

**More information on
Seaweed for Agriculture**

AB Sano Roots

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Underneath some results of the use of seaweed extracts (= SE) on different crops. SE increase root growth, plant growth, nutrient uptake and yield. SE increase plants defense mechanisms against as well biotic as abiotic stress factors. These effects are summarized in Table 1 and 2.

Next 19 abstracts on the use of SE for agriculture are shown as has been presented at the first World Congress on the use of Biostimulants in Agriculture, November 2012 in France.

These seaweed extracts are one of three agricultural technologies in AB Sano Roots.

Table 1.**The effect of Seaweed extracts on yield and on some other parameters.**

Crop	Country	Year	Yield increase in %	Other parameters
Wheat	China	2010/11	11-23,5	decrease NPK
Garlic	China	2010/11	10-18	decrease NPK
Apple	Poland	2004/07	++	quality ++
Cucumber	Poland	2011/12	++	quality ++
Broccoli				
Onion				
Barley	Ireland	2011/12	++	c/b ratio: +
Maize	Poland	2009/10	Soaking experiments	Increase of roots and shoots
Oilseed rape				
Pear	Spain	2007/08	10	
Sweet pepper	Poland	2007/09	++	Increase of roots, stem and leaves
Banana	South Africa	2005/11	15-17	
Pomegranate	Iran	2010/11	++	Blossom ++
Olive	Iran	2010/11	24	
Gerbera	Iran	2010/11	+	Larger flowers

Table 2.**Overview of other relevant aspects of the use of Seaweed Extracts = SE**

1. The use of SE results in (much) more efficient use of traditional fertilizers
2. Tomato plants treated with seaweed extracts present increases in nitrate reductase and phosphatases activities and also in the ferric chelate reductase activity.
3. SE are biostimulants with a positive effect on plant mineral uptake
4. SE decrease the incidence of diseases and pests like thrips and others
5. Cost effective agricultural technology

Underneath 19 abstracts are shown as presented at the 1st World Congress on the use of Biostimulants in Agriculture, November 2012, Strasbourg, France

A Seaweed Fertilizer Based High Efficient Fertilization Technology on Open Field Crops – Wheat and Garlic in China

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This technology has been adopted since 2009 to carry out high-yielding low carbon emission seaweed fertilizer based fertilization technology in Shandong Province. Thanks to the properties of seaweed fertilization, a recommended integrated technical system and dosage application based on soil tests and the planning of a fertilization procedure, the traditional fertilization costumes could be changed.

1). Impact on yield

Thanks to the adoption of the high-yielding low-carbon seaweed fertilization technology the yield per Ha increased by 10.96%~23.62% in the case of wheat and by 10.02%~18.23% in the case of garlic.

2). Ecological impact

In the case of garlic cultivation, the applied amount of pure nitrogen, pure potassium and pure phosphorus could be respectively reduced by 135-180 kg/ha, 157.5- 202.5 kg/ha and 22.5-67.5 kg/ha. In other words, the application ratio of nitrogen, phosphorus and potassium fertilizers decreased by 28%~34%, 40%~50% and 6%- 17% respectively. In the case of wheat cultivation, the applied amount of pure nitrogen and pure phosphorus could be respectively reduced by 169.5-238.5 kg/ha and 56.25 kg/ha, i.e. the applied ratio decreased by 53% and 50% respectively.

3). Financial benefit

The income from wheat cultivation increased by 2325~2880CNY/ha, while the income from garlic cultivation increased by 18585~20700CNY/ha in comparison with the conventional chemical fertilization. The high-yielding low-carbon seaweed fertilizer based fertilization technology adopted for the cultivation of winter wheat and garlic can completely replace single-nutrient chemical fertilizers. While achieving the target of a high yield, it is also a key-factor in reducing the application of chemical fertilizers and pesticides as well as CO₂ emissions.

Seaweed extract used as plant nutrition and yield booster

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The challenge of modern agriculture is to adapt itself to the increase of world population by upgrading yield while preserving the environment. A method for achieving this goal is to improve plant nutrition with the use of biostimulants such as seaweed extracts. In fact, plant nutrition is a key process with a large impact on yield.

