Bien nourrir les plantes
pour mieux nourrir les hommes

To Puteaux (France), November 21th, 2014,

UNIFA's comments concerning the draft 6th Recommendation of Priority Substances to be included in Annex XIV of the REACH Regulation

Summary:
The BORON, absorbed by plants in the form of borate, is essential to vegetables. It plays a role in the meristematic growth, the migration of carbohydrates, synthesis of nucleic acids and proteins.
The boron deficiency is linked to the availability of this nutrient in the soil, that can be influenced by the soil pH and by various other soil and climate conditions. This results in anomalies of the leaves extremities, stalks, fruits and roots.
This deficiency is corrected by precise applications of boron to the soil or in foliar spraying, knowing that an excess of boron can have an adverse effect on vegetables.

The boron is a nutrient, which plays a specific role in the metabolism of the cellular multiplication. The boron is substitutable by no other chemical element. **The industry of the fertilization did not find alternative to boron substances listed in the draft 6th recommendation.**

An absence of borated fertilization would engender in the short term in France more than 800 million euros per year of yield loss, including the quality of the crops, knowing that certain crops like sugar beet, sunflower and rape are more sensitive to boron deficiency than others. Furthermore, if this deficiency cannot be corrected because of the absence of borated fertilizer, the issue would remain in the following years with increased concern.
It is important to underline that these crops are grown in all Europe and they are not specific to France. It would also have an impact in term of employment in the whole supply chain of fertilizers, which has already set up the Risk Management Measures (RMM) in the factories and the training courses for the farmers.

Consequently, UNIFA recommend that boron substances listed in the draft 6th recommendation are not included to the annex 14 of REACH regulation and that a Risk Management Option (RMO) is led.

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I. The role of boron in vegetables

The boron [1] is one of 7 essential micro-nutrients for the growth of plants but in small quantities in comparison with the primary nutrients (Nitrogen, Phosphor, Potassium) and secondary nutrients (Calcium, Magnesium, Sodium and Sulphur).

The boron plays a role in the migration and the use of carbohydrates. It contributes to maintain the integrity of the cellular walls, favors the forming of proteins and acts on the cellular reproduction in meristems. Boron deficiency symptoms are well identified on different crops.

The boron is also indispensable in the germination and the fertility of the pollen.

II. How to diagnose a boron deficiency?

It can be based both on:
- The boron requirement of crops, that is well known by experiment (sugar beet, rape, sunflower…), because there are diseases caused by boron deficiency;
- And a soil analysis. This one is going to determine the soluble boron content in the boiling water which characterizes the availability of the boron in the soil.

The application of boron is not systematic; it takes into account these 2 factors.

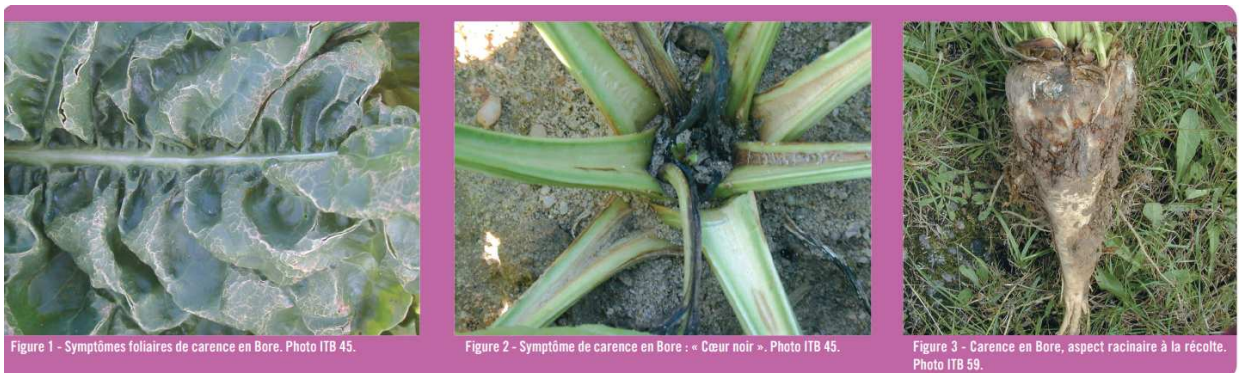
The boron content available in the soil can be too weak when the previous cultures used the boron reserves of the soil and when various factors are unfavorable to the availability of the boron, such as: the pH, the temperature, the soil water status, the biologic activity, the organic matter. In that case, the development of the plant is affected, that can go to the premature death of this one.
The symptoms of a boron deficiency in plants were described in numerous studies.

