AQM®
Tougher Turf

ROOT DEVELOPMENT AND RELIEF FROM WATER DEFICIT STRESS

The nutritional value of seaweed used as a soil amendment has been observed for centuries. It is well documented that seaweed extracts contain all major plant nutrients in addition to micronutrients such as iron, copper, zinc, molybdenum, boron, manganese and cobalt for healthy plant growth and development. Most seaweed extracts also contain mannitol, a chelating compound and alginate, which improves the water holding characteristics of soil.

Perhaps the greatest interest by scientists and turfgrass managers in seaweed extract over the past decade involves its two biologically active metabolic enhancers - cytokinin and auxin. Years of scientific research and use by turfgrass managers have confirmed that supplemental use of seaweed on turfgrass subject to stress:

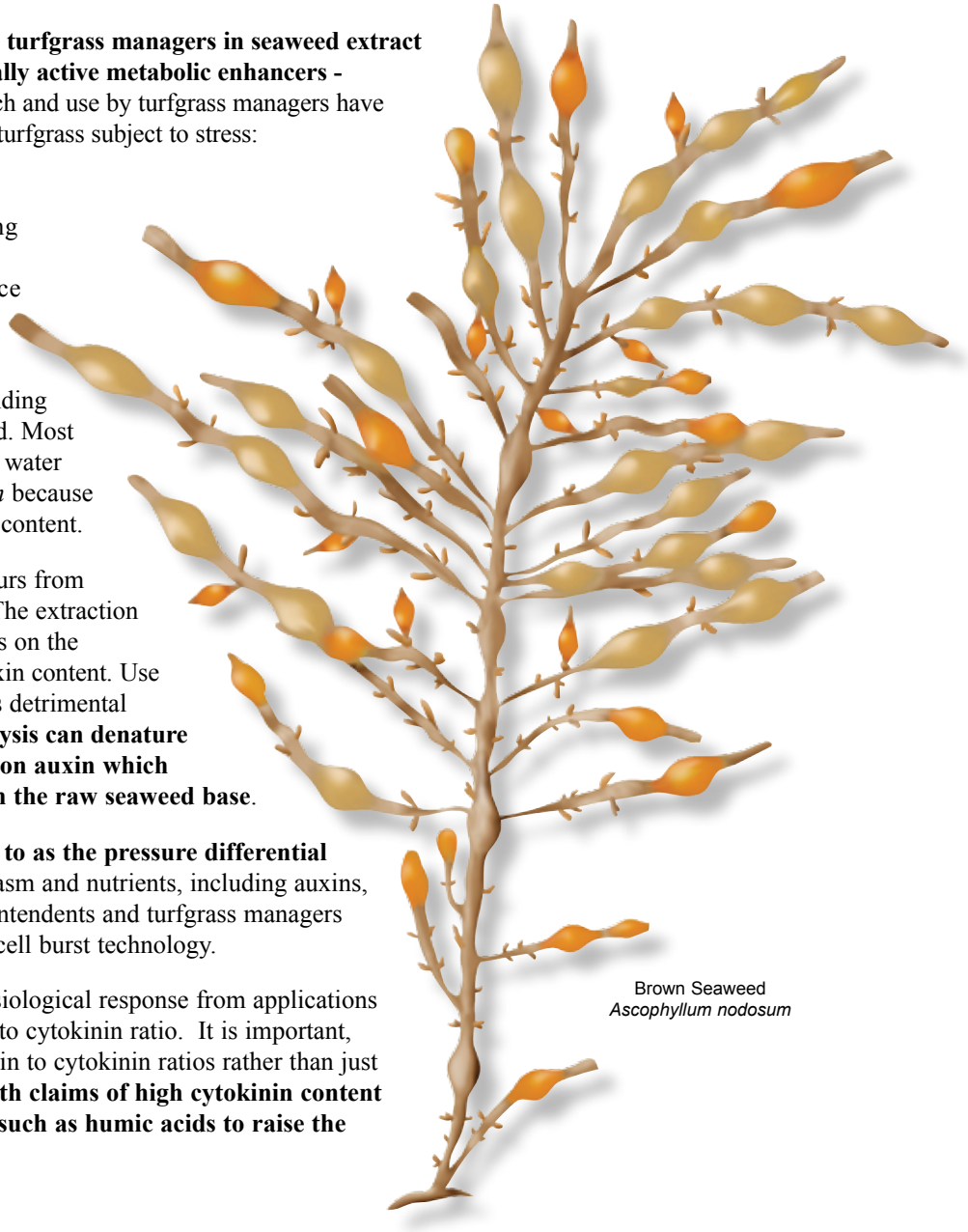
- Increases root growth and mass
- Improves stress tolerance, including drought and salinity
- Provides enhanced disease tolerance
- Enhances plant vigor and color

Seaweed extracts can differ dramatically depending on seaweed species and how they are processed. Most seaweed extracts available in the U.S. use cold water brown seaweeds such as *Ascophyllum nodosum* because of their excellent nutrient, cytokinin and auxin content.