Nitrogen is a very important element for plants to produce proteins, nucleic acids and chlorophyll. Nitrate is absorbed from the soil and represents the major source of nitrogen for the plant. The nitrate uptake is performed by nitrate transporters belonging to the NRT family. Then, nitrate is converted to nitrite by the nitrate reductase. It has been shown that plants treated with seaweed extracts present a higher activity of this enzyme. Phosphorus is also an important macro-nutrient. Tomato plants treated with seaweed extracts present a higher phosphatases activity. Iron is participating to the chlorophyll synthesis and represents an important micro-element. Seaweed extract applications on plants increase the ferric chelate reductase activity.

Moreover, plants treated with seaweed extracts present a well-developed and more robust root system. The presence of more roots increases the exchange surface between the soil and the plant, and probably increases the nutrients uptake. Treatments with seaweed extracts allow a doubling of the foliar biomass in lab conditions, macroscopic effect which is easily visible. By these observations, we can conclude that seaweed extracts have a positive effect on plant nutrition and then on yield.

Effect of seaweed extract application on yield and quality of apples

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The investigations aimed at assessing the influence of *Ascophyllum nodosum* extract on the yield and fruit quality under climatic conditions of Central Poland depending on the number and dates of treatment. The studies comprised two field experiments. The first one was carried out in the years 2003-2004 and 2007 in a commercial orchard in the Grójec region and the second in the years 2004-2005 at the Warsaw-Wilanów Experimental Station. Both experiments were performed on 'Šampion' apple trees on M.9 and additionally on 'Gala' on M.9 in the commercial orchard. In the experiment I two combinations were compared: control and three sprays – at the green bud stage, at the pink bud stage and at full bloom. Experiment II included four treatments: control; a single spray – at the pink bud stage; two sprays – at the pink bud stage and at full bloom; three sprays – at the pink bud stage, at full bloom and after bloom. A dose of 3 l of seaweed extract per ha was applied at each date.

The highest fruit set and yield per tree was obtained in the treatment of triple spray (a complete spray programme). This programme also resulted in obtaining the largest fruit size, the biggest share of large fruits (over 80 mm in diameter) as compared with the control and the smallest share of small fruits (60 mm in diameter). The effects of a single and double sprays were less pronounced than those of three sprays, nevertheless all the performed treatments resulted in the fruit yield increase as well as in the improvement of fruit quality as compared with the untreated control.

Efficacy of a new oligosaccharide active against scab on apple

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Scab on apple, caused by the ascomycete *Venturia inaequalis* is one of the most important diseases in fruit growing. Seventy five % of the pesticide use in apple production is related with control of fungal diseases, in which apple scab has a share of 70 %. With the new regulation replacing Directive 91/414 and the Framework Directive on the sustainable use of Pesticides (2009/128/EC), products will disappear from the European market which will give a new challenge in IPM strategies to control pests and diseases. Besides there is the pressure of environmental and consumer groups on supermarkets to reduce residues on fruits. As such, the use of pesticides is at the moment under debate. To this end, research concerning alternative control measurements experiences a boost. The active compound tested here is an oligosaccharide extracted from seaweed. It is an elicitor which induces plant resistance mechanisms to bacterial and fungal diseases. Used alone to fight the scab pathogen, it can reduce the disease pressure. Included in protection programs against scab throughout the secondary contamination of scab in summer, it also contributes to a reduction in fungicide applications and as such allows reducing residues on apples.

The effect of seaweed extracts on the yield and quality parameters of some vegetables in open field production

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The use of products based on seaweeds is becoming more and more common in vegetable production in Poland. Therefore more studies are needed to investigate the influence of seaweed extracts on the yield but also on some quality parameters important both for growers and consumers.

Experiments were carried out in the years 2011-2012 at trial stations of three leading Life Sciences Universities in Poland. Trials were conducted on 3 cultivars of cucumber, broccoli and onion. Seaweed cream and seaweed filtrate derived from *Ascophyllum nodosum* were applied as a foliar spray.

In the experiment conducted on cucumber, plants were treated with seaweed cream during flowering and fruit setting. Generally the marketable yield increased due to both higher number of fruits per plant and decreased number of unmarketable fruits (deformed, overgrown). Positive effect on the earliness was also noticed.

