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Review Article

Ecological Intensification of Agriculture to Preserve Profit

Joao Biche Danune*

Department of Agriculture, University of Beire Interior, Covilha, Portugal

ABSTRACT

Future perspectives suggest that a real revolution in agricultural production processes will have to happen. If, on the one hand, the productivist model, originating from the green revolution, has shown its limits, especially with regard to the unsustainable use of natural resources and the negative impacts they cause on the environment, on the other hand it is estimated that the world population should reach to 9 billion people in 2050, thus increasing the demand for food, fiber, wood and join that list: Biofuels.

Keywords: Plant breeding; Biomass; Bioeconomy; Bioenergy; Agroecology; DNA; Agricultural biotechnology; GMOs's; Biotic regulation; Pollination; Ecosystem services and biodiversity; Bio-waste and biological cycles; Research and agriculture; Food security; Forests

INTRODUCTION

Rationale: This increase in demand will be even greater than a simple progression in population growth, since a substantial improvement in the quality of life of the least favored populations is expected. This improvement in the quality of life will inevitably have to go through a greater per capita use of products from agriculture.

The solution that has been adopted for millennia to circumvent the problem of increased demand for agricultural products deforestation and agricultural expansion is simply no longer possible. There are almost no more reserves of arable areas and of this, the vast majority are located in South America and therefore, far from the place where the demand will be more expressive: In Asia. In addition, the current levels of deforestation have already been associated with important changes that threaten both agricultural production itself (increased pests, reduced pollination as a result of reduced bees, soil erosion, etc.), as well as the demand for biodiversity and global climate change with its negative consequences [1].

LITEERATURE REVIEW

The challenge presents itself clearly: How to meet the demands and products of a larger population and with a better quality of life, in a sustainable way, without increasing the cultivated area and with less availability of water and fossil energy? To respond to this challenge, a new proposal for a production model emerged in France at the end of the first decade of the 21st century-ecologically intensive and high environmental value production systems. Ecological intensification means designing productive, economical agriculture with external inputs and less harmful to the environment.

In this model, the aim is to create conditions for the natural mechanisms of ecosystems to be intensified instead of directly subsidizing production with inputs. This means, depending on the case, eliminating or reducing plowing and harrowing and thus optimizing soil functioning; use cover plants and thus favor the development of earthworms and fix carbon; practice improved fallow to maximize the period of photosynthesis, biomass production and biological nitrogen fixation or even practice the biological fight against pests and diseases and conserve biodiversity [2].

This model does not exclude the use of fertilizers or pesticides or Genetically Modified Organisms (GMOs), but these are practiced in a much more rational way, only in addition to the best agro-ecological practices in order to guarantee gains in environmental quality without compromising profit.

Correspondence to: Joao Biche Danune, Department of Agriculture, University of Beire Interior, Covilha, Portugal; E-mail: jdanune@gmail.com

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An ecologically intensive agriculture with a high environmental value implies a management of agricultural techniques and spatial organization much more complex than those used today, applying to the most different levels of agro-ecosystem management from the stand to the hydrographic basin.

Thus, this form of agriculture is intensive not only in terms of ecological features, but it also requires a strong intensification of knowledge and a holistic view, in addition to an integrated management of the different users of ecosystems. There is, in doubt, a great and necessary evolution.

DISCUSSION

In addition to urgency, investing in food

Global agronomic research must face the challenge of sustainable food. The current food crisis is shocking and shakes the collective scales of priorities. It is necessary to undertake urgent international solidarity actions for the present, as well as for the future, to face the challenge of sustainable food. This crisis poses the immediate problem of access to food for the poorest, without a global deficit in food quality. However, in 2050 the food supply could be insufficient if we do not have an agricultural production capacity to feed 9 billion people [3].

INRA's projections for 2020 show that world agriculture can satisfy this food demand, but also reasonable energy needs, with an increase in income. Equivalent for the last 20 years and an increase in the cultivated area between 5% and 10%. This is within our reach, if these three conditions are met: To continue and re-launch material and intellectual investment in all continents, to encourage the adoption of ecologically sustainable practices and to disseminate innovations and the experience gained.

In 2050, agriculture will be of a different kind and intensive in another way. It will be rich in biological, technical and economic knowledge and expertise; adapt the potential of each medium and mobilize the practices of local actors. In this way, it will be plural and agronomic research will have to prepare a whole range of solutions [4].

It will be necessary to resort to all disciplines, both molecular biology and ecology, at all scales, from gene to plant, from plant to field.

But this mobilization and these investments require the deterrence of economic speculations about food, the prevention of health damage, a guarantee of protection in case of destructive effects related to climate change and to promote the management of natural resources. These elements depend on public policies for stabilization and regulation.

Agricultural biotechnology: Challenges and solutions

Biodiversity and agriculture: "Agriculture must take ownership of biodiversity" to respond to the demographic and environmental challenges of this 21st century and to be involved in sustainable development, you must be able to increase yields and cultivated areas, while preserving and favoring biodiversity and adapting to climate change. For this reason, agriculture must re-appropriate biodiversity, favor it and value it in all its forms: Diversity of plants and domestic animals, diversity of production and landscapes, diversity of living beings in the mediums and semi-spaces natural.

This is a new challenge for research, which should contribute to taking action in an uncertain world, even though a large part of the functioning of agro-ecosystems has not yet been discovered, the usefulness and fragility of biodiversity propel action [5].

