PRP SOL

ACTIVATEUR DES FONCTIONS VITALES DU SOL

PRP TECHNOLOGIES

C'est parce que la terre est vivante qu'elle est source de vie.

LE SOL, SOCLE DE L'AGRICULTURE DURABLE

La vocation première de l'agriculture est d'utiliser le sol pour produire en quantité suffisante des denrées destinées aux populations de chaque pays.

Aujourd'hui, les enjeux se compliquent. Il faut nourrir une population en pleine expansion sur des territoires qui ne sont pas extensibles à l'infini. Les consommateurs exigent des produits de qualité. De plus, les agriculteurs doivent inscrire leurs pratiques dans le respect des ressources naturelles, l'eau, l'air et la terre, en tenant compte d'un contexte climatique en changement. On parle alors d'une gestion durable de l'agriculture pour un développement durable de l'humanité.

Pour cela, il est indispensable de reprendre les fondements agronomiques qui régissent les écosystèmes, et d'admettre que la fonction du sol n'est pas seulement d'être un support pour la culture.

Les multiples fonctions du sol :

- Nourrir les plantes
- Produire des aliments (pour l'homme et l'animal)
- Produire de la biomasse (pour l'énergie et les biomatériaux)
- Filtrer et stocker l'eau dans les aquifères
- Séquestrer le carbone et l'azote
- Entretenir la biodiversité

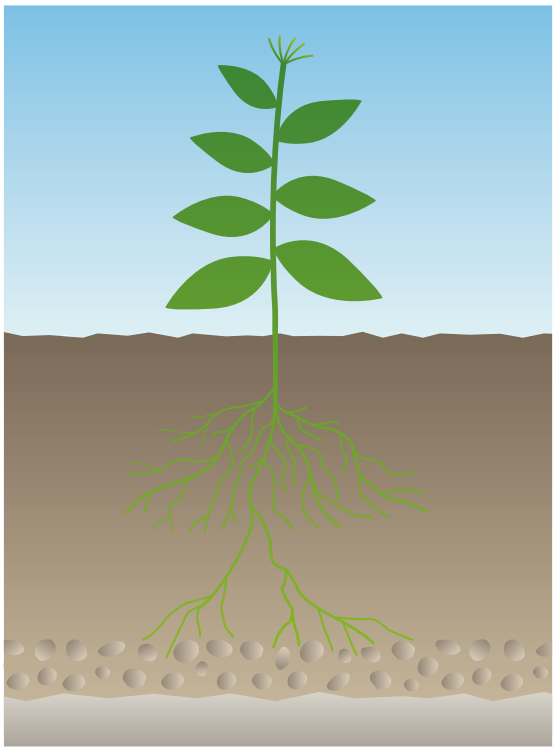


Schéma d'une coupe de sol

SOIL FORMATION AND DEGRADATION

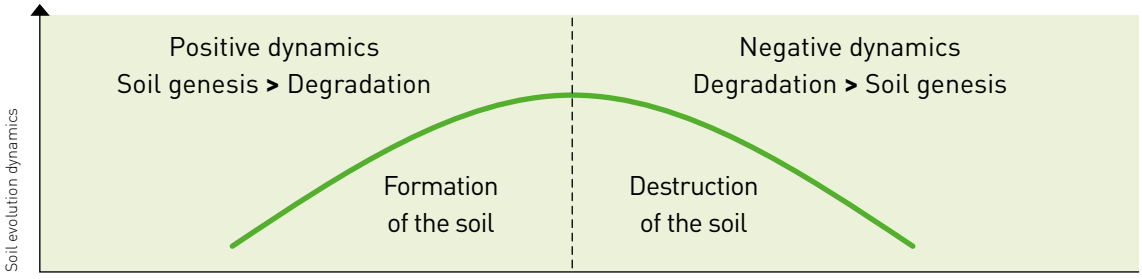
The soil is a complex product, created firstly through alterations in the parent rock under the effect of climate, water, roots and micro-organisms and secondly, through the degradation of organic compounds falling on its surface.