Here are some examples of demanding boron botanical species: the sugar beet, the rape, the sunflower, the alfalfa, the tomato, the fruit trees, the vineyard …

II.1 The sugar beet [2]

The boron deficiency, or heart rot of sugar beet, occurs especially during dry summers, with a high soil pH or when soil has been recently limed.
In the case of a boron deficiency, the leaves of the sugar beet heart remain small and become yellow then blacken. The old leaves become mat and yellowish and often present small characteristic gray streaks. It sometimes appears as forerunners while the other symptoms are not still visible.
The petiole of the old leaves also show black streaks. These leaves, in serious cases, eventually dry out. The central bud darkens and decomposes. The rot penetrates into the upper root.
Cracks appear around of the root at the level of dark brown necrotic spots.
When the boron content is too weak in the soil or when its absorption at the level of roots is limited by outside conditions (deficiency generalized by the root absorption or blocking of the boron on the clayey elements of the soil), the heart growth of the sugar beet is disrupted in order to form new leaves. When the phenomenon increases, we attend a heart degeneracy of the sugar beet. This one necrosis and develops a typical symptom called "heart rot of beet ".

According to the gravity and the type of soil, the heart rot can imply a loss of return in sugar going to 60 % [2, 3, 4].
Secondary roots rot can develop afterward and damage the conservation of beets in bulk.
The heart rot is an irreversible physiological phenomenon, before the appearance of the first symptoms.
Fungicidal treatments are not an alternative solution because they are not efficient. A foliar application of boron before the lock of lines can limit a few the phenomenon. If the deficiency is visible, an application of boron will not allow finding the level of hoped return.
We must be sure, by an analysis of soil, that the boron is in sufficient quantity in the soil when we make the sowing and that the outside conditions do not limit its absorption by the plant.



Source: Technical Institute on sugar beet (ITB) [3]

II.2 The rape

The association of several symptoms is necessary to conclude in a boron deficiency :
- Thickening of the pivot, and possibly necrotic marrow in the top;
- Regression and disappearance of the terminal buds;
- Very low departure of the ramifications;
- Bushy carriage/bearing;
- Longitudinal cracks on the stalk in active growth in " knocks of razors ";
- Pinching out of the stalk under the flower buds of the main handle and the ramifications;
- Siliques are very few, more or less empty, often in hook.

1

2

Thickened and hollow pivot Blocking of the siliques growth

Source: CETIOM [5]

It is important to estimate the boron availability by means of regular soils analyses in some conditions of risk: sandy soil, soil rich in active limestone (including liming the year of the culture) and situation of aridity.

For the CETIOM, a soil which contains 0,3 - 0,8 ppm of boron is generally well provided except in the clay-limestone soils where a value > 1,2 ppm would be desirable.

The foliar application is to be privileged during the spring while the applications to the soil are possible in the situations of high risks: sandy soils and cold and wet autumn.

II.3 The sunflower

The boron is an essential element for the sunflower: it absorbs more than 400 g/ha among which 80 % between stages " 5 pairs of leaves " and "flower bud". The deficiency exercising before the symptoms show themselves, it is useless to intervene after their appearance because there is no curative action. In the South of France, the frequent warm conditions often perturb the assimilation of the boron and cause the appearance of deficiency with heavy consequences: **until 10 q/ha and a decline of 5 % of the content in oil [6].**

The deficiency expresses himself on the leaves of the third superior of the plant, 10-15 days after a defect of food, by an embossing then a discoloration. The foliar surface, that is essential for the completion of seeds, is then reduced. In serious cases, there is sometimes the cutting of the stalk and the fall of the capitulum, from the stage clear button.

Symptoms on leaves On the stalk
Source : CETIOM [6]

II.4 The alfalfa

The alfalfa is one of the most boron demanding cultures because the availability of the boron has certain effect on the quality and the returns on the alfalfa [7].
The boron deficiency causes a "disease" called **alfalfa yellow**.
The first symptoms are the deformation of the terminal buds, a chlorosis or a yellowing.

