mainly by farmers, are related to the pillage we have made with the environment, which, under the framework of agribusiness and a predatory and dehumanized capitalism, has not only caused the land to become poorer, but we have also reduced its potential to provide us with food human kinf needs to continue living, threatening our survival as a species, as well as the very condition with which the planet maintains its balance and functions.

The strategy that we succinctly propose implies:

(a).-Reducing the effects of climate change on nature.

(b).-Defending the role played by age-old knowledge within the new productive processes.

(c).-Incorporating the productive culture of smallholding farmers to the development proposals.

(d).-Constituting people as the focal point of any process or strategy, particularly farmers.

(e).-Recovering the virtues that agriculture based on the imitation of nature has for the environment.

Background

Some of the most important and significant problems being faced by humankind nowadays, and mainly by farmers, are related to the pillage we have made with the environment, which, under the framework of agribusiness and a predatory and dehumanized capitalism, has not only caused the land to become poorer, but we have also reduced its potential to provide us with food human kinf needs to continue living, threatening our survival as a species, as well as the very condition with which the planet maintains its balance and functions.

In this sense, climate change and its effects, the increase in world hunger and poverty, along with the squandering of age-old knowledge of peoples, which has helped them survive living under the industrial model for many years, are just some expressions of the civilization crisis that is currently affecting the social and productive growth of millions of human beings on the planet.

In the face of this, it is necessary to boost a series of measures and policies to help peoples search for a new balance in the growth of civilization while reducing starvation and malnourishment, using new production and technological strategies that may help humankind and societies, not only to recover their food self-sufficiency, but also, based on a new relationship between age-old knowledge and technology, to put a stop on environmental deterioration which allows humanity to revert climate change, as well as to preserve agro environments that have helped people preserve and reproduce as a species on the planet.

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In the context of sustainability and as a response to the concern over the degradation of resources related to agriculture, we propose to focus on an organic-mineral agricultural management for food production, in which we rely on alternative and chemical synthesis inputs to attend to production factors. Considering climate change as a scenery for food production, in which a rise in environmental temperature stands out along with evaporation, rainfall, and others, we have developed a technological proposal that attends to the limiting factors of production, which is why we promote agricultural innovations, namely**:**

1.- Energy. We promote the use of low frequency energy using a magnetic field.
2.- Genetics. The alternative of using rustic hybrids to tolerate climate and biological stress conditions stands out here.
3.- Climate. Taking climate elements as a reference, such as solar radiation, rainfall patterns, agro climatic indices are elements to propose planting and population doses and agricultural management practices that optimize the photosynthetic rate.
4.- **Soil**. Conceived as a medium made of three phases: solid, liquid and gas, which influence water storage and nutrient supply; production factors are attended to under this concept, concentrating on conservation agriculture, remineralizing soils, restoring soil biology, incorporating organic matter and humid substances, soil enhancers. This explains the promoting of actions such as:

4.1**.- Tillage**. We promote mechanization by means of chisel plows in order to destroy the plow floor, and consequently, to have adequate storage conditions for water from heavy and aggressive rainfall, typical of this time of climate change, thus contributing to reduce soil erosion. The use of disk plows is reduced.

4.2.- **Precision Farming**. We promote a spatial distribution and the best possible use of, mainly, the reserve of organic matter, minerals, water, light.

4.3.- **Nutritional Diagnosis**. The geo-referenced analysis of soils is a tool to diagnose the offer of nutrients in the soil, which, when related to the goal yield, and integrating it with field information, leads to the construction of Geographic Information Systems to design the fertilization strategy, and the following stand out:

4.3.1**.- Managing the Reaction of Soil or pH.** The purpose is to shift to chemical conditions that help nutrient absorption.

4.3.2.- **Remineralization.** This action is aimed at restoring the richness of minerals in soil, and therefore we promote the incorporation of diatoms, zeolites, phosphoric rock, dolomite, and other enhancers, based on the level of degradation identified. This leads to an increase in availability of nutrients from the solubilization of minerals, as well as to improve the Capacity of Ionic Exchange, regulating pH, and other aspects.

4.3.3.- **Incorporating Organic Matter.** A strategy intended to improving the habitat of the soil fauna and water storage, and to improve the efficiency of fertilizer use. For this purpose, we promote the preparation and incorporation of compost, vermicompost and humic substances.

4.3.4**.- Soil Biology**. The rhizosphere, the area just below the crops´ roots, crucial for reactivating biogeochemical cycles, nutrient availability and to promote the induction of induced resistance, is promoted using a microbial consortium:

(a).- **Growth-Promoting Bacteria:** This is a strategy for the biological fixation of nitrogen and to reduce the doses of nitrogenated fertilizers. It also constitutes agro-environmental and sustainable alternatives in the inoculation of beneficial organisms for the rhizosphere that lead to the induction of resistance in crops.

