

AGRONIX, Web application for fertilization planning

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Introduction

The increasingly evident negative effects of human action on the nature require that political system guide its choices in favour of biodiversity and of eco-sustainable agricultural practices in order to avoid natural disruptions (visible to all), without giving up the quality of life gained so far and using scientific knowledge and technology to reduce impacts of human activity on the environment.

For decades the European Union (EU) puts its emphasis on the use of natural resources by reducing waste, by promoting an eco-sustainable development, by imposing constraints through directives on the appropriate use of dangerous chemicals in order to prevent contamination of soil, aquifers and to reduce air pollution, by emphasizing reuse through the recycling of materials, wherever possible, to limit the depletion of raw materials and promoting all aspects and practices that can contribute to the preservation of nature and biodiversity.

To force the adaptation to an eco-sustainable agriculture, the UE has linked the payment per farm to conditions (known as ‘cross-compliance’) that guide towards the adoption of a set of agricultural techniques and good agricultural practices (appropriate use of pesticides and fertilizers) for wildlife protection, for maintenance of the land in good agronomic and ecological condition; for a proper use of livestock manure that can cause nitrate pollution of aquifers in particularly vulnerable areas.

To meet the constraints of cross-compliance imposed by the EU, the Italian regions are trying to supply to farms and to technicians software tools useful for monitoring land and for application of the imposed rules. For fruit and vegetable farms, each region is providing software that can schedule the contributions of fertilizers according to the real needs of the crop and taking into account the scientific knowledge on plant physiology so as fertilizers will be applied at the just time in which should be available for plants avoiding unnecessary losses to leaching or excessive salinization of agricultural land.

AGRONIX born as support tool for an optimized planning of the chemical and natural elements and stretched out to a balanced vegetative and productive growth to ensure quality production of agricultural crops. It is a multilingual software on-line for the preparation of programs specific for crop fertilization and pedo-climatic characteristics of the farm land. Because of its inherent characteristics may be used in any agricultural area of the planet.

AGRONIX is a product of ADM srl that boasts extensive experience in the field of fertilization and irrigation. There are numerous collaborations with research institutions and universities that contribute to the already considerable scientific, technical and practical know-how of ADM acquired in over 22 years of research and software and services development for agriculture.

System functionality

More than twenty years experience in using the homonymous stand-alone software and adopted by hundreds of technicians and farms across Italy, AGRONIX, differently from the previous version, refines its calculations by using functions capable to model more closely the rates of absorption of nutrients and more integrate the multiple factors that influence the production.

Every crop manifests different productive responses not only for the soil nutrient availability but also for particular pedological and climatic conditions (microclimate) of the area where the crop is cultivated. In

addition the particularities of the agricultural practices adopted that may positively or negatively affect the general welfare of the plant.

AGRONIX has the aims to collect as much information as possible. The farm land is logically divided (mapped) in the plots and their in homogeneous production units (HPU).

Data of plots are used to provide information on farm's lands uniform for soil characteristics (presence of skeleton, structure, depth of soil, etc. ..) and for physiography (morphology, exposure, etc ...).

The HPU is the part of the plot that is uniform for physical, chemical and biological characteristics, crop, variety (rootstock) and production technique. The distinction in homogeneous production units can assess the best responses of the crop production depending on the characteristics of the land itself and of cultural practices applied by the farmer.



The part in yellow and blue of the photo represent the same plot homogeneous in terms of physiography and pedology (same type of soil, same exposure, etc. ..) but consists of two different production units: the yellow one consist of Chardonnay on 420A rootstock and the blue one of Chardonnay on 1103 P rootstock. Assumed that both units have a land with the same chemical and physical characteristics and that they are processed with the same cultivation operations (mechanical tillage, trellis systems etc ...), the vegetative and productive response will be different because different are the rootstocks (slightly vigorous rootstocks of the first unit and vigorous of the second one) grafted on the same variety. So the collection of detailed information per unit becomes crucial for the system to generate the proper fertilization advice respectful of the needs of the crop.