The biggest difference in seaweed extracts occurs from how the "fresh" raw materials are processed. The extraction method will have significant detrimental effects on the composition of the final product - including auxin content. Use of heat, dehydration and freezing techniques is detrimental to nutrient and auxin content. **Alkaline hydrolysis can denature the base material and have a negative effect on auxin which can alter the ratio of auxin to cytokinin from the raw seaweed base**.

The preferred extraction method is referred to as the pressure differential cell burst process, which preserves the cytoplasm and nutrients, including auxins, cytokinin and amino acids. Golf course superintendents and turfgrass managers should favor seaweed products using physical cell burst technology.

There is now significant evidence that the physiological response from applications of seaweed extract often depends on the auxin to cytokinin ratio. It is important, therefore, that turfgrass managers focus on auxin to cytokinin ratios rather than just auxin or cytokinin content alone. **Products with claims of high cytokinin content may require the addition of other materials such as humic acids to raise the auxin level and restore this delicate balance.**



Brown Seaweed
Ascophyllum nodosum

AQM – BALANCED FOR PERFORMANCE

AQM is a highly refined liquid seaweed extract blended with a surfactant complex. It is formulated to provide the golf course superintendent with a nutritionally complete, biologically active supplement to be used in conjunction with proven turfgrass programs to:

- **Manage plant development**
- **Increase plant resistance to environmental and cultural stresses**
- **Improve water availability in the rootzone**

AQM – COMPONENTS

Many liquid seaweed products use an alkaline extraction process that can be highly destructive and denature the base material. The seaweed extract in the AQM product is produced from fresh *Ascophyllum nodosum* and is extracted using the much preferred physical cell burst technology that preserves the cytoplasm, auxins, cytokinins, nutrients and amino acids in their natural state.

Additional auxins have been added to AQM to promote a balanced auxin to cytokinin ratio and to enhance consistency.

A surfactant is included in the AQM formulation to enhance the availability of water to turfgrass roots to meet transpirational requirements, reduce water deficit stress and to supply the hydraulic basis for cytokinin transport (via transpiration).

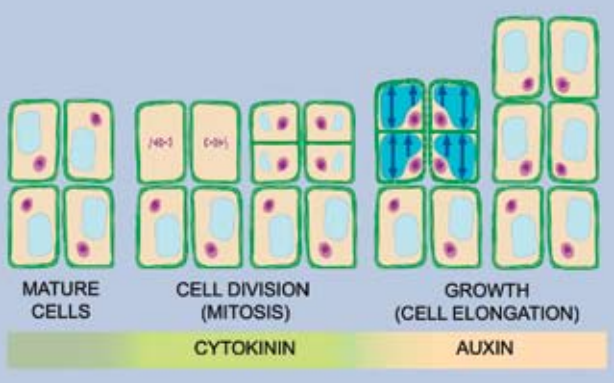
AQM – PERFORMANCE CHARACTERISTICS

Root Development

Many products claim that cytokinins in their seaweed extract product(s) promote root growth and root mass. Some even claim that the exceptionally high cytokinin content in their product is responsible for superior root growth and root mass versus their competition.

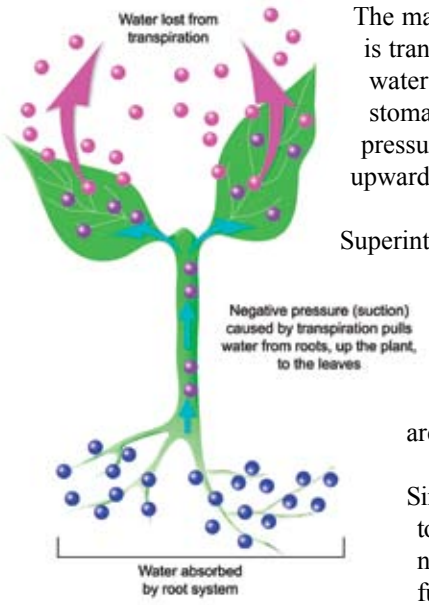
The influence of cytokinins and auxins on root development is often misunderstood. Cytokinin is often incorrectly singled out as the biostimulant that promotes root growth and root mass in turfgrass. Cytokinin only stimulates cell division (mitosis) in plant cells. **True growth in plant cells requires both cytokinin and auxin**. Auxins acidify the cell walls of divided cells and allow them to elongate as water enters the cells through osmosis. It is only at this point that root "growth" is realized. Further, auxin has been identified as the metabolic enhancer (biostimulant) that initiates the formation of lateral and secondary roots - increasing the root system's effective area of absorption.