Seaweed filtrate application during early stage of broccoli cultivation resulted in higher weight of broccoli curds. The limitation of the occurrence of hollow stem was observed. Some positive changes in chemical composition of broccoli curds were noticed. In the experiment carried out on onion, plants were treated with seaweed cream just before bulb formation and bulb enlargement. The results show positive effect of the preparation on the yield and the yield structure – number of bulbs with diameter below 30 mm slightly decreased, the share of bulbs with diameter above 70 mm in total yield increased. The obtained results shown that extracts derived from *Ascophyllum nodosum* have positive effect on the yield therefore they are useful tool in modern vegetable production.

Effects of Commercial Seaweed Extracts on Barley Growth and Yield

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Abstract

Several biological effects of seaweed extracts have been reported in different plant systems, including enhancement of plant growth and stress alleviation. The present research work investigated the effect of commercial seaweed extracts A & B and refined fraction 3 (RF 3) on barley growth and their yield improvements under field conditions. In total seven different treatments were studied; (i): commercial seaweed extract A (CSE @ 2.5 L/ha, (ii): CSE A @ 5.0 L/ha, (iii): commercial seaweed extract B (CSE B) @ 2.5 L/ha, (iv): CSE B @ 5.0 L/ha, (v): RF 3 @ 2.5 L/ha, (vi): conventional agrochemical and (vii): control (water) were applied twice (on 30 and 45 days old crop) as foliar spray to promote growth and improve yield parameters. The open field trials were conducted during the Irish spring season in consecutive years (2011 & 2012). Results of the study showed a significant difference in barley plant growth promotion and yield parameters in all the treatments. Treatment with CSE A @ 5 L/ha provided the best results as it improved the maximum shoot length, total grain yield/plot and total grain yield/ha. Moreover, the same treatment significantly ($P>0.05$) increased the additional yield/ha (237.9 kg), additional income/ha (€39.3) and benefit cost ratio (1.3) compared with conventional practice.

This study concluded that the CSE A @ 5 L/ha, CSE B @ 2.5 L/ha and RF 3 @ 2.5 L/ha applications were superior in barley growth promotion and yield improvements to traditional fertiliser/agrochemical treatments.

Seaweed Extracts and their Impact on Fusarium wilt in Tomato Plants

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Extracts of the brown seaweed algae, *Ascophyllum nodosum* have been used as biostimulants to promote growth and productivity in a number of agricultural production systems. The impact of these extracts on plants under the influence of biotic and abiotic stress in field conditions has been widely observed by end users. In the present study, a total of 12 treatments of commercial seaweed extracts (CSE A and CSE B) and their refined fraction (s) (RF 1 to 6), were used in three different inoculation methods (pre-, co- and post-inoculation) to control Fusarium wilt in Tomato caused by *Fusarium oxysporum* under glasshouse conditions. All the experiments included pathogen and healthy controls with 5 replications in randomized design. RFs 1 to 3 and RFs 4 to 6 were extracted from CSE A and CSE B, respectively. Percentage disease reductions ranged from 7.7 to 38.5%, 8.6 to 40.0% and 8.3 to 33.3% for pre-, co- and post-inoculated plants. when compared to control (pathogen treated) plants, respectively. Evaluation of classical ISR markers revealed treatment with CSE A provided the strongest induction as it significantly induced peroxidase, polyphenol oxidase, phenylalanine ammonia lyase, total phenol and total protein when challenged with pathogen. However, qRT-PCR data revealed increases in expression of PR1 and PR5 genes in treatments CSE A and RF 3 + pathogen compared with those of pathogen treated control plants at week 1 after pathogen inoculation. In conclusion, commercial seaweed extracts and their refined fraction(s) induced expression of ISR markers in treated tomato plants.

Effect of seaweeds extracts and humic and fulvic acids on germination and early growth of Maize (*Zea mays* (L.) and Oilseed rape (*Brassica napus* var. *oleifera* (L.)

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Glasshouse and laboratory experiments were conducted during 2009-2010 in the Institute of Plant Protection – National Research Institute in Poland. The aim of these trials was to determine an influence of seaweed extracts consist of brown algae *Ecklonia maxima* and *Saragassum spp.* and a humic and fulvic acids mixture on the germination, early growth and development of maize and oilseed rape depending on the method of application. Trials involved soaking of seeds in aqueous solution of seaweed extracts and humic and fulvic substances (variant A), soaking seeds and then foliar application (variant B) and finally, two foliar applications (variant C). Foliar applications were done at the growth stages BBCH 12-12 and 14-16 of plants.

