SEPTEMBER 1973

USGA GREEN SECTION RECORD

A Publication on Turf Management
by the United States Golf Association

Flower Power
Before

After

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Cover photo-
Entrance to Lake Merced C.C., San Francisco where "Before and After" flower treatment by Chairman Ludwig and Superintendent Berardy makes the point.

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The Power of Flowers—

When Green Chairman M.S. Ludwig and Superintendent Ed Berardy turned on the flower power, there were no brown outs at Lake Merced Country Club, San Francisco.

Maybe They've Got Something There

by **CARL SCHWARTZKOPF,** Mid-Continent Agronomist, USGA Green Section

It wasn't long ago that "Flower Children" took up their stand on street corners selling flowers, saying that, "They will bring peace, joy and happiness into your life." Maybe they've got something there! Maybe you should give thought to flowers and how they could help brighten your golf course and your career.

As the member drives down the winding lane to the clubhouse and parking lot, he should be entering an environment of recreation and enjoyment, with the problems and pressures of the business world left behind. What better way is there to brighten up the driveway edge, the bare soil around the trees, the parking lot and the area around the clubhouse than with flowers? There are flowers of all types that can be planted for continual color and effect throughout the year. Here is one example of planning for continual bloom.

Planting Time	Bloom Time	Flower Types
Fall (September - November)	Spring (March - April)	Bulbs: Tulips, Crocuses, Daffodils, Hyacinths
Spring (April - June)	Summer (June to First Frost)	Annuals and Tender Perennials: Petunias, Geraniums, Coleus, Pansies, Snapdragons
Summer (May - July)	Fall	Chrysanthemums

Step plantings before and after at Lake Merced Country Club. BEFORE

To have flowers in the spring, it is necessary to plan and plant this fall. Flowering bulbs, such as tulips, hyacinths, daffodils, grape-hyacinths and crocuses, bring a welcome sign of spring after a long, gloomy winter. These bulbs must be planted in the fall while dormant. They will root immediately, if the soil is cool and moist. They are an explosion waiting to happen and it does when spring arrives. After flowering, leaves continue to grow for awhile, then wither. If not disturbed, the bulbs rest leafless through the summer until the cool temperatures of Autumn initiate new root growth.

After the first season of flowering, future flowering depends upon the care you give the bulbs. Basically, it is a matter of letting the leaves grow and manufacture food for the bulb. The leaves should not be cut off although they may be "bunched" or tied in an attractive manner to improve appearance.

SOME HELPFUL HINTS FOR GROWING BULBS:

1. Choose a site that has sunshine in the spring.
2. Soil should be moist when the bulbs are planted, or the roots may not initiate growth.
3. Fertilize in the spring, when the leaves are growing. Water when dry.
4. Yearly lifting and resetting of the bulbs is not essential. Usually, bulbs are left in the ground until they become crowded. They are dug after the foliage has withered in the late spring or early summer, sorted and reset in the fall.

Waiting for the foliage to wither while it is manufacturing food for the bulb often interrupts the planting of other annuals in the bed. Therefore many superintendents dig the bulbs after flowering. Although the leaves have not had sufficient time to manufacture food, they will still produce flowers the following year, although smaller and weaker ones. After the first year of flowering, some superintendents dig them up and give them to the ladies of the club. This is a thoughtful and point-making gesture.

TULIPS:

Of the many bulbs that can be planted in the fall for spring flowering, tulips are the most popular. In warm climates, it is necessary to store bulbs in a refrigerator for a period of four to six weeks prior to planting. Should the bulbs fail to receive adequate cold treatment, they will not flower. Tulips provide the most exciting and vivid colors of springtime. In addition, they vary considerably in shape, height and time of bloom. No wonder they are the most widely used of all the spring-flowering bulbs! For a wonderful long season of tulips, plant some of each of the general tulip types. Following is a list of types and the order of their flowering:

A) *Botanical.* As a general rule, these are very early (blooming with crocuses and the first daffodils); they are relatively small and suited for rockeries.

B) *Early Singles and Doubles.* These tulips bloom about the same time as the daffodils. They look like regular tulips, but have relatively shorter stems.

C) *Main Season.* Many types are within this group; some are fringed Parrots, egg-shaped Darwins, peony-flowered doubles, pointed-petaled lily flowered types, etc.

DAFFODILS:

Daffodils are not only one of the earliest and most delightful spring flowers, but also their bulbs are a remarkable permanent investment.

AFTER

They stay with you and multiply. Year after year they remain in the ground, increasing and producing more and more blooms with little care. Planting time is as early in the fall as you can obtain the bulbs. Their roots like to begin growth early. Soil must be moist at that time or roots won't grow, so water artificially if rainfall is inadequate. Bulbs planted too late in dry soil die during the winter. You can select daffodil varieties that bloom early, mid-season and late. Color choices include solid yellow, pure white and several combinations.

Remaining bulbs, such as crocuses and hyacinths, require the same cold treatment in warm regions as tulips and daffodils. As other bulbs, crocuses and hyacinths do better the following year if the leaves are allowed to die back naturally and require the same maintenance practices as tulips and daffodils.

SUMMER COLOR:

After the bulbs of spring have provided early color, it is time to turn your imagination to landscaping ideas that feature annual flowers. When it comes to brightening the area more beautifully with flowers, your imagination is the key. So, let it run a bit wild!

Just think of the many interesting and unusual ways you can use annuals. They can be planted in wooden containers, metal buckets (a good use for pesticide containers after they have been well cleaned and painted), tires, or even an old bath tub! Or you can be a bit more conventional, but no less imaginative, by planting annuals in flower beds, urns, patio or window boxes and in rock gardens.

Usually it is best to plant many of the same type and color annual flowers in one area, because they tend to look prettier in large groups or masses. Look around at what others are doing, especially the most successful local nurseries and arboretums.

There are literally hundreds of different flowers available for your landscape imagination to implement. They come in a wonderfully wide choice of colors, heights and shapes. Use them wisely—and widely—and let your landscaping with annuals add another dimension of beauty to the golf course.