Parent rock
↓
Sands
↓
Silts
↓
Clays
↓

Dead plant material
Animal manure and animal carcasses
↓
Transient organic products
↓
Humus
↓

Formation of the clay-humus complex
↓
Soil genesis

The average soil formation rate in Europe is approximately 1 tonne per hectare and per year.
Grower practices (choice of crops, fertilisation, soil cultivation, irrigation, treatments, etc.) determine the positive or negative dynamics of soil evolution.



The degradations below feature among symptoms revealing dysfunctions:

PHYSICAL	CHEMICAL	BIOLOGICAL
Erosion	Acidification	Reduced humus levels
Soil compaction	Mineral lock-out	Decrease in biological activity
Asphyxia	Leaching	Collapse of biodiversity

IMPORTANCE OF BIOLOGICAL ACTIVITY

Biological activity is the root of soil formation, but it also is necessary for it to function properly and makes it fertile. The flora, fauna and microflora are the key players.

Flora:

CROPS, PASTURES, PLANT COVER
• Protection of the surface against erosion, UV radiation, etc. • Soil cracking by the root system • Supply of fresh organic matter for the entire soil ecosystem • Symbiotic association with the microflora in the rhizosphere.

Fauna:

MACROFAUNA	MESOFAUNA	MICROFAUNA
Earthworms, wood lice, myriapods, ants, insects and larvae.	White worms (Enchytraeids), springtails, mites.	Protozoa, nematodes.
All these species cut, mix and process the organic matter, thus opening the way for fungi and bacteria. Their activity also mixes organic compounds with minerals and structures the soil.		

Microflora:

BACTERIA	FUNGI
They are essential for the organic matter, carbon, nitrogen and phosphorous cycles to function. They help make minerals soluble.	They degrade the decaying organic matter and help form the humus. Mycorrhizae play a major role in feeding the plant.

The extent of the biomass in a soil depends on systems adopted by the grower.
Its abundance, diversity and activity are an indicator of soil quality.

MINERAL INDUCTION BY PRP TECHNOLOGIES

The humusphere is the soil ecosystem as a whole in all its complexity. It is constantly producing an infinite quantity of biochemical reactions, which are conditioned by the fauna and flora, the minerals and the circulation of air and water.

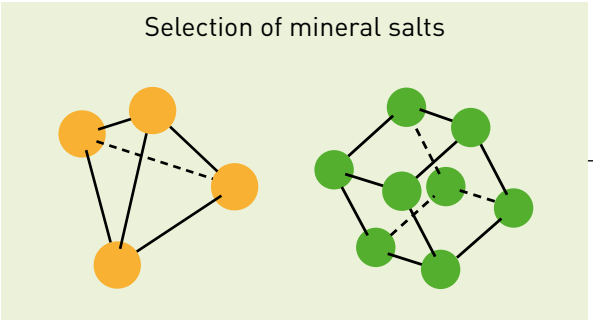
Managing it correctly involves the key players in its functioning, in other words the micro-organisms.

Cultivating the soil, compacting by machinery weighing several tonnes, crop protection products and fertilisers used by growers to boost their production are not without consequence for all this living world.

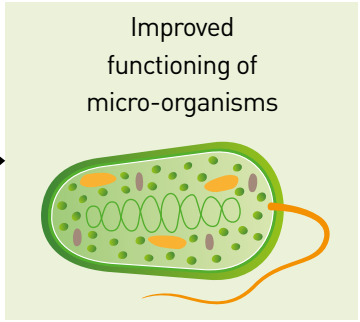
To offset the impact of production factors, PRP Technologies has developped an original method to revitalise the biological processes essential to sustainable agricultural production.

MIP -Mineral Inducer Process:

MIP is based on activating cell metabolisms through the controlled addition of specific mineral salts.



