



**Xpert4growth** Bvba

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Synthese 2015-2020

After five years of working with ChitosanHC, we give you, in this note, our experience and the results obtained from a large number of various applications.

### 1. In general.

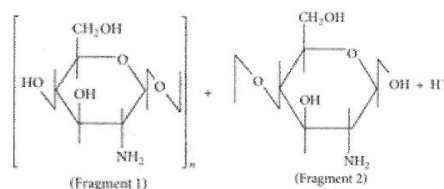
ChitosanHC has been used by us in very different areas such as golf greens, apple trees, growing young fruit trees, clover for fodder, various vegetables, organic hops, roses, hyacinths and lilies, ornamental plants.... The dosage ranged from 50 to 100 grams/Ha and the frequency of application from 7 to 15 days during growth.

In all cases positive effects were *observed: increased plant vigour, better leaf appearance, measurable increase in stem and leaf thickness with increased resistance to perspiration (-25%) and frost (up to -20C), a continuous growth gradient even during very hot periods (e.g. during the summer of 2017 and 2018), normal growth in soils infested with pathogenic nematodes. Leaf analyses show that more nutrients are found in plants treated with ChitosanHC. In soils too, an increase in the proportion of symbiotic organisms and biodiversity and finally, a decrease in the need for pesticide use from -50% to -100%.*

No negative effects were observed, even in the production of fruits, flowers and vegetables.

For golf courses, use was followed 3 years in a row; in other cases these are tests carried out during only one season.

Remember that the product used is a chitosane chloride, totally soluble in water, with a degree of deacetylation (DDA) of 82% and a molecular weight of 10 kDa. The chemical formula can be written



The molecule is made up of nitrogen, carbon, hydrogen and oxygen. Chlorine (a few mgr/l) is released when solutioned in water and combines with elements such as iron, calcium, magnesium present in water and soil. The proportion of nitrogen is about 16%. The product is classified as a eu 563/2014 base substance and is listed as a usable product in organic farming. (FIBL and CE 889/2008)





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## 2. Classification of the effects of ChitosanHC

The effects of ChitosanHC are manifested both by the leaves, directly, and by the soil, through the action of bacteria. During spraying, there is no loss of product, which is remarkable.

In the first case, the product systemically penetrates through the leaves, accesses each cell and causes the *formation of an enzyme* (chitinase) as well as the formation of hormones and proteins, all of which stimulate the natural defense system of *plants*. *There is also an increase in the thickness of the cell walls which causes better resistance to abiotic stress*. This case applies only to plants with many leaves as well as in combination with the following case.

In the second case, the product enters the soil and given its quality of "sugar" (polysaccharide) feeds many bacteria (e.g., Bacillus, Pseudomonas fluo, Actynomics, Mycorhizes, Rhizobacteria,... ).

ChitosanHC molecules are destroyed by bacteria following an enzymatic reaction so *that the constituent nitrogen, carbon, oxygen and hydrogen are released slowly into the soil*. *ChitosanHC behaves like a fertiliser slowly releasing its components at the rate of its decomposition*.

The produced enzymes that come into contact with the roots are absorbed by the plant and *strengthen its biotic and abiotic defense system*.

These bacteria, fed by chitosanHC as well as other natural elements, proliferate and the *proportion of symbiotic organisms increases sharply* for the sake of biodiversity and plant vigour.

The part of chitosanHC not used by bacteria complex cations such as Ca, Fe, Zn, ..., *mobilizes them and facilitates their transfer*, directly or through mycorhizes, to the roots. The product has an "accelerator" effect that improves the availability of nutrients for plants as well as the transport of these elements in plants. This Chitosan also reacts in the plant as in the first case and forms stimulating and protective enzymes.

*In fact, the process described occurs naturally in soils of higher biological quality in which dead organisms containing chitin are disintegrated by bacteria and transformed into chitosane, chitinase and other elements.*

(Natural Cycle of Chitine)

The scientific literature mentions many other properties of chitosane; see, for example, "The Multifunctional Role of Chitosan in Horticultural Crops; In Review. By Rahat Sharif, and Others. (27/02/2018) »





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### 3. Conditions for effective use of ChitosanHC: results.

In the case of golf greens, given the regular cut and the very short length of the leaves, the action via the leaves is almost not possible and *the action of the ChitosanHC is almost 100% via the ground!*

**Also, all operations that improve soil quality allow the beneficial action of ChitosanHC:** the physical characteristics (permeability, structure, ...) and chemical (pH, minerals, balances, ...) of the soil must be sufficient and maintained on the basis of tests and analyses. The "top dressing" combined with vertical or other aeration is very important!

*The presence of bacteria (see list of point 2) is essential for the beneficial action of ChitosanHC.* The use of bacteria-destroying chemicals is a barrier to its effectiveness.

*Also note that the pH of the water used to dissolve ChitosanHC should be less than 6!* If the water is not acidic enough, you have to lower the pH with for example citric acid or another. Don't mix with pH-up products! (At pH above 6.3 ChitosanHC loses its polycationic character as well as much of its reactivity.)

The usual dose is 100 g/Ha and the frequency every 15 days during the growing season and every 30 days in the winter.

Note that the goal is first of all to feed the bacteria that, following this action, release the elements that have a beneficial effect on the plants!

Given the low doses used, *applications should be done very regularly.* In areas or during periods of high pathogen activity, *the frequency first, not the dose, should be increased.* (For example, every week for a month).

ChitosanHC also has a healing effect; it is therefore advisable to spray after mowing if possible.

Finally, note that all ChitosanHC users who have made applied the product on a good way don't longer use fungicide products from the third year of application.

**In summary, the following parameters must, as a priority, be taken into account in order to have a beneficial action of ChitosanHC, (without forgetting the others):**

- **pH of solution and mixture less than 6,**
- **The porosity of the soil is assured, on the surface and in depth,**
- **Presence of beneficial bacteria in the soil,**
- **The regularity of the applications.**