Reliable and important annuals provide a good display of color over a relatively long season, up to six months in many parts of the country. In the northern regions of the United States, it would be difficult to achieve comparable continuity of color with hardy perennials. Since most annuals don't come into their own until late June or early July, it is helpful to precede them with spring bulbs for earlier color.

CULTURAL TIPS FOR ANNUALS:

Sun versus Shade—Although the list of reliable bedding plants is long, nearly all of them perform best in full sun. Fortunately however, there are some plants that require light to moderate shade. These include the impatiens, fiberous and tuberous begonias, coleus, lobelia and exacum. Certain other annuals can be grown in light shade (although they ordinarily perform better in full sun): petunias, alyssum, annual phlox, salvia, snapdragons, verbena, aster, periwinkles and pinks.

Soil Preparation—Although bedding annuals are easy to grow, as with all ornamentals, you should not take any shortcuts in preparing the soil. Spade or cultivate the area deeply, preferably the previous fall, working in generous amounts of organic matter, such as leafmold, peat moss or compost. Leave it rough during the winter. Then till, level, and rake the bed smooth a week before planting. At the same time, incorporate peat moss, fertilizer and lime

as needed. Also provide adequate drainage. Should it be a problem, remedy with tile, channels or by elevating the beds a few inches above the surrounding area.

The chances of success with flowering annuals are far greater if the soil has good physical structure; that is loose, friable, well aerated, with high humus content. Overpulverizing the soil, either by hand or with a rototiller, can destroy soil structure.

Fertilization—There is a bit of truth in the old saying that, "Any soil capable of growing good weeds will also grow good annuals." However, a plant grown in soil that has been properly and judiciously fertilized will grow better flowers.

While adequate amounts of phosphorus (P) and potassium (K) in the soil are essential, "caution" is the word with nitrogen (N). If in doubt, have soil tests made, then plan a fertilizer program accordingly. Many annuals bloom best with rather low amounts of nitrogen in the soil. When excess nitrogen is applied, lush foliage, tall stems, and few flowers will be produced. The soil pH should be near neutral (6.5 - 7.5); therefore, do not apply lime unless needed, as indicated by soil tests.

When cultivating the beds in the spring, incorporate a complete dry fertilizer, such as 5-10-5 or 6-10-4, into the soil. Use ½ to 2½ pounds per 1,000 square feet, depending upon the soil test results. Should the nitrogen level be extremely low, use the larger amount. Later in the spring or early summer, more fertilizer can be applied if the nature of growth indicates a need for it. Or, it may be more convenient to inject a fertilizer solution into the water line, thus fertilizing as you water.

Allowing fertilizer to be carelessly scattered over portions of the flower beds when adjacent turf areas are fertilized can lead to difficulties. Also, if nitrogen washes into the beds with drainage water from a lawn area that has been recently fertilized, anticipate some effect on the growth of the flowers.

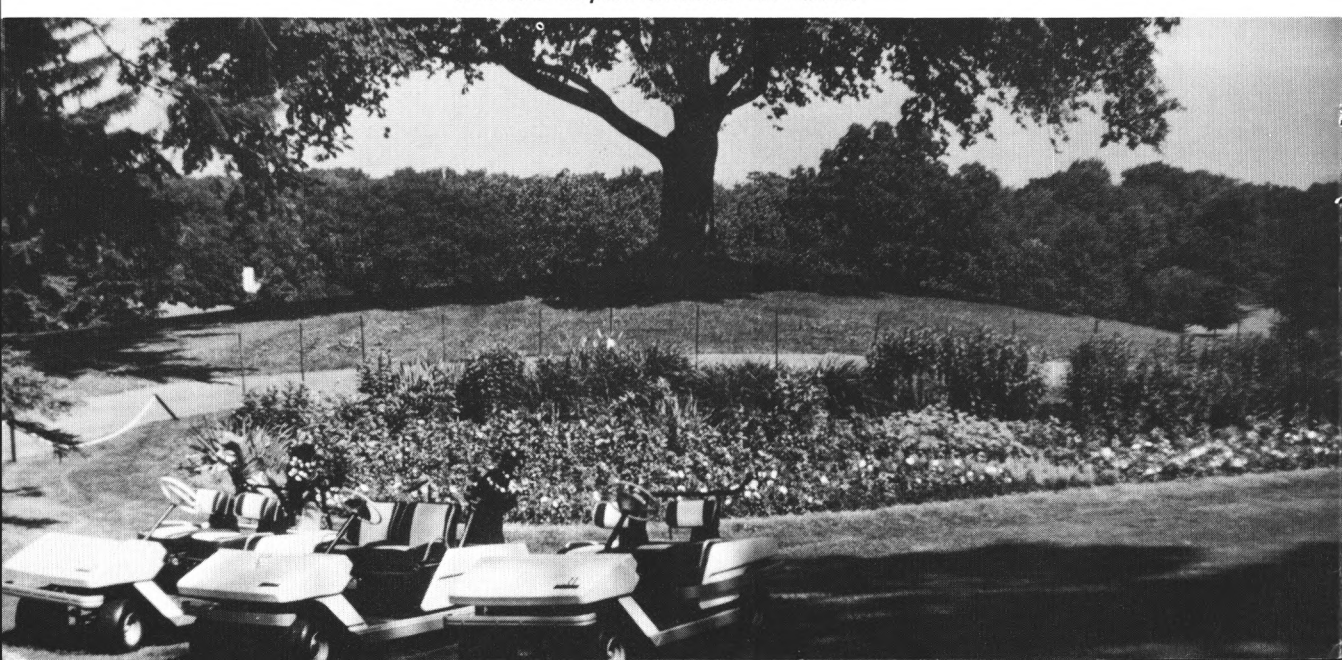
Watering—If there are any real secrets for success in growing annuals, proper watering is certainly one of them. Water should be applied slowly and for a sufficiently long period so that it can penetrate the soil and soak down through the root zone, perhaps 8 to 12 inches. Once this has been accomplished, don't water again until the soil is on the dry side. However, don't wait until you see wilting; wilting never benefited any plant.