Sample mineral crystalline structures



Bacterium diagram

PRP Technologies selects and proportions these mineral elements rigorously based on their redox levels and ratios adapted specifically to the stated objectives.
MIP gently stimulates the functioning of the humusphere by pinpointing the soil's native microflora most suited to its land.
This action induces a set of reactions favourable to the development of the soil and crops, thereby offsetting the impact of degrading factors triggered by the intensification of agricultural practices.

PRP SOL - ACTIVATES VITAL SOIL FUNCTIONS

PRP SOL is a pellet containing the technological MIP additives.

Incorporated into a matrix of calcium and magnesium carbonates via a natural binder, the PRP ingredients dissolve after application and are dispersed in the soil solution.

The activation of the biological processes can then commence.

The increased biological diversity and the activity of native micro-organisms improve:

- fauna activity
- organic matter processing cycles
- geochemical cycles (carbon, nitrogen, phosphorous, etc.)
- the physical structure of the soil
- plant development

PRP SOL improves all the vital functions of the soil by acting on the biological fraction.

The intensification of the natural functioning of the soil/plant ecosystem without loss of balance provides the grower with a basis for a productive and sustainable agriculture.

A patented process

PRP SOL and its mode of action are patent-protected. This underlines the originality of the product, especially its impact on enzymatic activities and the diversity of the soil microflora.

LABORATORY RESULTS

New scientific techniques produce advances in the knowledge of soil microbial communities that are still widely ignored.

The BIOEMCO Mixed Research Unit (Biogeochemistry and ecology of continental environments) studies the dynamics of agrosystems, especially the biodiversity and functioning of soils. Its aim is to encourage innovation in environmental management and ecological engineering.

Its sub-unit IBIOS (Biological interactions in soils) at the Université Paris Est* has studied in vitro the effect of PRP SOL on the soil's biological components.

These investigations, using the most recent enzymology and molecular biology techniques (such as DNA extraction, amplification and observation on electrophoresis gel), represent a ground-breaking approach towards studying the impact of inputs on the soil ecosystem.

This work has highlighted several results:

- PRP SOL modifies microbial communities in the soil, thereby prompting better balance between different populations;

- PRP SOL interacts with the various organisms present (earthworms, roots) as a catalyst of biological soil activities;

- PRP SOL magnifies the enzymatic diversity and the activity of a certain number of specific enzymes (two to ten times more active depending on circumstances);

- PRP SOL duplicates the plant biomass in laboratory conditions.

* UMR Bioemco unites teams of researchers from INRA, CNRS, the Universités Pierre et Marie Curie and Paris Est, the Ecole Nationale Supérieure, IRD and AgroParisTech. It has five sub-units.

RESULTS IN THE FIELD

The effects of PRP SOL on the functioning of microbial communities in the soil and on the diversification of the profile of enzymatic activities affect all the biological, physical and chemical parameters of the ecosystem.

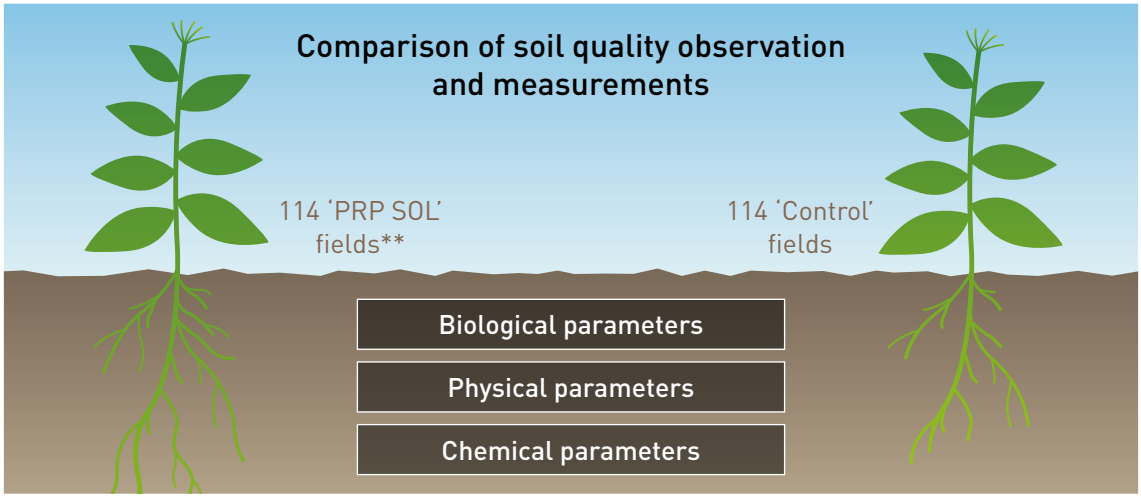
The **SQUAD (Soil Quality Database)** study measures changes in these parameters in the field, in actual production situations.