Boron deficiency
Source: McGill University [7]

The dose and the frequency of an application depend on precipitation, on the nature of the soil and on its pH. It varies from 1 to 3 kg/ha/year every year, or every 3 years [7].

II.5 The tomato [8]

The young leaflets close to the apex are slightly chlorotic, necrotic and fragile and tend to deform. The growth of plants is slowed down, the internodes of the higher part of the stalk are shorter. One or several terminal buds, also necrotic, eventually die. Symptoms are visible on and in fruits.

II.6 Fruit trees [9]

We classify the fruit sorts according to their answer to the boron deficiency as follows: Apple tree > Pear tree > Peach > Cherry tree
The most typical symptom of the boron deficiency is spots inside and on the fruit for the apple and peach for examples.
The boron is a mattering element to insure the conservation of fruits.

II.7 The vineyard

The symptoms of boron deficiency are observed on leaves before bloom and are characterized by discolored spaces around the limb which can lead to necroses. The symptoms on shoots/branches affect at first the extremity and shoots present a waffle-like texture and many ramifications in zigzag.

Boron deficiency
Source: French institute on vineyard and wine [10]

The consequences of a boron deficiency on vineyard are a bad lignification, fruit or flower displacement and the millerandage (poor fruit set).

A boron deficiency frequently occurs in agriculture, horticulture and forestry if boron is not applied to the soil in very precise concentrations.
In a general way, the recommended doses must not be exceeded because a too strong application of boron can imply a toxicity for plants and reduce their growth.

II.8 Evolution of the soil boron content in France
Every year, a small part of crop lands in France receives boron B (1 439 878 ha, that is approximately 6 % of crop lands according to the study of the French Ministry of agriculture in 2011, See Annex 1).
The database of the INRA [11] contains many results concerning the boron content of the crop lands in France for various periods.

For period **1990-1994**, more than 68 000 results are available, as detailed below (values expressed in mg $B.kg^{-1}$):

Median	1st decile	1st quartile	3rd quartile	9th decile
0,35	0,15	0,21	0,60	1,00

For period **1995-1999**, about 102 000 results are available, as detailed below (values expressed in mg $B.kg^{-1}$):

Median	1st decile	1st quartile	3rd quartile	9th decile
0,33	0,15	0,22	0,51	0,89

For period **2000-2004**, about 92 000 results are available, as detailed below (values expressed in mg $B.kg^{-1}$):

Median	1st decile	1st quartile	3rd quartile	9th decile
0,31	0,13	0,20	0,54	0,95

For period **2005-2009**, about 156 000 results are available, as detailed below (values expressed in mg $B.kg^{-1}$):

Median	1st decile	1st quartile	3rd quartile	9th decile
0,41	0,18	0,26	0,76	1,35

The coverage of France by these analyses is very partial; it is probably influenced by the planted crops (sugar beet, alfalfa, sunflower for examples).
The highest contents are observed in the center and in the South of Paris Bassin, as well as on the clayey soils of the Meuse and the Haute-Marne region.

The maximum boron application on the same plot of land is every three or four years (with the exception of fruit trees) because of the crop rotation on the same plot of land with cereals, which are undemanding in boron and which receive very rarely an application of boron.
The foliar application of boron is about equal to the quantity of boron absorbed by a culture. **The evolution of the median value of the content in boron of the agricultural soils and the value of the 1st**

decile are quasi-constant in time, the INRA database does not show statistically a trend/tendency to an increase of the boron content in soils.

In France in industrial crops, 337 838 ha of sugar beets (French Ministry of Agriculture, 2011) have had an application of boron (that is approximately 86 % of the total area for this crop, See Annex 1) by foliar application in 90-95 % of the cases.
The critical contents of soil boron for the sugar beet would be between 0,40 and 1,00 mg of boron by kg of soil when the pH increases from 6 to 8 [12]. So if the sugar beet was cultivated on the whole territory, 50 to 75 % of the agricultural fields would be below the critical threshold.
The foliar application ranges from 100 to 500 g of B/ha (that is equivalent to 0,01 to 0,05 g of B/m^2) while the soil application ranges from 0,5 to 2kg of B/ha (that is 0,05 in 0,20 g of B/m^2).