Frequent light waterings result in a shallow root structure. In this situation, plants wilt rather quickly on hot, dry days. If insufficient applications of water continue, you needlessly get yourself in a vicious circle that is difficult to break. Plants should have extensive root systems, so they are able to reach the moisture reserve deep down in the soil during periods of drought.

One hears many arguments among flower fanciers about the proper time of day to water. It is true that water loss from evaporation will be greatest during the heat of the day. However, watering during the evening or night may encourage foliar disease. Therefore, watering early enough in the day so that the foliage has an opportunity to dry before nightfull is advisable.

General Maintenance Practices:—Aside from the previous points, annuals require little other care. The young plants should be pinched back shortly after planting. A second pinch is rarely needed. It is generally not necessary to remove the old flower heads, unless they are taken off

The first tee at Bloomfield Hills Country Club, Michigan literally blooms thanks to the efforts of Superintendent Ken Farrer.



To brighten the entrance to Knollwood Club, Lake Forest, Ill., Superintendent James Bertoni uses tulips with great effect.

because of unsightliness. Some types of annuals may fail to re-bloom satisfactorily unless the seedheads or spikes are removed; the snapdragon is an example.

The petunia is one plant that may require some extra attention. Some varieties tend to become open-centered, rangy or matted down in the summer. When petunias reach this stage, pruning back will rejuvenate them for an improved appearance in late summer and fall. The stems should be cut back 8 to 12 inches from the base. This can be done all at once, or a few stems at a time, so that there is not a drastic disruption of flowering. Surprisingly, in a short time new shoot growth will occur, along with a fine showing of blooms.

Some annuals need support or staking; these include the taller snapdragons, the tall African marigolds, etc.

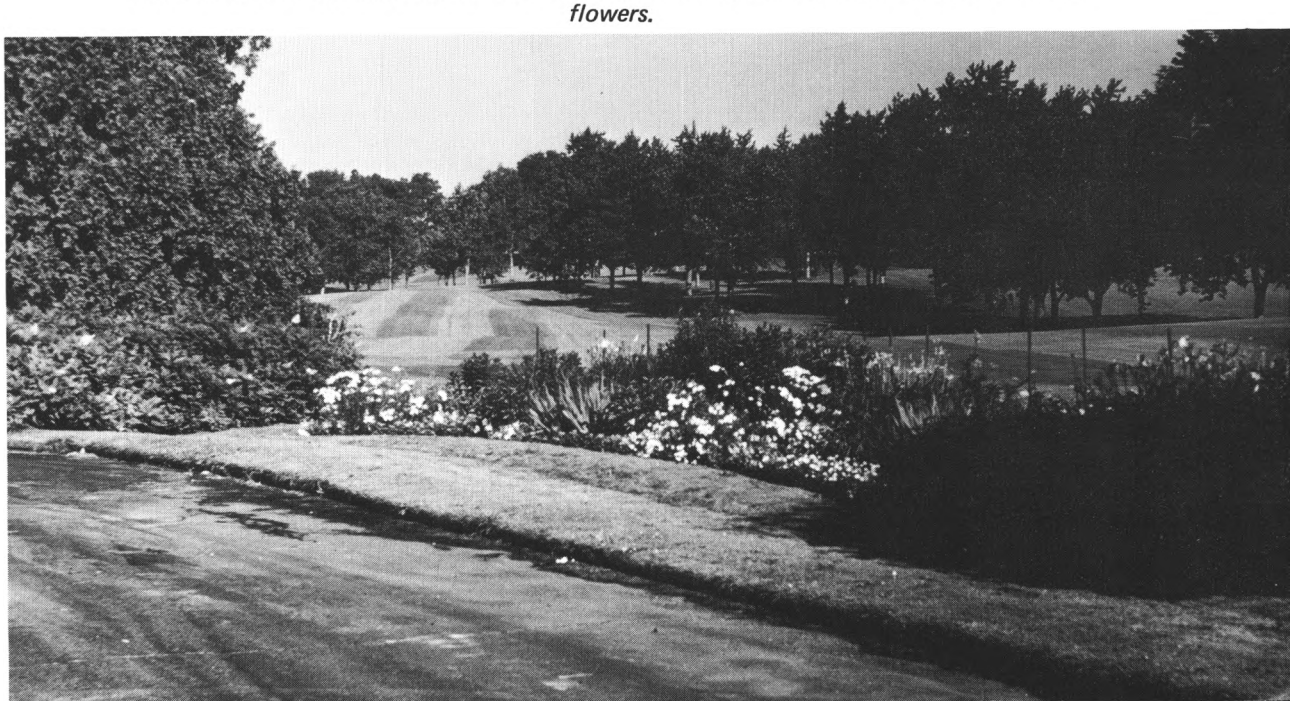
The aforementioned cultural practices will have to be adapted and modified according to the climatic and geographical area in which the plants are grown.