This study is based on observations and analysis by experts and independent laboratories* of 672 soil profiles, taking into account the diversity of textures (sands, silts and clays).

This database now includes 114 sites which have been sampled and analysed statistically.

Half these samples have been produced from sampling 114 fields treated with PRP SOL and the other half from sampling the 114 control fields.

All 114 pairs contain identical cropping plans, soil cultivation, organic matter management and soil texture and depth.



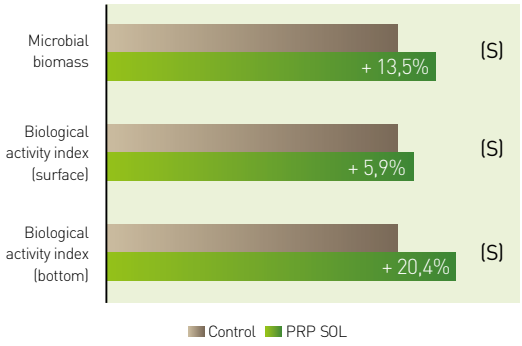
* Technical and scientific service providers involved in the SQUAD study:
ISARA (Rhône-Alpes Higher Agriculture Institute), CESAR (Regional Agricultural Scientific Centre), CELESTA-LAB (formerly ALMA TERRA), LAMS (Microbiological Soil Analysis Laboratory), BIORIZE, AISNE DEPARTMENTAL ANALYSIS AND RESEARCH LABORATORY.

** PRP SOL was applied on average for 5.6 years at the time of observations.
The average calculated rate in the samples is 228 kg PRP SOL/ha/year.

PRP SOL EFFECTS

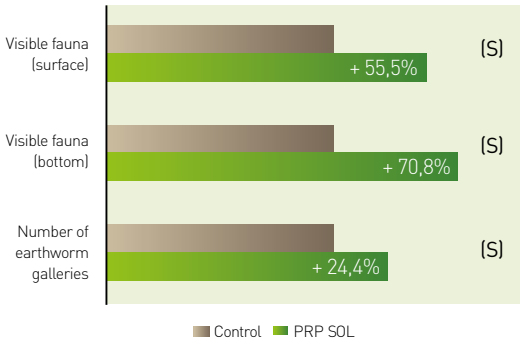
The results presented below are taken from the SQUAD study.
Other work in Europe on the same topic - at the University of Poznan in Poland, for example - confirms these observations.

Microbial flora



The PRP SOL effect on microbial communities measured in the laboratory is confirmed in applications out in the field. Through more extensive biomass and more sustained activity, the micro-organisms impact the food chain in the soil as well as the mineral element cycles.

