GCSA Convention

SPEECHES

What Makes Plants Respond?

• Natural Selection Is A Continuing Process
• Growth Depends on Daily Temperature Changes
• Winter Weather Reduces Disease Potential
• Grasses Require High Sunlight Intensity

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Plants and, in fact, all living organisms, react to their environment in many ways. In a sense every change occurring in the life of a plant is a response to environment. Various factors such as light, temperature, water supply, nutrients and many more, act upon the genetic or hereditary background of the plant to induce specific responses.

Plants do not necessarily react in the same way to the same set of environmental conditions. Different species and varieties, or even different plants of a variety, will often react quite differently.

During the millions of years which have passed since plants first appeared on the earth many evolutionary changes within the plant kingdom have taken place. As geological changes occurred on the earth, plants were forced to make adaptive changes in order to survive under the conditions of their particular environment.

These adaptive changes were heritable; i.e. passed on from generation to generation and are still taking place today. It is incorrect to assume these changes occur purposefully. Instead, it is purely a matter of natural selection. Heritable changes occur frequently in all organism and in several different ways — through mutations, gene recombinations and interspecific hybridization, for example. Some few of these changes may have survival value, permitting the plant to grow and reproduce itself better than others under a given set of conditions. Plants having a genetic makeup not favorable for growth and reproduction under these same conditions will be quickly lost — at least after a few generations. This in simple words is evolution — Darwin's natural selection through survival of the fittest.

Rise of Grasses

It is through this process that our higher plants have arisen and our numerous genera, species and varieties developed. It is in this manner that our warm and cool season grasses have come into being. Natural selection should not be thought of as a process which occurred in the past and has now ended. It is dynamic, still taking place. Man, through his agricultural endeavors has added some interesting complications to this picture, both consciously and unconciously. The plant breeder selects naturally occurring heritable changes or manipulates his material by hybridization or induction of mutations to produce the changes he desires.

Supts. through turf management practices may be affecting a natural selection process. For example: Poa annua in greens is a big problem. Because they mow greens very closely, supts. are selecting types of poa peculiarly adapted to those conditions — types which would have poor survival value under most other conditions.

These are highly perennial, dense prostrate, sparse flowering and often even sterile strains. The perennial nature and prostrate growth habit are advantageous characteristics under these conditions. Low fertility is of little consequence. These strains are not able to compete with the taller growing heavy seed producing types in a different environment, as for example in a golf course rough.

Strong vs. Weak

This same selection process occurs with the highly variable seaside bent under putting green conditions. The mottled appearance, characteristic of old seaside, is caused by single plants, genetically better adapted to the particular environment of that green, spreading and overcoming the competition of more poorly adapted plants.

Can an individual plant, poorly adapted to an environment, itself become better adapted merely by being grown in this environment? For all practical purposes the answer is No. The genetic background of the plant will not be changed, hence it cannot become better adapted. There are such adaptations as the "hardening" of plants to cold or by changes in nutrition. But these are purely physiological changes in the plant tissue and of a temporary nature.

Let us look at some specific environmental responses, keeping in mind that the response of any given plant is predetermined by its genetic or hereditary constitution. One of the most obvious plant responses is that of growth to temperature. We all know that plants will not grow unless the weather is sufficiently warm. We also know that if it becomes too warm, growth will be slowed and eventually stopped.

Plants also have certain optimum temperatures, i.e., temperatures at which they will grow best. Why is heat necessary for plant growth? Heat is a form of energy which is necessary for the many chemical reactions and physiological changes which occur in the growing plant. For example, the rate of photosynthesis increases with increase in temperature to an optimum after which the rate declines. The rates of most chemical reactions increases with an increase in temperature, hence the rate of growth also increases.

Why growth rate declines as temperatures increase above the optimum is not thoroughly understood. It is in part a matter of the plant using the carbohydrate food supply more rapidly than it is able to synthesize it. It has been shown that the optimum temperature for photosynthesis is lower than the optimum for respiration. There may be actual destruction of certain complex organic chemicals in the chains of reactions bringing about growth, especially when temperatures are high enough to cause injury.

Aubrey Babson (l), president of the Northern Calif. GCSA, recently presented a check for $300 to John Madison, U. of California horticulture professor, to further the turf research work that is being carried on at the university.

Must Consider Range

The important concept to keep in mind is that various species and strains of plants do have rather specific and different minimum, optimum and maximum temperatures for growth. It is largely on this basis that we are able to delineate regions in which plants are adapted.

Many plants make their best growth under a rhythm of alternating day and night temperatures, rather than a constant temperature, day and night. This response has been called thermoperiodism. It has been shown that some plants make most of the growth at night and for these, at least, the night temperature is of critical importance.

Low temperatures are important in winter for the breaking of bud dormancy in some plants. Some of our cool season turf grasses, especially Kentucky blue, perform very poorly in Southern California, even in coastal areas. This poor performance occurs in spite of tempera-

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at planting time, one-half inch or more ought to be applied the first day. The upper three inches of soil should be kept moist. As the grass begins to take root frequency of the watering can be reduced and the amount of water per application increased.