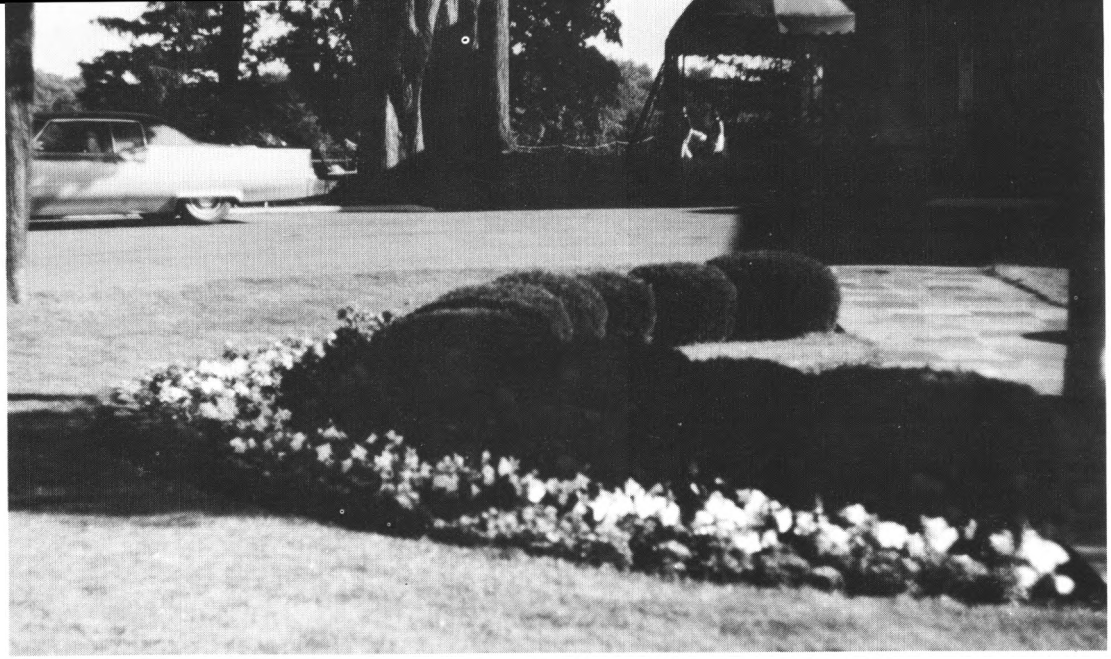
CHRYSANTHEMUMS FOR A COLORFUL FALL:

Beautiful fall color around the golf course can be successfully achieved by planting chrysanthemums in late spring. Fall mums must be started in May in Northern areas.

Remember, the mums need plenty of sun. Find just the right spot for them, and have

Another area of the Bloomfield Hills Country Club that has been enhanced by the use of flowers.





An attractive border of petunias sets off shrubbing around the club house.

cuttings 4 inches high, with strong stems and 1-inch roots ready to plant.

First, soak each cutting in water five minutes before planting, or until the foliage is firm. Dig a hole one inch deeper and wider than the roots. After cutting has been set, firm the roots by pushing the soil toward the stem. Then water heavily and immediately after planting; also check for wilt on sunny days.

It is advisable that the cuttings be planted 18 to 24 inches apart because the mums will fill in the empty spaces as they grow. Spacing also helps to cut down the danger of spreading leaf diseases, should they occur.

During the summer, water to a depth of 4 inches, but avoid wetting the plants. Should the stems droop, tie the plants loosely to a stake, forming a figure 8 with the string.

Also, unless the branches are pinched, the mums tend to grow straight and tall, with few flowers. Pinching back the growing tips allows other branches to form and this results in a bushier plant. Pinch the growing tip each time it has added four to six inches to the total plant height, but only pinch off one half inch to one inch of the new growth.

Start cultivating the soil during the week after the plants are set out and continue this every week. Be careful not to damage the roots. Should it be difficult to cultivate, use a mulch. Mulch when the soil is moist and all the growing weeds have been removed. Dried grass clippings applied in a 1- or 2-inch layer have been helpful in discouraging weeds.

In order to make the plants look better and to minimize the disease possibility, clip off the faded and old flowers.

To prepare the plants for winter, cut them back three to four inches when the flowers and foliage start turning brown. After the top several inches of soil freezes, apply a straw mulch three to four inches deep.

In the spring, remove half the mulch and loosen the remainder, but don't take the rest of the mulch off until sometime in early May.

If mums are already planted and you want to divide them, early spring is the time to do it. When the growth is about 1½ inches tall, dig up the plant. Shake off moist soil and cut off the side shoots with roots attached to the main clump. Then, replant the separate plants as you would new plants.

To divide the plant by taking cuttings becomes a bit more complicated. Use a soft downstem cutting, which can be taken until mid-July. Cuttings should be rooted in a clean, shallow flat or box with sand and peat moss that is covered with a plastic bag. It takes three to four weeks for cuttings to root by this method.

These suggested cultural practices for mums are general rules to follow and will have to be adapted and modified for your particular part of the country.

JUST A LITTLE PLANNING:

With a little planning before planting, it is possible to have flowers brighten many areas of the golf course throughout most of the playing season in the Northern regions of the country. In the Southern and warmer sections, continual color can also be achieved year around by selecting appropriate plant materials. Brighten your life a little!

Drought Stress on Turf

by **R.E. SCHMIDT** Associate Professor of Agronomy,
Virginia Polytechnic Institute and State University

Drought is a water stress that diminishes plant turgor causing wilting (a symptom of drought) that limits or prevents plants from normal growth. The degree of drought injury (and wilting) depends upon the growing medium (soil), plant, and atmospheric factors. One aspect cannot be studied alone; all must be considered simultaneously.