Fauna

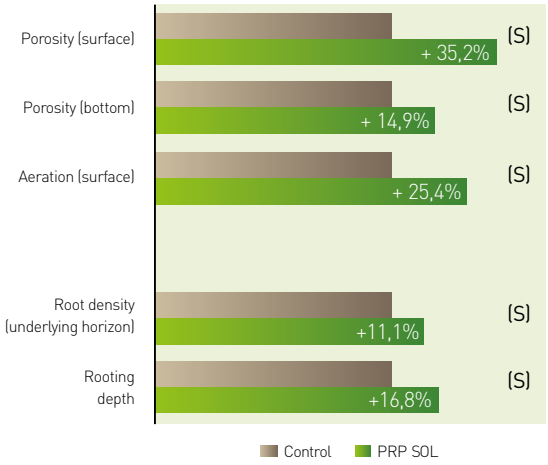


Larger quantities of fauna and more intense earthworm activity in the soils indicate higher biological quality. This fauna acts directly on the conversion of organic matter and its mixing with the mineral fraction of the soil, whilst also promoting the structure.

(S) = statistically significant difference ($p < 0.05$)

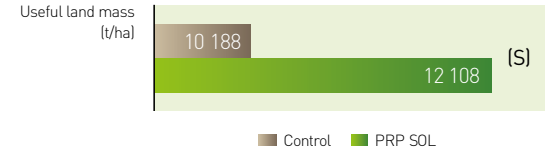
PRP SOL EFFECTS

Soil structure and plant development



Soil porosity is an essential criterion as it allows water and gases to circulate freely. The presence of oxygen is essential, not just for the humification of organic matter but also, more generally, for all the aerobic metabolisms and for root development.

Useful land mass for crops

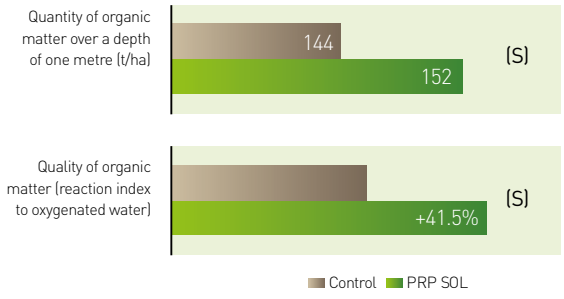


The volume of earth accessible to the plant increases considerably by reducing compaction areas and extending the root hair. The plant therefore has better access to organic, mineral and hydric resources.

(S) = statistically significant difference ($p < 0.05$)

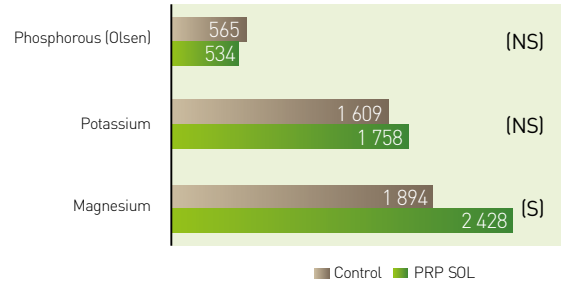
PRP SOL EFFECTS

Organic status



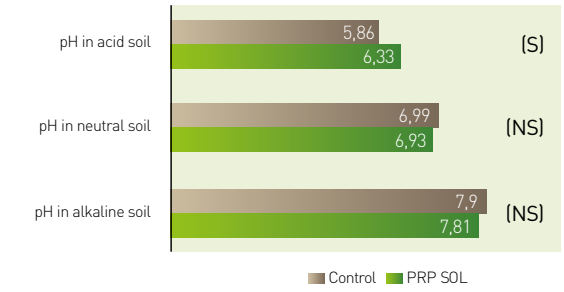
The organic quality of the environment in which the roots develop benefits the plant. The organic matter acts like a sponge for water. It also helps the crop resist hydric stress better as well as providing a source of minerals protected from leaching.

Quantities of mineral elements (kg/ha) in the useful soil volume



The microflora maintains the geochemical cycles and the bioavailability of mineral elements. The aim is not to overload the soil solution, with a risk of exposing the minerals to being carried towards the water tables, but to create sufficient flow to support the needs of the vegetation.