The foliar application is less expensive than the soil application and tends to become the most popular. Indeed, the boron applied on leaves is directly absorbed by the plant and the necessary quantities of boron are less compared to a soil application.

In France concerning the field crops, the rape and the sunflower (French Ministry of Agriculture, 2011) represent 754 175 hectares fertilized with boron (that is approximately 30 % of the total surface of these crops, See Annex 1).
An application of 100 to 500 g of B/ha (that is 0,01 to 0,05 g of B/m^2) is the average for foliar application in 95 % of the cases.

The concentration of the boron in the foliar fertilizers is very variable.
Products are then prepared by dilution in a volume of water from 200 to 400 liters/ha. The boron concentration of the spray is thus very low: 0,25 g of boron B/liter (0,025 %) to 2,5 g of boron B/liter (0,25 %).

These crops are not specific to France. In EU-28, they are cultivated on:
- 1,613 millions of ha of sugar beet in 2013 among which 0,394 in France (24 % of the total)
- 6,678 millions of ha of rape in 2014 among which 1,5 in France (that is 22 % of the total)
- 4,285 millions of ha of sunflower in 2014 among which 0,655 in France (15 % of the total).

III. Economic Impact in France

The economic impact of the borated fertilization absence in France was **estimated at more than 800 million euros per year** if we consider only 3 cultures.

For the sugar beet, there are about 507 million euros per year in France with:
- 337 838 hectares of sugar beets fertilized with boron in 2011 while 393 134 hectares of sugar beets are cultivated in France (Source: French Ministry of Agriculture, 2011);
- An average loss of 1 500 euro per hectare for these crops cultivated (the sugar yield can be 30 %lower) (Source : ITB).

For the sunflower and the rape, it is estimated at approximately 301 million euros per year in France with :
- 754 175 hectares of sunflowers and rape fertilized with boron in 2011 while 2 296 748 hectares of sunflowers and rape are cultivated in France (Source: French Ministry of Agriculture, 2011);
- An average loss of 400 euros per hectare of sunflower cultivated (the yield and the oil content can decrease respectively by 40 % and 5 % in case of deficiency) (Source: CETIOM).

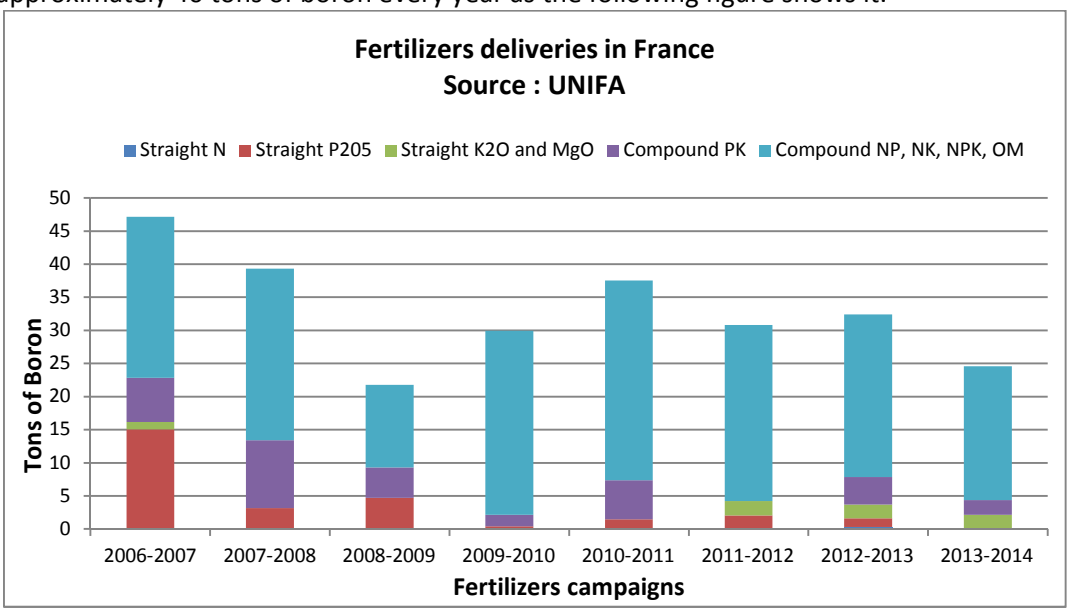
Note: there are various sources allowing to get an idea of the price of the agricultural crops such as:
http://www.depeche.fr
http://www.agritel.com/
http://www.agreste.agriculture.gouv.fr/conjoncture/prix-agricoles-et-alimentaires/