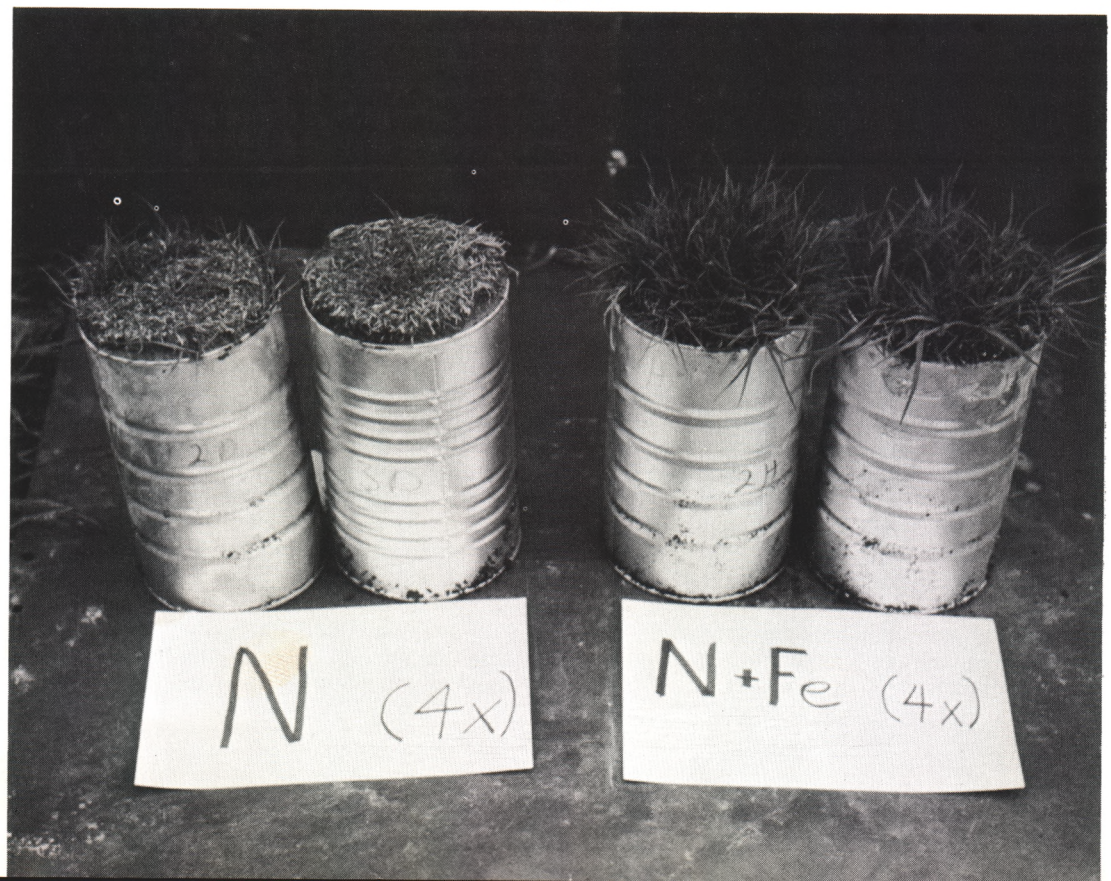
When dealing with the phenomenon of wilting, we are in essence dealing with availability of medium-water (soil-water) to the plant. Hypotheses concerning the availability of soil-water to the plant are: 1) soil water is equally available to the plant from field capacity to permanent wilting point; 2) soil water availability to the plant gradually decreases as soil moisture decreases from field capacity to permanent wilting point; and 3) is a compromise that attempts to divide the available range of soil-water into readily available and decreasingly available.

Although all of these theories were based on research and observation, none can describe the entire dynamic array of the soil-water-atmosphere phenomena.

The more recent view of soil-plant-water relation is a concept of a unified and dynamic system. The amount and rate of water uptake is affected by the roots' absorption ability and the soil's ability to supply water at a rate sufficient to meet the transpiration requirements. Water availability to plants is dependent upon physical aspects of soil, plant, and atmosphere. In this soil-plant-atmosphere continuum, water flow occurs from wet to dry throughout the soil, plant and atmosphere continuously.

Flow encompasses the water transportation through the soil to the roots, absorption by the roots, movement to the leaves, evaporation in the intercellular air spaces of the leaves and vapor diffusion through the stomatal cavities to the air boundary to the external atmosphere.

Frequent late fall chelated iron (Fe) fertilization off-sets winter dessication effects on bentgrass.



Water movement occurs along a path of increasing suction (decreasing potential energy). Not only the water content and potential soil-water but also the flow rate of the soil influence the water supply to the plant. The water flow in the various parts of the system is proportional to the resistance of flow. Factors such as soil aeration and nutrients and plant age and genetics, as well as meteorological factors, can influence resistance to flow.

Resistance to flow is generally greater in the soil than in the plant, and greatest in the transition from leaves to the atmosphere, where water changes from liquid to vapor.

In the soil-plant-atmosphere continuum concept the resistance to flow may by analogy be compared to electrical current passing through a stress of variable resistors. The resistance is variable because hydraulic conductivity varies with fluxation of soil wetness and because roots change their density. In the plant resistance is also variable. Stomatal apertures vary with changing leaf water potential. The atmospheric boundary layer may also vary its resistance as humidity, temperature, and wind velocity change.

SOIL MOISTURE

When soil moisture decreases, soil water suction increases; thus the plant water suction must increase to obtain water from the soil. As water uptake increases and soil water decreases, plants will wilt at higher soil moisture levels. If plant-water suction is less than soil-water suction, the roots will not take up water and desiccation will commence. This principle may apply to dry or frozen soil, because both will have very high soil-water suction.

As the soil dries near the root zone a soil-water suction gradient develops and water will move from the wetter to the drier area. Plant wilting depends upon whether the plant can increase root-water suction or root density, and whether the soil-water moves toward the root fast enough to compensate for the plant water loss to the atmosphere.

Decreasing water in a sandy soil has little influence on plant response until a critical point, then wilting takes place. In clay soils, suction increases gradually with decreasing water content. At any particular suction, clay soils retain more moisture than sandy soils. The hydraulic conductivity of clay soils tends to be larger than sandy soils.

Changes in transpiration rate will not affect the wilting point of plants grown in sandy soils but may in clay soils. In clay soils wilting occurs at higher soil moistures than in sandy soils as water uptake increases. Thus, both suction and wetness at wilting are affected by water uptake. A clay soil can maintain a higher rate of transpiration larger than a sandy soil since both its water content and hydraulic conductivity are generally higher.

PLANT RESPONSE TO WATER STRESS

Through evolution, many of the grasses we use for fine turf have developed a capacity to survive droughts. Most grasses have features such as closing or reducing stomata apertures, rolling of leaves, or increasing cuticle thickness to resist transpiration losses when water stress is initiated.