Experiments involved seed germination, chlorophyll content and fresh weight of shoots and roots.

Results shows different action of tested substances on maize and oilseed rape depending on application method. Extracts from brown algae and humic and fulvic acids improved the germination capacity of seeds. The plants sprayed twice with the tested substances had the largest shoots and roots. Plants obtained from seeds soaked in solutions of seaweed extracts were characterized by a higher weight of shoots and roots, as compared with plants obtained from seeds soaked in solutions of humic and fulvic acids.

Soaking seeds in solutions of the tested substances and an additional foliar application of extracts from seaweeds and the acids on plants stimulated growth of plants root system stronger in comparison with the growth of shoots. Humic and fulvic acids had a stronger effect on the roots.

A seaweed biostimulant effect on fruit set and fruit yield on two pear cultivars in Spain

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During two years it was studied a seaweed biostimulant (SB) effect on fruit set and fruit yield in Conference and Abate fetel orchards. Studied strategies were SB, SB +Prohexadione-Ca, SB+Prohexadione-Ca+GA3, a standard fruit set strategy (Prohexadione-Ca+GA3) and an Untreated Control (UTC). In Abate fetel GA3 was substituted by GA4/7+6BA (Promalin). Fruit set was evaluated on one hand on marked branches, from blossom until the end of June, and on the other hand another fruit set evaluation at harvest on the whole tree. It was also determined yield (kg/tree and fruits/tree), fruit weight.

SB increased fruit set in Abate Fetel-2007. There was a significant increase on fruits/tree at harvest, in the comparison UTC vs. SB. In Conference-2008 there was a significant increase in number of fruits/clusters on the marked branches, in the comparison UTC (1,3 fruits/cluster) vs. SB (1,6 fruits/cluster). In the same experiment it was detected a significant increase in the final fruit yield, with 30,3 kg/tree in the Standard strategy (Prohexadione-Ca+GA3) and 34,7 kg/tree in the Standard+ biostimulant strategy.

In reference to fruit weight, it was registered a significant increase in Conference-2007 in comparisons UTC vs. SB and Standard vs. Standard+SB with similar crop load. This improve average on fruit weight was around 10%. In Abate fetel-2007, there was difference on crop load in favor to SB, despite this situation there was no negative effect on fruit weight.

Finally, the studied seaweed biostimulant has showed the capacity to increase fruit set or fruit weight on both pear cultivars.

Effects of a specific seaweed extracts on growth, yielding and fruit quality of sweet pepper growing in non-heated tunnels

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The annual production of sweet pepper in Poland counts 70-80 thousand tons, from cultivation with limited stem cutting system, in non- heated tunnels. Due to uncontrolled climate conditions the plants are exposed to different types of stress. The use of biostimulants is an opportunity to improve the physiological condition of plants and enable them to make the best yield in difficult growing conditions.

In 2007 and 2008, a seaweed filtrate was applied to pepper's seedlings. The measurement results of morphological parameters showed that the tested filtrate had a positive impact on the growth of roots, stem and leaves of seedlings as well as the yield of first harvest in comparison to only watered young plants.

In a second experiment, from planting to first harvest (May-July), plants were watered three times at 0.1% filtrate concentration, and during flowering (June-July) and sprayed with 0.1% seaweed cream. Separately, plants were only watered with the filtrate or sprayed with the seaweed cream. The average weight of 1st class fruit, 1st class yield, marketable and total yield was evaluated at 1st picking time and during the whole harvest period.

The best influence on all fraction of pepper's yield had plant sprayed with seaweed cream and treated with both extracts of *Ascophyllum nodosum*.

In 2009-2011, 0.5% Seaweed cream was also used during pepper fruiting stages. Fruit colouring acceleration was obtained as well as improvement of sensory attributes (QDA met.)