(b).- **Mycorrhizae.** We promote the application of the mycorrhizal fungus *Glomusintraradices* as a strategy for supplying phosphorous and other nutrients into maize, hence attending to inorganic phosphorous deficiencies, enhancing the microbiology in the rhizosphere, as well as promoting the induction to resistance in maize crops.

(c).- **Entomopathogenic Microorganisms.** *Bacillusthuringiensis* entomopathogenic bacteria that has proven its toxicity against insects, fungi such as *Beauveriabassiana, Metarriziumanisoplae, Trichodermaharzianum* are a part of the non-pathogenic microbial consortium in the complete management of soil pests and diseases.

5.- **Supplementary Mineral Nutrition**. Attention to nutritional needs of essential nutrients and beneficial elements is carried out by incorporating minerals into the soil, by making a rational use of chemical synthesis fertilizers, as well as foliar fertilization, in order to attend to limiting factors, and particularly the formation of organic and inorganic components, the activation of enzyme systems and redox reactions, stressful situations, particularly frost and drought.
Foliar fertilization derives from soil analysis and comprises the incorporation, via the leaves, of:

(a).- humic substances;
(b).- amino acids;
(c).- minerals: Cu, Zn, Mn, Fe, Mo, B, Mg, Si, Se and Ni, mainly.
(d).- growth hormones
(e).- Resistance inductors

6.- **Pest Management.** For soil, we promote the use of entomopathogenic microorganisms as pest control agents: white grubs, wireworms, root worms, mainly, where entomopathogenic fungi cause a reduction in the pest insect population, invading the insect's cuticle and causing the death of the insect by mechanical harm and malnourishment, where the insects infected are the new source of infection for the individuals in the pest population. For air pests, we promote the strengthening of the immune system of the crop by foliar fertilization including silicon, along with biological control.

With these agricultural innovations, we attend to the reserve of organic matter, the biology of soil and of nutrients required by crops for an adequate growth. Practices are also promoted to contain water, a crucial element for nutrients and physiologically active substances can be absorbed by plant cells. Vulnerability to pests can be attended to preventively using biological management. Practices promoted are aimed at the creation of microclimatic conditions in the maize crop, founding the strategy in precision farming and a supplementary nutrition.
This strategy will undoubtedly face great obstacles coming from the productive culture of technicians and officers, as well as from the lack of understanding of the farmers themselves, who have been vaccinated by the system that constantly promises results and improvements of their quality of life, without fulfilling this intention.
To set the operation of the processes and the strategies for the above to occur, it is necessary, as we already mentioned, for the farmer to be the axis around which the aforementioned processes and strategies unfold. This is only possible if

we boost participative planning as a crucial part of any proposal and as the main means by which productive initiatives by farmers are to develop, but also their adoption of technological models that sustain the productive proposals intended for promotion in rural communities where this type of programs take place.
In this way, participative planning, that is, the collective reflection process amongst farmers to adopt a technology, supposed, among other aspects, the timely compliance of the following guidelines.

- Taking productive organization as a base.
- Acknowledging the main production-related problems that farmers may have from their own concerns and interests.
- Finding the main obstacles for production, as well as their nature and impact on the lifestyles of farmers.
- Acknowledging their productive strategies, as well as the cultural work they carry out on a daily basis.
- Finding the productive proposals and intentions of the farmers.
- Articulating the productive proposals around a basic grain for popular consumption.
- Thinking collectively about the productive proposal and its technical and economic viability.

Complying with the above guidelines implies obtaining the following products and the implementation of the following processes.

1.- Diagnosis

Social diagnosis of the areas, communities, or groups of farmers interested in the rural development proposal implied in the project.
Ecological diagnosis of the agro systems of the area focused for the development of the project, which includes: cultural work, varieties and main ways of production that prevail in the area of the project.
Productive diagnosis of the areas on which the project focuses.

1.- Organization

- Formation of reflection group, whether by communities or formal organizations.
- Creation of non-organized groups.
- Creation of proposals.

2.- Preparing and Making Proposals

- Determining the productive proposals to be articulated in the project.
- Explanation and collective discussion of the technological model that will serve as a basis for the work to be carried out with farmers.
- Enrichment of the technological model based on the proposals by farmers and by work groups.

3.- Training

- Training farmers on each of the axes that make up the model and the technological proposal.
- Technological training for technicians on the model and the productive proposal.

4.- Technical Assistance

Creating the technical assistance program of the program, of the introduction of the technological model and of the technological proposal to be developed in areas chosen for this purpose.
The proposal here exposed is alternate to the agriculture method known as the Green Revolution, which is intensely promoted in Mexico, and considers aspects such as: (1) improved seeds; (2) mechanization; (3) irrigation; (4) chemical synthesis fertilization; (5) intensive use of herbicides and pesticides; (6) credit; and (7) large-scale farming, mainly. Currently, the drop in the fertility of Mexican soils, related to a drop in organic matter in the soil, forces us to search for alternatives to restore and maintain productivity. The sustainable practices described can be attended to by crop nutrition, restoration of biogeochemical cycles and maintenance of soil productivity.