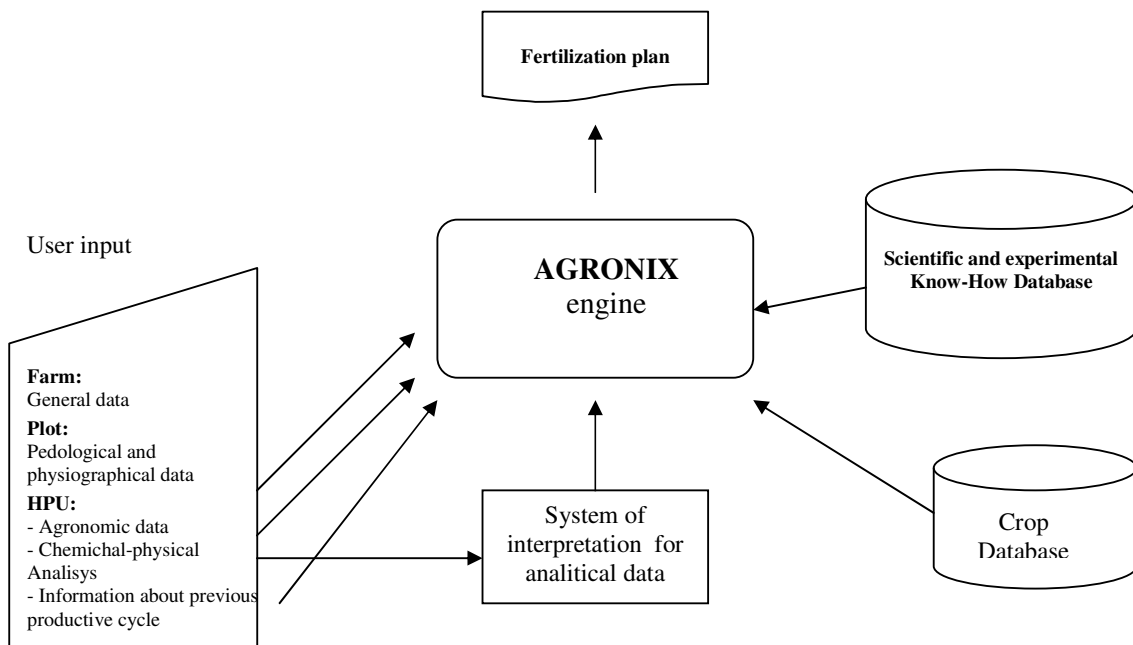
The required information are shown briefly as follows:

Plot	Homogeneous Productive Unit (HPU)
Orography (hill, plane, altopiano etc..)	Geografic coordinate
Soil position	If irrigated: irrigation system
Soil exposure	Crop
Distance from sea	Variety
Frangivento	Rootstock
Origin of secondary layer	Vigor
Drainage	Productive cycle
Structure	Mulching/Cover crop system
Hydraulic accomodation	Plant density
Extraordinary operation	Extimated production
Depth of the soil and of tillage	Subject to EC regulation
Water provision	Physico-chemical properties (sand, lime...)
Water class	Soil structure (pH, conducibility, Organic matter, Total lime...)
Belonging to nitrate vulnerable area	Cation Exchange Capacity and Cation Balance (Ca ⁺⁺ , K ⁺ ,

	Mg ⁺⁺
	Major elements content (N, P ₂ O ₅ , K ₂ O...)
	Meso and micro elements content (Fe, B, Mn....)
	Information about previous productive cycle (Crop, obtained production, estimated production advised previous year...)
	Fertilizers really distributed (N, P ₂ O ₅ , K ₂ O, S.O., Mg, Fe)
	Vegetative growth observed previous year
	Productivity observed previous year
	Quality of production observed previous year

The fertilization advice is influenced also by the knowledge of growing, production and quality trends of previous years that enriching the knowledge base of the system, allows the detection of anomalies that does not necessarily depending on nutritional imbalances, but on the use of inappropriate agricultural practices, diseases arising, unpredictable factors or local connotation.

From knowledge comes new knowledge able to relate more specific factors and likely to generate a system of recommendations appropriate to the particular production.



The result is a fertilization plan perfect in terms of quality and production needs as well as the optimization of resources. It is provided to the user in **pdf** or in **odt (open office extension)** format related to the single homogeneous production unit. The fertilization plan is a detailed document that includes:

- Summary data for the homogeneous production unit (HPU)
- Physical-chemical soil data and agronomic interpretation of results
- Fertilization plan with nutrients distribution splitted up in different periods of intervention
- Recommendations on how to distribute the fertilizers
- Recommendations on types of fertilizers to use
- Maximum contributions permitted by law (based on European directives or production disciplinary) if the production is subject to constraints.

AGRONIX is usable by all those involved in the planning of production and that are able to collect data on productive and qualitative outcomes obtained as a result of such programming (farmers, technicians, agronomists, etc. ...). The production and quality outcomes as well as the indication of the given fertilizers provide the information more interesting for the generation of new knowledge in the system that will take into account in subsequent planning. Everyone can contribute to the creation of new knowledge: more the data are reliable even more such data will contribute to the identification of specific events related to the territory and the local microclimate.

Besides this, **AGRONIX** determines, in accordance with Community, national and regional laws (Nitrates Directive, rules of good agricultural practice, disciplinary of production) and only if it required by the user, what are the limits of contributions of some elements. In this way the user will know what the real needs are for his production in terms of nutritional needs and at the same time what are the production constraints imposed by current regulations.

AGRONIX will be free available on Internet after registration. It will be enough to fill a form: an email confirmation will be sent to the applicant that can immediately access to the service.

Conclusions

AGRONIX on-line originated as a support tool for crop fertilization but will not stop to this. New services are already implementing to offer further assistance to farms.

As fertilization software will continue to receive further enrichment due to the volume of data that users provide and that will create the conditions for the use of neural networks capable of identifying more specific items in local areas (farm level) and anomalies not readily mouldable.

Closely related to the fertilization will be the agri-irrigation plan, which, supported by private or public agro-climatic monitoring, will allow irrigation techniques suitable for an optimized use of water resources up to enable controlled deficit irrigation management or partial root drying techniques.

Information on cultivation techniques, fertilization and the pesticide treatments will be collected by a special register (a request) to be used not only for regulatory purposes (Community) but also to document the traceability of agricultural products.

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