Superintendents report that their use of AQM, with its balanced cytokinin to auxin ratios, resulted in significantly better overall root system development than the cytokinin-dominant formulations of competitive products.



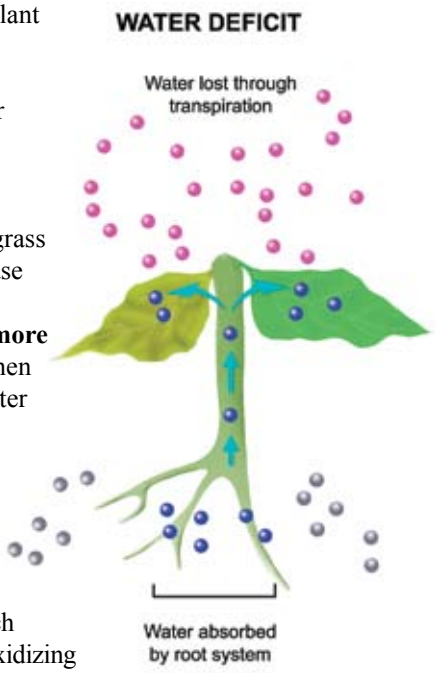
AQM – PERFORMANCE CHARACTERISTICS

Water Deficit Stress



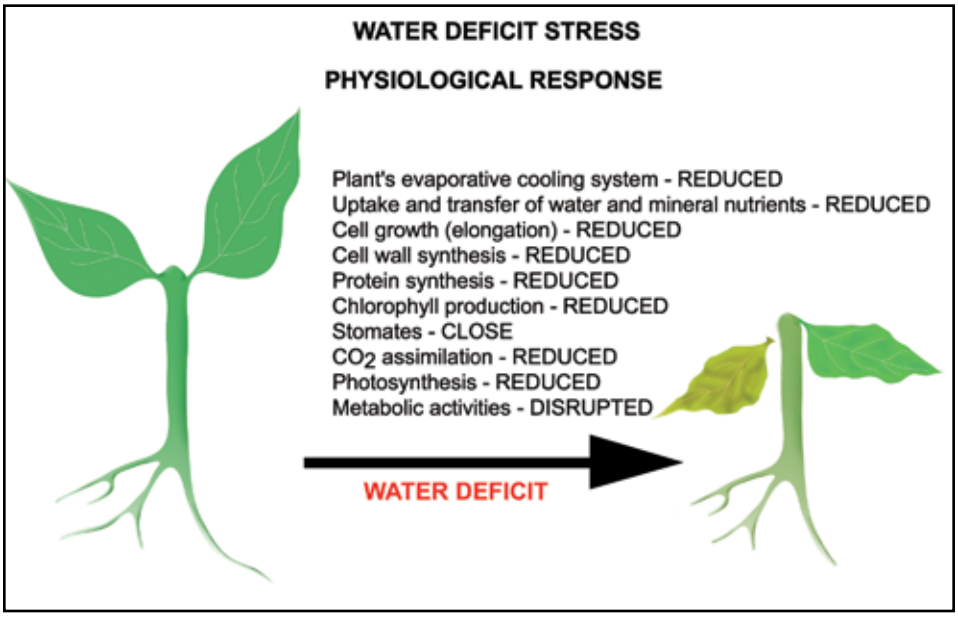
The main mechanism for water and mineral nutrient transport into a plant is transpiration of water from leaves. Transpiration is the process of water evaporation through specialized openings in the leaves, called stomata. Evaporation from the leaves creates a negative water vapor pressure (suction) and water absorbed by the root system is "pulled" upward and is transported to various parts of the plant.

Superintendents and turfgrass managers must constantly deal with turfgrass subject to stress from insects, weeds, nematodes, fungal disease and temperature extremes. However, **water deficit stress interferes with the normal functions of turfgrass plants more than any other stress factor**. Water deficit stress occurs when the roots' absorption ability and the soil's ability to supply water are insufficient to meet the transpirational demands of the plant.