IV. Evolution of the deliveries to the farmers in France

The study results of the French Ministry of Agriculture in 2011 (which is only realized every 5 years, See Annex 1) confirm that the application of boron is frequent (because necessity) on some cultures/crops as the sugar beet, the rape and the sunflower.

This is the reason why we think that between 200 and 700 tons of boron are applied every year in France for all crops and that this boron use is stable in time.

Furthermore we can note that fertilizers brought to the soil (and not the foliar fertilizers which are majority) represent approximately 40 tons of boron every year as the following figure shows it.



V. The placing on the market in France

The boric acid, the disodium tetraborate (Borax), the diboron trioxide or the disodium octaborate (Solubor) can be dissolved in water and applied to the soil or sprayed by foliar application. The boron can be also added to NPK fertilizers.

The placing on the market of fertilizer containing boron is strictly supervised:

- In Europe: by the regulation EC n°2003/2003 (table E of the annex I of the RCE 2003/2003) which fixes the minimal boron content of the fertilizer according to its method of production and its essential ingredients. Furthermore, it requires that the following mention appear in the labelling :
  « To be used only where there is a recognised need. Do not exceed the appropriate dose rates. »
- In France:
  - by the standards NF U 42-002-1 or NF U 42-003-1 that have a compulsory application because of a ministerial decree
  - or by an authorization delivered by French Ministry of agriculture/ANSES
  - or by principle of mutual recognition (RCE 764/2008). Note that the standards NF U impose the following mention on the labelling « Engrais contenant un (ou des) oligo-élément(s) – A n'utiliser qu'en cas de besoin reconnu, ne pas dépasser les doses prescrites. »

Furthermore it is forbidden to place on the market for the general public products containing some boric acid, tetraborate of disodium or diboron trioxide in concentration equal or superior to that defined in the directives 67/548 and 1999/45 (See regulation UE N°109/2012), which entered into force on June 2012.

VI. Organization of the supply chain in France

Many companies intervene in the supply chain, from the producer to the farmer. This is partially due to the fact that fertilizers are produced all year while they are only used on a few months of the year (according to the needs for the cultures and for the requirements of the directive nitrate 91/676).

- ✓ Producers

UNIFA (Union des industries de la fertilization - Union of the fertilization Industries) represents the producers of mineral and organo-mineral fertilizers as well as the producers of lime materials, who sell their products mainly to professionals.

UPJ (Union des entreprises pour la protection des jardins et des espaces verts - Union of companies for the protection of gardens and green spaces) groups in particular the manufacturers of fertilizers intended for the home gardeners or for the professionals of public places.

✓ Distributors

"Coop de France" represents cooperatives, that are the distributors of fertilizers.

FNA (Fédération Nationale du Négoce – National federation of trade) represents trade companies.

AFCOME (Association Française de COmmercialisation et de Mélanges d'Engrais – French Association of Marketing and Mixtures of Fertilizer) gathers private companies and cooperatives which practise the mixture of fertilizers.

✓ Advisers

The APCA (Assemblée Permanente des Chambres d'Agriculture - Permanent assembly of chambers of agriculture) represents the 115 departmental and regional farmers' associations and insures the animation and the coordination between farmers' associations by functions of methodological support and representation on the national, European and international level.

VII. Manufacturing of the fertilizers

The picture N°1 shows boric acid handling system with a 1 ton bag in position for dosing into one of the production vessels. The bag is loaded using a fork lift truck and then the operator uses the glove box (shown on the picture N°2) to open the bottom of the bag. This means that the operator does not make any physical contact with the contents of the bag.

The discharge of boric acid from the bulk bag to the production vessels is an automated process via a rope and disc conveyor and a system of augers (picture N°2). The entire conveying system is fully enclosed, therefore there can be no release of boric acid to the environment.