Some grasses must go dormant (only buds, crown or rhizomes survive) to persist. At the same time other grasses will remain green and grow because they have root systems that are able to obtain enough moisture to satisfy their transpiration needs. The fescues, bermudagrasses and zoysiagrass are some of the most drought hardy turfgrasses, while the bluegrasses are moderate and the creeping bentgrasses are poor.

PHYSIOLOGY OF WATER DEFICITS

When plants are subjected to drought, protoplasmic viscosity generally increases and metabolite breakdown. The hydrolysis of starch and protein increases during desiccation. In drought (and frost), the water level decreases within the tissue and osmotic and matric potential becomes more negative. It appears that in drying, the water is absorbed in the hydrating matrix, especially protein, thus reducing enzymatic activity. It has been proposed that enzymes cease activity (especially during freezing) when the water layer around protein molecules desiccates and permits sulfhydryl groups to contact each other and form disulfide linkages.

Plant response to water deficits may be altered with water management. It has been shown that under water stress roots may increase to a larger extent than tops. This may be explained on the basis that free energy of water in the roots exceed that in the tops. Therefore, more water is available for cell elongation in the roots than the tops. This condition prevails regardless of water stress. However, during water stress a large portion of the carbohydrates are transported to the roots where they can enhance root growth. From this it appears that a limited water-stress at critical times may actually increase resistance to drought stress.

Generally, low nitrogen and high phosphorous fertilization may increase drought resistance. In Virginia we have found late fall

Effect of early May drying on the Virginia Tech experimental green. The plot (on right) containing 80 per cent coarse to medium sand has smaller water porisity than the plot containing 50 per cent coarse to medium sand (on left). These soils require different water managements.

nitrogen fertilization stimulates root development but also increases winter desiccation of creeping bentgrass. This increase of desiccation, however, may be offset with iron fertilization. Therefore, in this area we are better able to withstand summer droughts when fertilization is properly managed to develop deep root systems.

METEOROLOGICAL FACTORS

As has been mentioned previously, transpiration rate is dependent upon the water potential (water vapor) gradient between the stomate cavity and the atmosphere as well as the resistance of water flow.

The gradient in pressure of water vapor is determined to a large extent by the thickness of the boundary layer between the leaf and the atmosphere. The thinner the boundary layer the larger the transfer of water vapor (or heat convection). Since the boundary layer becomes thinner as wind increases and the boundary layer is thinnest for small leaves, small leaves in high wind will generally have high water vapor transfer to the atmosphere.

The vapor pressure (potential humidity) is a function of temperature. As temperature increases there is an increase in vapor pressure deficit (the difference between actual vapor pressure and the potential vapor pressure). If we assume that the leaf is saturated with water vapor and the leaf temperature is higher than the air temperature and the leaf holds much more water vapor than the air, the loss of leaf water will then be rapid. Here we can see that transpiration (and possibly wilting) will occur if the air has lower relative humidity (actual humidity compared to potential humidity) than the leaf or if the leaf has a higher temperature than the surrounding air even if both the leaf and air are vapor saturated.

Another factor that will influence the transpiration rate is the substances dissolved in the cell-wall water which influence the tension with which water is held in the plant. Our current studies indicate that fertilization may affect this phenomenon.

In addition, the stomatal aperture is variable and is nature's way of changing transpiration rates to benefit the plant under varying environmental conditions.

RELATION OF SOIL MOISTURE AND TRANSPIRATION

A plant canopy that completely covers the soil will approach maximum transpiration rate if meteorological factors are correct and the soil has a high water content. However, as the soil dries, the leaf-water potential results in closure of the stomates and increases resistance to water transfer to the atmosphere.

SOME PREVENTIONS TO MINIMIZE DROUGHT STRESS OF TURF

Since most drought stresses may be directly related to soil-water potential, it seems fitting that prevention to reduce drought begins with the soil. Where possible, steep slopes that are conducive to rapid water run-off and consequently low water infiltration should be eliminated as much as possible. Also, it is important that adequate internal soil drainage be provided. When gravitational water is not permitted to escape, or exceptionally high water tables exist, roots are prevented from growing deep and are readily subjected to drought stress.

When modifying soils for specialized turf areas, such as golf putting greens, the tendency is to use large quantities of sand to prevent compaction. In some cases sand is used exclusively. These soils, of course, will not maintain as long a duration of transpiration as one that contains adequate clay or organic matter.

Drought resistant species should predominate on turf areas that will receive no supplemental irrigation. For example, the fescues will tolerate drought stress better than Kentucky bluegrass, and either of these species will tolerate drought better than creeping bentgrass.

Shaded areas should be considered as drought susceptible areas, especially under trees. The trees, in addition to reducing the light the grasses intercept, which limits photosynthesis and consequently lowers the turf root depth, will also utilize water, thus creating a soil with a high water suction.

Fertilizer schedules should be employed to enhance root depth. Cool season grass roots are mainly formed in April and early May. Excess nitrogen nutrition should be avoided immediately prior to or during this period. Fertilization with nitrogen at this time will stimulate top growth, utilize the reserve carbohydrates and limit root development. Subsequently grasses that develop shallow root systems in the spring will be most drought stress prone in the summer.

Grasses, such as creeping bentgrass, that need more moisture than the normal precipitation provides will need to be irrigated. To reduce drought stress, prudent water management must be exercised.

Frequent watering, especially when roots are developing, will prevent good gas exchange between the soil and the atmosphere which limits root development. Also, this will produce grasses with large cells and large air space between the cells which are relatively less drought hardy.

During periods when transpiration rate is low (spring), a limited restriction of irrigation frequency may induce better drought hardiness. Inducing moderate soil water suction at these periods will limit foliar growth, decrease cell size and enhance root development, all of which increases drought resistance and hardiness.

Restricting watering during periods of high transpiration (summer) may increase soil-water suction to the point that roots will be irreversibly damaged. However, frequent irrigations, light or heavy, should be avoided as much as possible since this practice limits gas exchange in the soil.

This is especially true if the irrigation system must be shut down during the winter. There is good evidence that a heavy irrigation in the late fall will help prevent desiccation during the winter.