Simply put, failure of the turfgrass root system to provide water to meet the transpirational requirements of the plant will prevent normal growth, limits photosynthesis and disrupts metabolic functions. Water deficit stress also exposes the plant to the production of reactive oxygen species (strong oxidizing agents) which can attack the photosynthetic apparatus. The plant's normal defense mechanism against these strong oxidizing agents is the production of antioxidants. However, antioxidant production is depressed under water deficit stress.

Extensive research has shown that turfgrass treated with cytokinins and auxins such as found in AQM, consistently enhanced antioxidant concentration, chlorophyll content, photosynthetic activity and conditioned the plant to improve its tolerance to environmental stresses.



Benefits of Surfactant Complex

With the use of AQM, the golf course superintendent will also address the issue of water availability to the plant. AQM balances the benefits of its seaweed extract component with a highly effective soil surfactant.

When AQM is applied to turfgrass, its surfactant components attach to the non-polar sites on hydrophobic soil particles to provide:

- **Uniform movement of water into and through the soil matrix**
- **Patterns of wetting and re-wetting that will improve the amount of water in the root's zone of absorption to meet transpirational and metabolic demands of the plant**
- **Long lasting surfactant activity**

AQM® Tougher Turf

- **ENCOURAGES ROOT DEVELOPMENT AND ROOT MASS**
- **PROVIDES RELIEF FROM WATER DEFICIT STRESS**
- **IMPROVES HYDRATION OF THE ROOT ZONE**
- **COST EFFECTIVE**

BALANCED FOR PERFORMANCE!
GUARANTEED FOR SATISFACTION!

AQM® Tougher Turf

AQM is a balanced formulation of highly refined, enriched seaweed extract and a technologically advanced surfactant complex to be used in conjunction with proven turfgrass programs to:

- **Encourage root development and root mass**
- **Provide relief from water deficit stress**
- **Improve hydration of the root zone**

We strongly believe that AQM should be applied to turfgrass as a supplemental application to sound agronomic practices. Unlike some seaweed extract products, the AQM formulation purposely does not include added "active ingredients" that may interfere, confuse, or mask results of either the AQM treatment(s) or a superintendent's successful fertilizer, micronutrient, pesticide and water management program(s).

DIRECTIONS FOR USE

ESTABLISHED TURFGRASS	FORMULATION	DIRECTIONS FOR USE
Root Development (Spring)	**Liquid**	Tank mix 3 oz. of AQM liquid in 1 to 2 gallons of water per 1,000 ft^2 (95 ml per 100 m^2 in 4 to 8 L). Apply every 15 to 30 days during periods where environmental conditions favor root growth and photosynthate production.
Water-Deficit Stress (Preconditioning)	**Liquid**	Tank mix 3 oz. of AQM liquid in 2 gallons of water per 1,000 ft^2 (95 ml per 100 m^2 in 8 L). Treatments should begin approximately 60 to 90 days prior to anticipated water-deficit stress to precondition turfgrass to tolerate stress conditions. Apply every 15 to 30 days.
Water-Deficit Stress (Stress Relief)	**Pellet**	Use AQM Pellets at the rate of one AQM pellet per 12,000 ft^2 (1,114 m^2) during environmental conditions that promote water-deficit stress. Apply every 15 to 30 days.
Root Development (Fall - Post Stress)	**Liquid**	Tank mix 3 oz. of AQM liquid in 2 gallons of water per 1,000 ft^2 (95 ml per 100 m^2 in 8 L). Treatments should begin following water-deficit stress period when environmental conditions favor root growth and photosynthate production. Apply every 15 to 30 days.

SOD INSTALLATION	FORMULATION	DIRECTIONS FOR USE
Root Development	**Liquid**	Tank mix 3 oz. of AQM liquid in 1 gallon of water per 1,000 ft^2 (95 ml per 100 m^2 in 4 L). Treat immediately after sod has been installed. Apply every 15 to 30 days.
Root Development	**Pellet**	Use AQM Pellets at the rate of one AQM pellet per 12,000 ft^2 (1,114 m^2). Treat immediately after sod has been installed. Apply every 15 to 30 days.

Money Back Guarantee

AQM Liquid and Pellet formulations come with a 100% money back guarantee. If you are not satisfied with AQM for any reason after application at recommended rates, your purchase price will be refunded in full.

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