The picture N°3 shows the top section of the rope and disc conveyor with the connection to the pipes leading down to the production vessels.

The picture N°4 shows the connection of the downpipe into the top of a production vessel; as above this is a sealed connection with no possibility of loss of containment during transfer.

Empty bulk bags are removed from the discharge station by operators wearing air stream helmets and other personal protective equipment (gloves, overalls etc.). A picture of an operator wearing an air stream helmet is shown on the picture N°5.

N°1

N°2

N°3

N°4

N°5

VIII. Use by the farmers

VIII.1 Awareness campaigns for the farmers

The farmers using boron fertilizers are already widely aware of risk prevention because several actions were already led in France concerning the use of plant protection products.

Indeed, **UIPP** led several awareness campaigns in France on the prevention of the risk linked to the use of plant protection products for the farmers in order they adopt a good behavior.

Furthermore, the plan Ecophyto [13] (launched in 2008 in France following Grenelle on the Environment and piloted by the French Ministry of Agriculture) aims to reduce by 50% if possible the use of pesticides/plant protection products while maintaining an economically successful agriculture. Among the measures of the plan Ecophyto, there is the **CERTIPHYTO** [14]: individual certificate for plant protection products, which gives evidence of a sufficient knowledge for a safe use of pesticides. All farmers must get this certificate by **October 1st, 2014.**

A similar approach/initiative was launched in France with the **biocidal products**, which imposes on the professional users of biocidal products (type N° 8, 14, 15, 18, 23) to hold a compulsory individual certificate as from **July 1st, 2015** (See order of October 9th, 2013).

VIII.2 Compulsory control of spayers

Finally it is important to underline that the atomizers of plan protection products, which are also used for the foliar applications of fertilizer with micro-nutrients as the boron, are the object of **a compulsory inspection**, which includes visual inspections, function tests and measures allowing to diagnose:
- The general state of the equipment;
- The capacity to apply the deliberate quantity of product;
- The capacity to apply correctly products.

This activity is strictly supervised by official texts and came into effect on January 1st, 2009. The GIP Pulvés [15] is responsible for the follow-up of this plan.

IX. Conclusion

Boron is an essential micro-nutrient for plant growth, that farmers need to bring in very small quantities according to specific crops and conditions. In excess, the boron can also harm to the plant growth.

The boric acid, the disodium tetraborate and the diboron trioxide are mainly used by farmers, who are professional users. These substances obtained an important score by applying the new rules of prioritization because of **their important tonnage**.

The inclusion of these boron substances in annex 14 would limit the availability of boron fertilizers and the availability of this micronutrient for agriculture. This situation would be detrimental to the profitability of a number of important crops. Both yield and quality might be impacted by a boron deficiency while:

- **There are already limitations relative to the placing on the market of fertilizers containing boron for the general public** (See Regulation (UE) N°109 /2009 concerning the boric acid, the disodium tetraborate or the diboron trioxide);
- **And RMM in the factories of fertilizers and awareness trainings/campaigns for the farmers have already been organized in France**.

Furthermore, there has been a consultation in May 2013 relative to the harmonized classification of the sodium octaborate as reproductive toxic, category 1B H360FD (as the boric acid, the disodium tetraborate and the diboron trioxide). So, this substance could be later submitted to an authorization and it's not better for the workers' health.

No alternative to the boron substances quoted in the draft 6th recommendation of ECHA seems to be available.

The absence of borated fertilization in France would create a loss estimated **at more than 800 million euros per year based only on 3 crops** (sugar beet, rape and sunflower). Furthermore, it will increase the unemployment among many actors of the supply chain.

Taking into account the economic impact of these boron substances and the fact that no alternative/substitute are available for agriculture, we believe that the inclusion of these boron substances to the REACH annex 14 does not represent regulatory effectiveness and is not proportional.

This is the reason why we want:

- These boron substances are not included in Annex 14 of REACH
- And a Risk Management Option is led.

To include these boron substances in the annex 14 of REACH would mean a new burden for agriculture and a threat for important sensitive crops.