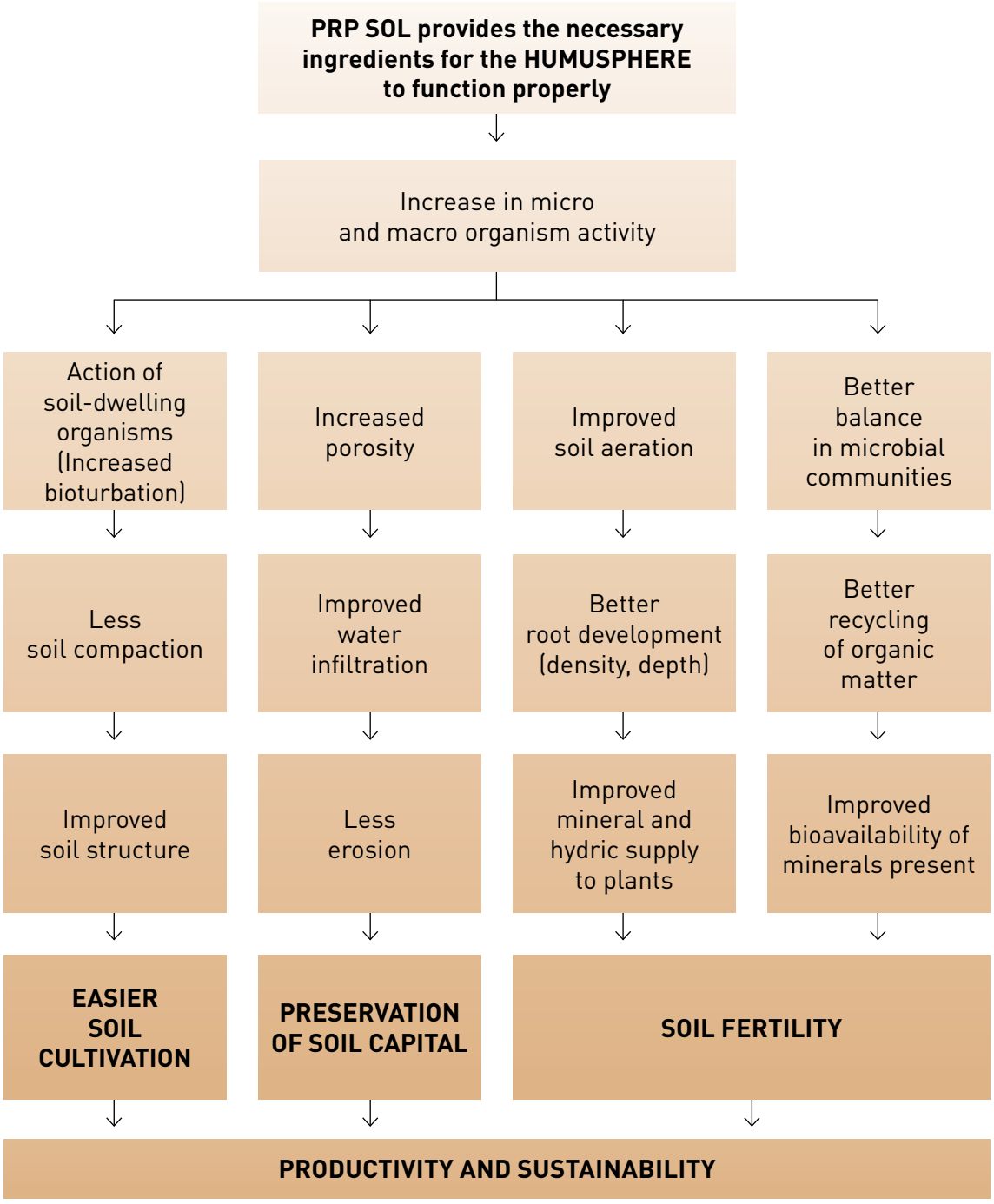
Acid-alkaline status



The biological activity developed by PRP SOL buffers the acid-alkaline status, tending to be neutral regardless of soil type.
A significant pH difference is noted in acid soil.