Discrete roles for seaweed extracts in enhancing plant growth, yield and tolerance to abiotic and biotic stresses

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Elucidating the precise roles of seaweed extracts in agriculture has been limited due a widespread 'one-size-fits-all' approach to extraction, development and functional validation. In this study, we stratify extracts of seaweed species on the basis of extraction, biochemical and functional properties therein and demonstrate discrete roles for seaweed extracts in enhancing plant growth and tolerance to abiotic and biotic stresses. In brief, the biochemical properties of extracts were characterized and their potential influence on plant growth and health was investigated in controlled laboratory and trial settings. Higher antioxidant levels are observed for high temperature-derived extracts (HTE) compared with low-temperature-derived extracts (LTE), with an almost 20-fold difference detected (FRAP assay), therefore suggesting benefits conferred by HTE in abiotic stress situations. Analysis of performance parameters in conditions of low and high salinity gave contrasting results. In low salinity, no statistical difference between treatments was observed. However, in conditions of high salinity, a 42% increase in lettuce growth on treatment with HTE was observed compared to 28.6% with LTE. In contrast, biotic stresses were alleviated more by LTE than HTE, with LTE achieving three and two-fold reductions in diameters of *Sclerotinia* and *Alternaria* induced lesions respectively. Trials carried out in nematode infested ground demonstrate significant increases in performance (potatoes) on treatment with LTE derived from different species of seaweed versus controls.

In conclusion, this study demonstrates high specificity and discrete roles for seaweed extracts in agriculture and supports a 'fitness-for-purpose' approach to validation of seaweed extract properties and their specific applications in agriculture.

A Commercial Extract of the Brown Seaweed *Ascophyllum nodosum* Suppresses Avocado Thrips and Persea Mites in Field-Grown Hass Avocados, A Practical Field Perspective

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Thrips cause damage to vegetables, fruits, and flowers and are found worldwide. They directly damage crops by feeding, vector viruses, and they also cause respiratory and skin irritation to workers. Effectively managing thrips with non-toxic materials has proven to be one of the most challenging aspects of natural pest control. An extract from the brown seaweed, *Ascophyllum nodosum*, reduced Avocado Thrips (*Scirtothrips perseae*) by 68% compared to the control in field-grown Hass avocado trees. This reduction in thrip numbers was not significantly different from abamectin; the most common chemical control for this insect in avocados. In addition, there were 87% less colonies of Persea mites (*Oligonychus perseae*) per leaf in the *A. nodosum*-treated trees compared to the control, which was also not significantly different from the abamectin standard. The following year there was no thrips pressure due to weather however *A. nodosum* extract again reduced Persea mite colonies compared to the control. In addition, the numbers of fruit per tree were significantly increased. *A. nodosum* extract applications result in significantly less feeding damage by thrips and mites on field-grown avocados as well as improves yields.

A Commercial Extract of the Brown Seaweed *Ascophyllum nodosum* Suppresses Western Flower Thrips in Greenhouse-Grown Peppers and Cucumbers and Avocado Thrips in Field-Grown Hass Avocados

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Thrips are found worldwide and cause damage to vegetables, fruits, and flowers. Some thrips are vectors of viruses such as Tomato Spotted Wilt Virus. A proliferation of thrips may also cause respiratory and skin irritation to workers. Effectively managing thrips with non-toxic materials has proven to be one of the most challenging aspects of natural pest control. An extract from the brown seaweed, *Ascophyllum nodosum*, harvested sustainably in Nova Scotia, reduced leaf deformation from Western Flower Thrips (*Frankliniella occidentalis*) based on leaf area measurements by 158% compared to the control on greenhouse-grown jalapeno peppers. Similarly, in studies on greenhouse grown bell peppers, treatments with *A. nodosum* reduced thrips feeding as well as the organic standard, spinetoram. Trials on greenhouse-grown cucumbers demonstrated a 54% reduction in the amount of leaf area damaged by thrips when plants were treated with *A. nodosum* extract compared to the water-treated control. Field-grown Hass avocado trees had 68% fewer Avocado Thrips (*Scirtothrips perseae*) per leaf compared to the control. This reduction in thrips numbers was not significantly different from abamectin; the most common chemical control for this insect in avocados. This data suggests that *A. nodosum* extract reduces thrips damage on greenhouse grown vegetables and field grown avocados.