As has been previously pointed out, wilt can occur during periods of high transpiration even though the soil may be saturated. This wilting may be prevented by syringing. Syringing should not be confused with light irrigation. When syringing, only enough water should be applied to wet the grass leaves and provide a cooling effect when the water evaporates.

Thatch build up that limits water infiltration into the soil thus increases drought stress. Periodic aeration, vertical mowing and soil topdressing will reduce thatch and subsequently improve soil moisture. Also, the practice of aeration eliminates the effects of compaction that demeans water infiltration.

Establishing wind breaks in critical areas, applying mulches, such as straw and wood cellulose fiber, on new seedings, and installing protective winter cover will reduce the transpiration rates and limit drought stress.

The simple practice of adjusting the mowing height will reduce drought stress. By raising the mower in the spring, more leaf area is permitted to remain. This increase in photosynthetic producing material will increase the plant carbohydrates and produce a deeper root system. By maintaining a high mowing height in the summer, a better insulation layer is provided to reduce the transpiration rate.

Prevention of insect damage (such as white grub infestation), elimination of disease, and proper use of pesticides could also reduce the ill effects of drought.

Ideal conditions for a sod farm—flat, open and organic soil.

To Sod or Seed?—That Is the Question

by **WILLIAM G. BUCHANAN,** Eastern Agronomist, USGA Green Section

With the fading of summer and the sun setting earlier in the West, thoughts turn to the work of fall. There are many chores that have to be done and re-establishing a turf cover on worn and bare areas is one of them. But then, this chore is not limited to the fall alone, even though it is an ideal time for it.

Courses throughout the country have either experienced the loss of turf or will experience this travesty at some time or another. Turf loss can result from many causes, but to the golfer, the cause is not nearly as important as how soon the turf can be replaced and be made playable again. This leaves the superintendent and green committee with two choices; either seed or sod the area.

Sod has many advantages in areas where traffic and maintenance is kept to a minimum. However, on areas with heavy traffic and maintenance such as greens and tees, the decision to sod should be made very carefully.

In recent years, the sod industry has grown by leaps and bounds. This rapid growth has made it necessary for a sod certification program to be initiated by many states. The certification program encourages the sod grower to produce a higher quality sod by using a higher quality seed. The production of certified sod is essential for golf course use. Superintendents should no more purchase a sod that is not certified than purchase seed that is not certified.

Golf courses should be very cautious. The choice of a turfgrass variety should be made clear when discussing the purchase. Many times in the past, a variety selection has been made at the nursery and the sod has been quite contaminated with several varieties of turfgrasses upon arrival.

When considering purchasing sod, it is wise to know something about the maintenance practices being followed by the nursery. Keep in mind that these establishments have to grow sod quickly, because the more crops produced

the more revenue received. The sod grower must be cost conscious and, for a moment, let's look at his viewpoint.

The first consideration for the grower is the land. It must be relatively flat, free from rock, trees and other debris that would hinder the harvesting of the crop. Also of great importance is the type of soil on the land. The first choice for a sod grower would probably be a high organic soil, like a peat or muck soil, because these soils have a lower specific gravity and therefore the shipping costs would be cut. A turf will generally develop and mature faster on an organic soil than on a mineral soil. Generally, a sod can be developed in 12 to 18 months on an organic soil, whereas it would normally take 18 to 24 months on a mineral soil. There have been, of course, some sods developed on organic soil as quickly as three months, but these cases are more the exception than the rule.

The second consideration of the sod grower is water. He must have a good supply for the grass plant.

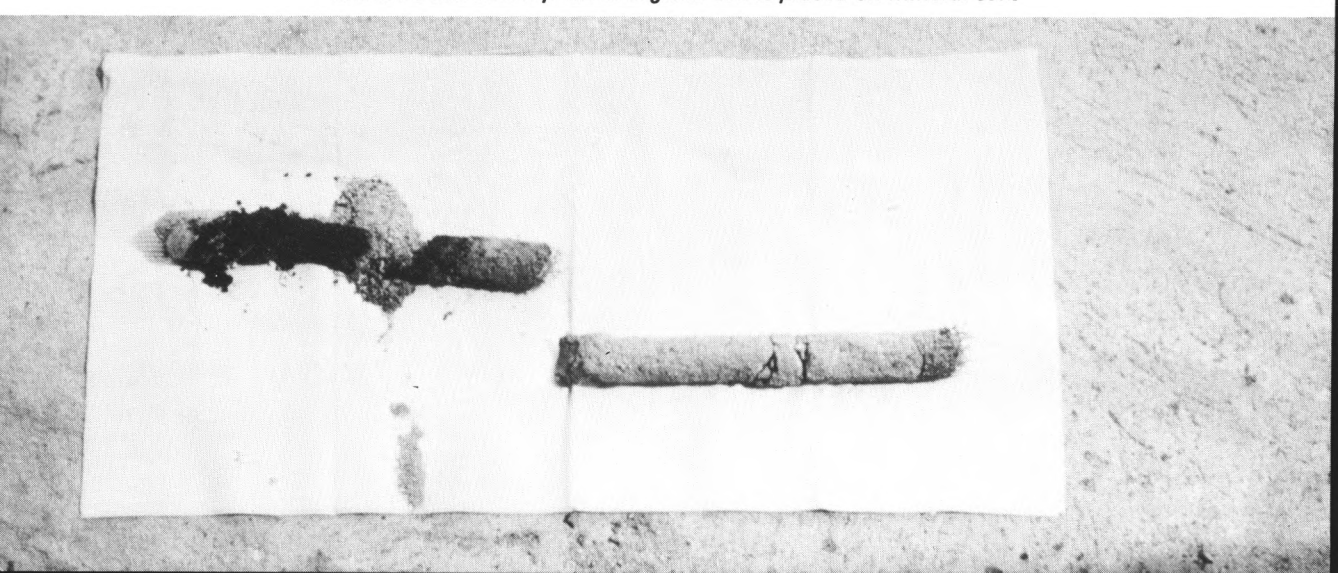
The third consideration is probably what varieties of grasses to grow to satisfy the market. In most cases, the largest share of the market is the homeowner. Now keep in mind that you are purchasing sod to be used on a golf course, not on a home lawn. As you have probably told some member at one time or another, conditions on a golf course are not quite the same as on a home lawn.