(S) = statistically significant difference ($p < 0.05$)
(NS) = statistically non significant difference

GLOBAL ACTION



BENEFITS

More economic agriculture

Sustainable agriculture must be more efficient in promoting inputs with respect to the tonne of plant material produced.
PRP SOL helps develop more economic agriculture by activating the vital functions of the soil:

• WATER

The work by the Provincial Centre for Legume Crops at Kruishoutem (PCG - Belgium) has revealed the effect of PRP SOL on improving water infiltration in the soil. The infiltrating water reconstitutes the reserves used by the plant during dry periods.
In addition, the increased root development allows the plant to search further afield for these water reserves. The grower can thus reduce the amount of water used for irrigation.

• FERTILISER

A greater useful land volume and more efficient biological cycles provide better recycling and increased bioavailability of mineral elements.
Using PRP SOL means optimum fertiliser management - especially of phosphate- and potassium-based fertilisers - which are now only used in exceptional circumstances.

• ENERGY

A large amount of the energy consumed when working the soil comes from the number of times tools are used and the resistance of the soil to the traction.
Cemagref (Agricultural and Environmental Engineering Research Institute) has demonstrated the impact of PRP SOL on reducing traction force. The reduction in compaction phenomena is linked directly to the biological quality of the soil.
PRP SOL is a major asset in moving towards soil cultivation methods that consume less energy.

BENEFITS

Improved production

The first goal of agriculture is to feed the populations. Demographic prospects involve maintaining or developing high production levels in the future. PRP SOL is part of this approach.
The work by technical bodies demonstrates that cropping programmes including the use of PRP SOL produce higher and more regular yields. The improved functioning of soils softens the effects of climatic hazards on production and the alterations linked to growing practices.
Respecting natural functioning mechanisms in the soil/plant system encourages a balanced supply of crops and pastures. One effect is the improvement in the nutritive quality of fodder consumed by livestock.

Preservation of the soil capital and the environment

The soil - a slowly-renewable resource - must be preserved if agriculture is to be sustainable. Erosion is the first degradation factor in Europe, affecting nearly 20% of surfaces.
The Laboratoire Central des Ponts et Chaussées (Central Bridges and Roads Laboratory) is developing a device to measure the sensitivity of soils to the erosive processes, by using a measuring instrument in situ - the mobile jet erosion meter.
This laboratory has highlighted the effect of PRP SOL on resistance to erosion. The data recorded show a significant drop in amounts of eroded land of between 20% and 50% depending on circumstances.
In terms of greenhouse gases, the increased amount of organic matter in the soil from the PRP SOL action helps store the carbon.