Research must be mobilized in an interactive and structured way. The collective scientific evaluation carried out by the European agricultural research institutes, shows the possible ways for a new dynamic of the relations between agriculture and natural biodiversity, highlighting, for example, the role of semi-natural species and the landscape mosaic in preservation and the potential for restoring biodiversity. In addition, it leads to the development of a spatial organization of agriculture that favors biodiversity and makes it possible to value its benefits, together with actors for the relevant time scale.

Research, agriculture and biodiversity are three themes on which the European Union (EU) has defined political guidelines and on which our fellow citizens have high expectations. A collective will to stimulate research on agriculture and biodiversity at European level is imperative.

Crop resources

Grassland or crop plants: The specific plant richness increases the use of Nitrogen (N), particularly under the effect of legumes.

Soil macrofauna: In the presence of several functional groups (earth, isotopes, chilipodis) the number of species does not influence the decomposition. It is the increase in functional diversity that increases function. Role of functional diversity in maintaining fertility, but relevant effects only if less intensive/ organic fertilization.

Entrance services

Biotic regulation: The decay of wild bees decreases with the distance of plants to pollinate in semi-natural meadows, pollinator reservoirs. The increase in abundance and the diversity of pollinators in the vicinity of the prairies allows to increase the percentage of flowers that bear fruit.

The bioeconomy proposes the replacement of materials and energy of petrochemical origin with their equivalents derived from renewable biomass, whether dedicated crops (hemp, sorghum, intermediate crops for energy) or bio-waste (agricultural waste, food industry waste, urban waste, water residuals) [6]. This great transition is not a simple change of resources, but it does require taking into account, from production to consumption, the ideal use and transformation of these various raw materials and their co-products. Faced with these challenges, INRAE identified four questions that will structure this future work: How to produce and mobilize more biomass under climate restrictions while preserving ecosystems and resources? How to optimize the transformation of biomass in all its diversity? How to guarantee the recycling of materials to complete the biological cycles of carbon, nitrogen and phosphorus? How to anticipate, organize and manage flows, exchanges and markets in a context of uncertainty? To answer these questions, it will be necessary to develop massive data acquisition and processing in order to propose optimal solutions adapted to different scales. Food is at the heart of our health.

- How to guarantee food security for people from local to global?
- What is the impact of our food consumption and behavior on our health and the environment?
- What are the links between ways of producing, the characteristics of food and our health?
- What are the action levers for healthy and sustainable food accessible to all?

Agroecology: For multi-performance agricultural systems, agroecology is the implementation of principles of ecology in agricultural systems to optimize interactions between plants, animals, humans and the environment to lead to sustainable and equitable agri-food systems. Our research aims to: Preserve cultivated environments, reduce the use of synthetic inputs (pesticides, antibiotics, fertilizers) thanks to biological regulations, diversify agricultural production at all scales, from the field to the dish [7].

Ensuring association in crop improvement

The increase in availability of high-throughput genotyping technologies together with advances in DNA sequencing and the development of appropriate statistical methodology for mapping varieties of association across the genome in the presence of considerable population structure contributed to the increase in association mapping of interests in plants. Although the majority of studies published on plantation species are based on conductive genes, genome studies are increasing. New types of populations providing greater resolution and power to detect effects of modest size and for the analysis of spontaneous interactions have been developed. Classical bi-parental mapping remains the method of choice for mapping the effects of rare alleles on the germplasm collection, with some disease resistance genes or intoxicated alleles of existing germplasm [8].

Plant breading: The application of genetic principles to produce plants more useful to man. This is achieved by selecting plants considered economically or actually desirable, first controlling the mating of selected individuals and then selecting certain individuals among the progeny. These processes, repeated over many generations, can change the hereditary composition and the value of a plant population far beyond the natural limits of existing populations. That is why the application of genetic principles to plant breeding is emphasized [9].

Final notes: There are important experts who advocate that you can increase production without necessarily having to increase areas. According to this illustrious professor of agrarian economics and natural resources, it is necessary to finish acabar com o uso ineficiente de inputs [10].

CONCLUSION

The fertilizer cost brutally. Effectiveness in the use of fertilizers → food has fallen a lot (chemical-mechanical model) → greater use of saturation decrease → high energy cost → dumped in the water/fertilizer cycle → where they will cause various damages.

To produce per hectare → without increasing inputs per hectare reducing inputs per hectare → implies: Use the inputs in a much more efficient way → better GIS (Geographic Information Systems) and remote sensing → put the fertilizer and the drop of water, at the moment when it is most needed.(Example-precision agriculture/drip irrigation. Return to doing what we undid, that is, we managed to close the nature factory and open the fertilizer factory. What you need to do: Get Nature's machine back up and running again. How do ecosystems work? It requires two things: Knowledge and healthy ecosystems → protection of the latest ecosystem services.

In turn, the increase in the price of energy → increase in all intermediate energycosts → Result: Decrease in the application of oil, application of fertilizers. What is the problem of intensifying the ecological base: Research → basic ecological knowledge has a very small part. It means that in practice, the knowledge we need is not easily valued by the market (market incentives). Finally: many of the problems of the previous model are priceless → Changing behavior requires changing policies → changing diets. The necessary knowledge is: Technological (GIS, Remote Sensing), ecological knowledge, politics, economics, social sciences. Type of research: the intention is to understand the current "drivers" in production systems → how farmers move in a cork oak or hill → about local systems and products → methodologies for measuring the values of ecosystem services in agriculture and in the forest.

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