Since the sod is for golf use, the specific variety of grass is important. A variety of bluegrass, bentgrass or bermudagrass may fill the bill. But the golf superintendent must be more selective than the home owner and therefore, his choice of sod nurseries will be more or less limited. Once a nursery is found that grows his type of sod, the superintendent must consider the quality of the sod and the soil upon which it has been grown. As mentioned earlier, the sod grower has to consider his costs, because although he wants to have a good-looking sod, he also wants to produce it as economically as possible. A way to do this is to mow at a relatively high height of cut and to apply a high rate of nitrogen and water to make a lush growth and a green appearance. These are acceptable practices for a sod producer, but on a golf course, consideration has to be given to a strong, healthy turf that can withstand heat and traffic stresses. Lush turf cannot do this for extended periods. When the sod is received, the grass will be clipped to the height you requested. However, the grass will be in a weakened condition because of the rapid change of clipping height and the fact that it has been transplanted.

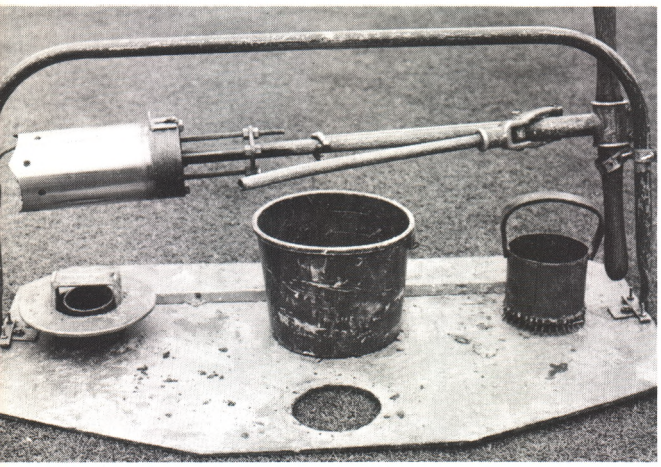
Careful consideration should also be given to the differences in soil types the nursery has and the soil on your course. Experience tells us that a sod grown on organic soil and placed on a mineral soil has difficulty becoming established. The root systems of the plants do not make the transition easily. The reason is that the organic soil will retain moisture longer than the mineral soil, and as long as the organic soil has a supply of water, the roots will not go to the mineral soil in search of water.

The considerations about the soil should be the most important factor in determining whether a particular sod should be used. If the soil types are not alike, then seeding would be the best decision. Perhaps the best solution to the "Sod or Seed" problem is for each golf course to grow its own sod. A good nursery is a very good "insurance policy" for any club. The area that is designated to grow sod for greens should have the same soil mix as the green and it should be maintained exactly like the greens. A nursery is best located near the maintenance building if possible but, where space is limited, any area, even part of the rough, will do for your own "sod farm insurance policy." Like any insurance policy, it must be established well in advance of the actual need. And this fall is an ideal time to do it.

Troubles can develop when organic sod is placed on mineral soil.



A TURF TIP FROM *RAY:*



Ray Markum, Superintendent of Pleasant Valley Country Club, Little Rock, Arkansas has developed a most ingenious cup changing kit! The ¼ inch metal base prevents the edge of the new hole from being raised and also reduces spilling of soil onto the green. The container in the middle holds the soil and cup puller. The small cylinder on the right has slanted metal stapes or prongs to help close the slit around the soil core at the old cup location. Ray says it's light, easy to carry and better cup cutting results.

Your USGA Green Section Research Money Going to Work!

From left to right: Alexander M. Radko, National Research Director, Dr. Steve Lund, Department Chairman and Dr. C. Reed Funk, Research Professor in Turfgrass Breeding, Department of Soils & Crops, Rutgers University examine U.S.G.A. Green Section Research and Education Fund, Inc. check in support of Dr. Funk's breeding work designed to produce better fairway grasses, especially Kentucky bluegrasses that thrive under close fairway cut.

USGA GREEN SECTION RECORD
SEPTEMBER, 1973

TURF TWISTERS

AVOIDING COMPLICATIONS

Question: Last fall an application of lime was made to our fairways. We waited a few days before applying a fertilizer. The grass plant then became weak and, in some areas, failed to survive. What happened? (Michigan)

Answer: At least one week must elapse between applying hydrated lime and a fertilizer containing nitrogen in the form of ammonia. When the two are mixed, they react instantly to form and release free ammonia gas. Free ammonia gas is very toxic to grass. Next time use ground limestone, especially the dolomitic type. It is safer and the rate of reaction is slower. However, still allow a week between applications to avoid complications.

HE NEW RYEGRASSES

Question: I read and hear a lot about the new, improved perennial ryegrasses *(Lolium perenne).* What have your observations been? (Arizona)

Answer: All good to-date! We have seen Pennfine, Manhattan and the Medalist types and there is much to be enthusiastic about. They seem to take traffic exceedingly well (wear areas near tees, greens, etc.), seem to tolerate at least a 3/4-inch cutting height where needed, have some shade tolerance and apparently a fairly wide soil moisture and temperature range. In some areas, they're also making a permanent (3 yrs. to-date) compatible warm season-cool season turf combination with common bermudagrass.

EGARDING THATCH

Question: Everyone talks about thatch, but I've never really heard a precise definition of the word as it relates to turf-grass management. Can you give me one? (Washington)

Answer: "Thatch," as defined by the Turfgrass and Crop Terminology Committee of the American Society of Agronomy is, "a tightly intermingled layer of living and dead stems, leaves, and roots of grass, which develops between the layer of green vegetation and the soil surface." Hope that helps!