Comparative analysis of two kind of *Ascophyllum nodosum* extraction procedures: similarity and differences

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Valagro SpA, via Cagliari, Italy, on behalf of ALGEA AS, Omagata, Kristiansund, Norway, CIRI (Centro Interdipartimentale di Ricerca Industriale) Energia-Ambiente, Ravenna, Italy.

Ascophyllum nodosum extracts are widely used in agriculture due to their widely recognized biostimulant activity. The aim of this work was to assess, using GC-MS, HPLC and ¹H NMR, two different extracts made by ALGEA as. on *Ascophyllum nodosum*, in order to evaluate the effect of the extraction procedures on the bioactive components in both products. Extract AN001 is realized in strong basic conditions with high temperature, while AN002 is realized in mild basic conditions and with low temperature. The extracts AN001 and AN002 gave very different results when analyzed through GC-MS: uronic acid content was higher in AN002 (8-9%) than in AN001 (1%), fucose, xylose and D-glucuronic acid present in AN002 but non-detectable in AN001, mannitol higher in AN001 (4%, compared to 1.6% in AN002). ¹H NMR confirmed the presence of high amount of mannitol in AN001 (10%), while sugars and uronic acids were found to be abundant in AN002 but not in AN001. Through ¹H NMR the signals of betains could be detected in AN002 but non-detectable in AN001. In conclusion, AN002 was remarkably higher in bioactive components derived from *Ascophyllum nodosum* than AN001, and it is advisable to use this extraction procedure in the industrial production to assure the quality of the final product.

The effect of a seaweed biostimulant, Kelpak, on banana (*Musa paradiscica*) yields in South Africa

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Key words: seaweed, biostimulant, bananas.

Abstract:

The effect of Kelpak seaweed biostimulant on Williams variety banana yield was evaluated in statistical trials conducted in Mpumalanga, South Africa. In the 2005 season Kelpak applied twice as soil drench, or trunk injection, or bell injection, did not show any increase in fruit bunch mass. Kelpak applied foliarly at 4 L/ha at five, four, three and two months before harvest, increased bunch mass significantly, 15% above the control.

In the 2009 season a 1% Kelpak soil drench applied twice, at 1 m plant height and 4 months later, increased the bunch mass 10% above the control. A 50 ml bell injection with 1 and 2% Kelpak solutions increased bunch mass with 15 and 12% respectively. Four foliar applications at 2 and 3 L/ha gave the best result increasing yield with 16 and 17% above the control.

In the 2011 season a bell injection with 1% Kelpak increased the bunch mass significantly by 11%. Foliar applications again gave the best result, with four 2 and 3 L/ha applications increasing bunch mass with 11 and 17% respectively. Two foliar applications at 3 L/ha five and three weeks before harvest also gave a 17% yield increase, while two 3 L/ha applications four and two months before harvest had no effect on yield. None of the treatments had an effect on hands per bunch or fingers per hand, indicating larger fruit.

A survey on efficiency of Stimplex, a bioproduct of *Ascophyllum nodosum*, on yield production of pomegranate in Iran

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Pomegranate, *Punica granatum* L., is native to the region of Persia. Iran is the second largest, producing around 35% of global production. No chemical pesticide and fertilizer have been used in pomegranate orchards in Iran thus pomegranate production is an organic cultivation in Iran.

Ascophyllum nodosum has showed biostimulant effects on plant growth in different surveys. To find an organic fertilizer alternative and biostimulant, this study was conducted to show efficiency of Stimplex®, a bioproduct of *Ascophyllum nodosum*, in comparison with common procedures such as cow-dung in 2010-2011. Pomegranate grove was approximately one hectare, with trees spaced at 5 m within rows and 5 m between rows, totalling around 400 trees per hectare and 125 trees were randomly selected. According to our results, using Stimplex® (2.5 lit/ha) had a significant effect on weight of 100 pomegranate ripened fruits of trees.

Stimplex® treatment increased number of blossom significantly in comparison with cow-dung fertilizer. Number of cracked fruits decreased significantly in comparison with common fertilization procedures. Ripening Speed of fruits of treated trees with didn't show significance differences. According to our results common fertilization procedures can be replaced by this material.