Grass planted with a straight disc type planter needs fertilizer in the upper two inches of the soil. You should mix the fertilizer materials with the soil, but a light drag is best in order to avoid getting the mixture too deep. Frequent light applications of nitrogen fertilizers beginning one week to ten days after planting will hasten development. Quick acting fertilizers will give better results on newly planted grass.

How Plants Respond

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tures well within the favorable range for growth throughout most of the year. In contrast, in the Mojave Desert, where summer day temperatures may be very high, these grasses are much more dependable and satisfactory. Two climatic features of these areas may account for this rather surprising observation. First, diurnal temperature fluctuations are great in the desert, but of only a few degrees along the coast. The cool nights on the desert perhaps affect the growth responses of bluegrass much more than do the high day temperatures. Second, desert winter temperatures are low. Our studies and those of others indicate that cold temperatures stimulate the subsequent development of new bluegrass shoots, resulting in a denser sod. Thus we may have the maintenance of dense turf year after year on the desert but a gradual thinning of the turf in coastal areas.

Low Disease Potential

The third factor, not directly related to our subject, should be mentioned. Cold winter temperatures keep the disease inoculum potential at a lower level in the desert regions. Hence turf grown on the desert may not be ravaged by disease as quickly as in areas of milder climate. The low humidity of the desert is also, of course, a factor in keeping down disease incidence.

One other effect of cold winter temperatures is of considerable biological importance. This is a reaction called vernalization. Many of the cool season grasses, such as bluegrasses, fescues, bentgrasses and others will not flower and produce seed unless first given sufficient chilling. Within limits, the greater the chilling, the greater will be the later production of flowering shoots. Also to some extent, the deeper the cold, the shorter will be the required length of exposure time to the cold.

People in the bentgrass stolon production business might use vernalization knowledge to reduce production costs. By locating stolon production fields in areas of mild winters, the labor of seed stalk removal to prevent variety contamination might be greatly reduced, since fewer inflorescences will be produced.

Sunlight Factor

Sunlight is another feature of environment which we accept with very little thought even though it is absolutely necessary for the existence of any form of life. Two aspects of light in relation to plant growth and development will be discussed here. These are light intensity or the quantity of light at any given time, and duration or the length of the light period.

A measure of light intensity commonly used is the foot-candle. In these terms, full sunlight will range from 10,000 to 12,000 foot candles. Light is the source of energy for photosynthesis, the chemical process by which plants produce carbohydrates from water and air. Most plants have evolved leaf arrangements which can efficiently catch the available sunlight. Individual leaves may use only about 25 per cent of available sunlight but because one leaf will shade another, quite high light intensities may be required for maximum photosynthesis by the whole plant.

Need High Intensity Light

Grasses in general require high intensity light for maximum growth. Some of our turfgrasses, such as the so-called shade grasses, will produce satisfactory turf at lower light intensities than others.

From many observations we can estimate the minimum light requirements for satisfactory, if not good, turf as follows: Zoysia, red fescue and St. Augustine, 1500 f.c.; Bentgrasses and tall fescue, 2000 f.c; Kentucky bluegrass, 2000-2500 f.c. and Bermuda, 2500 or more f.c. These intensities will be adequate only at optimum growing temperatures. At higher temperatures the light requirement will be correspondingly higher. These grasses will grow at much lower light intensities but won't have the density required for turf.

Daylength or photoperiod, the duration of the light period, produces a number of highly important responses in many plants. One of the most important and intensively studied is that of flowering. Some species of plants flower only when the length of day is greater than a certain number of hours. These are called long-day plants. Others will flower only when the length of day is less than a certain critical number of hours. These are the short-day plants. Chrysanthemums and poinsettias are well known short-day plants. Petunias, clovers and potatoes are long-day plants. Some plants are day neutral. They will flower at any day length. The tomato is a good example of this group.

While we refer to this as a response to length of day, it has been shown experimentally that it is actually the length of night, the dark period, that triggers the flowering response. But this is not important and the term day length is in common use.

Most of our common turfgrasses are long-day plants — bluegrasses, fescues, bentgrasses and ryegrass, for example. At least one group, the zoysias, are short-day plants.

How Ruffner Makes Two-Way Sales Bid

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"Each year, more and more, famous name and quality brands are becoming available to pro shops. I can remember when you could buy only two or three brands. Now more and more companys are willing to sell to the pro. Several shoe manufacturers are trying to get into pro shops. One famous brand has turned over one complete line to pro shops on an exclusive basis."

Narrows Brand Choice

Ruffner has decided you can't have all the brands available, so it's advantageous for the pro to make up his mind on two or three of the best brands for the price, stick with them and forget the rest.

Another Ruffner belief, which has been profitable, is sticking close to the club in the winter.

"A pro who is around his club" he says, "only has to work an extra two months to pay for a three-month vacation.

"December has been my biggest month, merchandise-wise, every year since I've