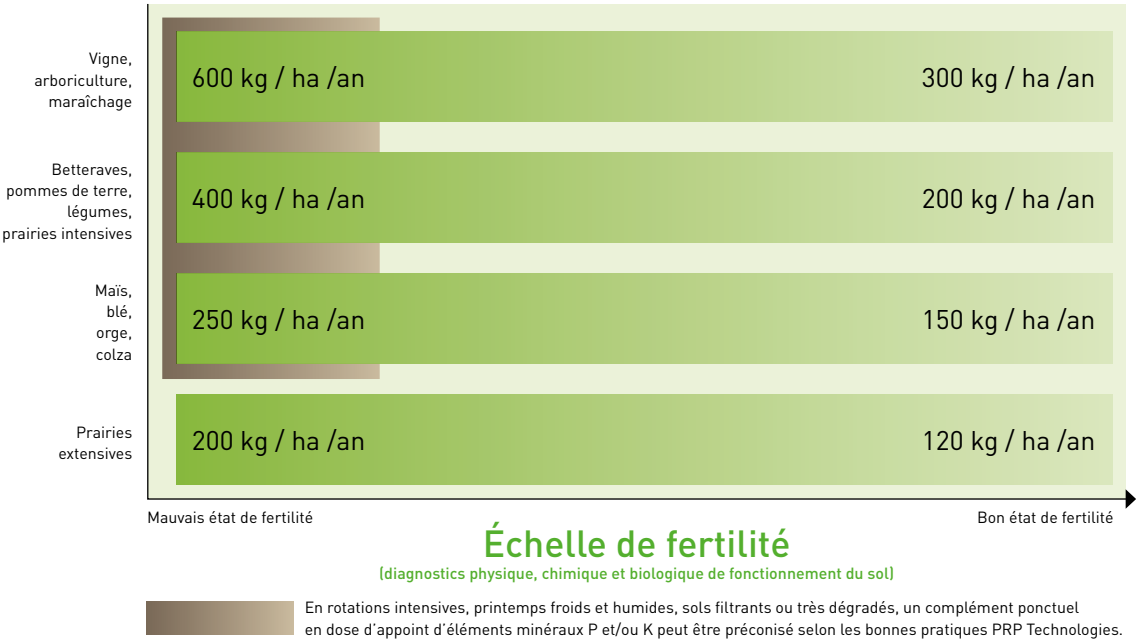
Enriching the land

The geological characteristics of a field and its climatic environment play a fundamental role in plant development and physico-chemical composition. The crop enriches its land the deeper it sends its roots and the more the grower or wine producer respects the natural biochemical balances. PRP SOL restores these balances by gently acting on the native microflora in the soil and encouraging the plant to develop its root system.

L'UTILISATION DE PRP SOL

PRP SOL s'utilise sur tous types de sols et de cultures.
Les quantités à épandre varient selon l'état de fonctionnement du sol et selon les contraintes appliquées sur le terrain lors des cycles culturaux.
Intensification de la rotation, compaction, irrigation, traitements, qualité du système racinaire, volume de résidus de récolte sont quelques uns des critères qui caractérisent l'impact de la conduite de la culture sur le sol.
Les différentes cultures sont ainsi réparties sur une « échelle d'impact ».

Échelle d'impact



Comme la plupart des organismes vivants, la microflore du sol réagit aux conditions de milieu, c'est à dire la température et l'humidité.
La présence d'humidité dans le sol et l'augmentation de la température, de la sortie de l'hiver jusqu'à l'automne, stimulent directement l'activité de cette microflore.
L'ensemble de cette période est donc propice à l'utilisation de PRP SOL.

FICHE TECHNIQUE

PRP SOL est un granulé constitué d'une matrice de carbonates de calcium et de magnésium et des adjuvants technologiques du procédé MIP (fer, zinc, bore, sodium, manganèse...).
L'ensemble est aggloméré par un liant soluble d'origine végétal : le lignosulfonate.

L'utilisation des carbonates de calcium et de magnésium inscrivent PRP SOL dans la classe réglementaire des amendements minéraux basiques (norme NFU 44-001 classe II).

Éléments analytiques déclarés :

Oxyde de calcium (CaO) sous forme de carbonates	35%
Oxyde de magnésium (CaO) sous forme de carbonates	8%
Sodium (Na2O)	5%
Valeur neutralisante	46
Solubilité carbonique	50
pH	7.7
Densité apparente	1.19

Conditionnement :

Sac de 50 kg (palette 24 sacs) – Big bag 600 kg / 1 200 kg – Vrac en camion complet.
PRP SOL est admis en agriculture biologique selon la liste des intrants du FIBL. PRP EBV est également conforme au règlement américain NOP (National Organic Programme).

Les qualités physiques de PRP SOL

Les process de granulation et de séchage mis en oeuvre lors de la fabrication de PRP SOL sont des spécificités PRP Technologies, reconnues par deux brevets européens.
Les qualités physiques du produit répondent aux spécifications des constructeurs de distributeurs d'engrais pour un épandage régulier jusqu'à 36 mètres.

97% des granulés ont un diamètre compris entre 2.5 et 4 mm (diamètre moyen : 3.47 mm).

Diamètre des granulés	> à 4 mm	de 3.15 à 4 mm	de 2.5 à 3.15 mm	de 2 à 2.5 mm	< à 2 mm
Répartition	0.6%	80.4%	16.5%	2.2%	0.3%

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