A survey on efficiency of Acadian®, a bioproduct of *Ascophyllum nodosum*, on yield production of olive in Iran

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Olive (*Olea europaea L*, Oleaceae) is a long-lived, evergreen tree native to the Mediterranean basin. It is valued for its fruit and oil. Olives are picked late in autumn or winter, as the oil content and fruit characteristics change with ripening. An extra 10,000 acres have been added to Iran's olive groves over the past 13 years in Iran. Different fertilization methods are using in olive orchards based on chemical fertilizing. *Ascophyllum nodosum* has showed biostimulant effects on plant growth in different surveys. To find an organic fertilizer alternative and biostimulant, this study was conducted to show efficiency of Acadian®, a bioproduct of *Ascophyllum nodosum*, in comparison with common fertilization procedures in 2010-2011. Olive grove was approximately one hectare, with trees spaced at 4 m within rows and 4 m between rows, totaling around 620 trees per hectare and 125 trees were randomly selected. According to our results using Acadian (1.5 Kg/Ha) showed significant differences on mean weight of 100 ripened fruits of treated trees in comparison with chemicals treatment. This amount was 392.5 ± 0.59 in Acadian treatment while this amount was 316 ± 0.98 in chemical treatments. Yield production was increased significantly (53.2 ± 2.5 kg) and this amount was (40.1 ± 1.9). Fruits oil content of dry material increased significantly in Acadian treated in comparison with chemical treatments.

Effects of Stimplex® on some bionomics of *Gerbera jamesonii*

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Gerbera jamesonii is a perennial herb with deeply lobed leaves covered with silky hairs arising from a crown. The striking inflorescence is borne on a long stalk and the outermost petals (ray florets) may be cream, red, orange or pink, while the central flowers (disc florets) are cream. To find an organic fertilizer and biostimulant, this study was conducted to show efficiency of Stimplex®, a bioproduct of *Ascophyllum nodosum*, on some bionomics of *Gerbera jamesonii* in 2010-2011. Green house area was approximately 2000 square meter, ten plots with 10 square meter area were selected and five plants in each plot were selected and bud height, bud diameter, stem diameter and leaf area was measured in comparison with chemical fertilizers. According to our results, using Stimplex® (2.5 lit/ha) had not a significant effect on bud height (3.37 ± 0.31 cm) in comparison with chemical fertilizer (3.5 ± 0.46 cm). Bud diameter parameter (16.12 ± 1.18 cm) showed a significant difference in comparison with chemical treatment (13.2 ± 0.45 cm). Stem diameter and leaf area had not significant differences in comparison with chemical treatments. According to our results Stimplex® can be a good alternative for replacing chemical fertilizers.

Effect of seaweed extract as biostimulant on plant mineral uptake and development

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Many naturally-derived products are used as growth promoters or biostimulants on plants, even if their mechanisms of action are still now unknown.

In our work, we would assess the biostimulant properties of a seaweed extract (SE) on both plant nutrition and development by a bioassay and greenhouse experiments.

A preliminary model test was performed on *Zea mays* L., in order to evaluate the effect of SE on root and shoot of early-stage maize plantlet. After that, greenhouse pot trials were conducted on two horticultural crops (*Lactuca sativa* L. and *Pelargonium* L.), by applying SE at 1/250 and 1/500 v/v rates to the 50% Hoagland and Arnon nutrient solution. Plant root length and weight, plant shoot height and yield, tissue dry matter, number of lettuce leaves/number of pelargonium flowers, leaf nutrient (N, P, K, Ca, Mg, Fe, Na, Mn, Cu, Zn, B) and chlorophyll content were determined. Obtained results evaluated by ANOVA.

Bioassay showed a good distribution of maize biomass (as shoot/root ratio), an increase of root caliper and an increase of plantlet total biomass. The mechanism induced towards plant nutrition determined the increase in Ca, Na, Cu and Mn uptake by roots and the increase of Mn and B uptake by shoot. Greenhouse experiments gave an improvement of plant quality both for lettuce and pelargonium, together with a significant increase in plant dry matter, leaves chlorophyll and, on general terms, nutrient use efficiency. Moreover, a positive effect on root development was recorded on both the crops, that means an increase of root dry matter.

Such promising results address to SE optimization for improving nutrient use efficiency in relation to specific plant mineral uptake.