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ANNEX 1: Extract of the survey of the French Ministry of Agriculture in France, 2011
(http://agreste.agriculture.gouv.fr/publications/dossiers/article/enquete-pratiques-culturales-2011-10339)

Nature of the culture		Cereals in straw				Rape & Sunflower		Pea	Corn	Industrial crops: sugar beet, potato		Meadow	Vineyard	Other feeds	Other industrial crops
Total surfaces cultivated in France, in 2011 (ha)		4 990 178	417 150	1 544 665	391 111	1 556 026	740 722	274 885	1 417 866	393 134	166 049	9 491 619	764 124	231 000	127 000

TOTAL	22 505 529

Part of surfaces having received at least a boron application during the campaign 2010-2011

		Common wheat	Durum wheat	Barley	Triticale	Rape	Sunflower	Pea	Corn	Sugar beet	Potato	Meadow
11 ILE-DE-FRANCE	0	86%		97%		44%		89%	98%	25%	79%	
	1	14%		3%		56%		11%	2%	75%	21%	
21 CHAMPAGNE-ARDENNE	0	97%		99%	s	60%	51%	92%	97%	6%	95%	100%
	1	3%		1%	s	40%	49%	8%	3%	94%	5%	0%
22 PICARDIE	0	s		s		46%		90%	91%	8%	89%	100%
	1	s		s		54%		10%	9%	92%	11%	0%
23 HAUTE-NORMANDIE	0	97%		92%		81%		96%	95%	16%	95%	s
	1	3%		8%		19%		4%	5%	84%	5%	s
24 CENTRE	0	s	98%	97%	98%	65%	80%	87%	98%	28%	87%	100%
	1	s	2%	3%	2%	35%	20%	13%	2%	72%	13%	0%
25 BASSE-NORMANDIE	0	96%		s	98%	75%		89%	99%	9%	96%	s
	1	4%		s	2%	25%		11%	1%	91%	4%	s
26 BOURGOGNE	0	97%		96%	s	39%	47%	91%	94%			s
	1	3%		4%	s	61%	53%	9%	6%			s
31 NORD-PAS-DE-CALAIS	0	s		s		72%			91%	28%	92%	100%
	1	s		s		28%			9%	72%	8%	0%
41 LORRAINE	0	94%		s	s	88%		100%	s			s

	1	6%		s	s	12%		0%	s			s
42 ALSACE	0	s							100%			100%
	1	s							0%			0%
43 FRANCHE-COMTE	0	s		s	100%	45%			96%			98%
	1	s		s	0%	55%			4%			2%
52 PAYS DE LA LOIRE	0	s	94%	s	99%	85%	87%	94%	s			s
	1	s	6%	s	1%	15%	13%	6%	s			s
53 BRETAGNE	0	s		97%	s	s		96%	100%		96%	s
	1	s		3%	s	s		4%	0%		4%	s
54 POITOU-CHARENTES	0	82%	100%	97%	99%	59%	91%	93%	98%			s
	1	18%	0%	3%	1%	41%	9%	7%	2%			s
72 AQUITAINE	0	s			s		71%		97%			100%
	1	s			s		29%		3%			0%
73 MIDI-PYRENEES	0	97%	s	s	s	85%	70%	88%	97%			99%
	1	3%	s	s	s	15%	30%	12%	3%			1%
74 LIMOUSIN	0				100%				s			s
	1				0%				s			s
82 RHONE-ALPES	0	99%	98%		100%		70%		s			s
	1	1%	2%		0%		30%		s			s
83 AUVERGNE	0	100%		100%	100%	57%	94%		97%			s
	1	0%		0%	0%	43%	6%		3%			s
91 LANGUEDOC-ROUSSILLON	0		100%		s		64%	s				100%
	1		0%		s		36%	s				0%
93 PROVENCE-ALPES-COTE-D'AZUR	0		100%									
	1		0%									
FRANCE	0	96%	99%	97%	99%	62%	77%	91%	98%	14%	91%	100%
	1	4%	1%	3%	1%	38%	23%	9%	2%	86%	9%	0%
surface fertilisée en bore (ha)		195 506	5 666	40 002	3 166	584 849	169 326	25 187	30 249	337 838	14 621	33 468

Source : Agreste - Survey concerning cultural practices in field crops and meadows 2011

TOTAL	1 439 878

0 no boron application during the campaign 2010-2011

1 at least 1 boron application during the campaign 2010-2011