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Lawns and Ground Covers in Landscape Design

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1. Introduction

It is well known that the lawn is one of the basic elements of garden designs, linking together all the other planting trees, shrubs, flowers into a harmonies whole. However, a beautiful lawn has an emotional appeal that can be translated into spiritual comforts. Hence, the lawn typically offers peace and serenity, and an escape from the glare and hard surfaces of sidewalks.

In suitable growing conditions, the grasses are one of the well lawn covering materials due to uniform in color and texture, soft and resilient, easy to take care of. In many areas, grasses can provide a surface that maintenance frees than paving. They can be walked on, sat on and used for many outdoor activities and sport activities such as; football, soccer, volleyball and related practices. However, although the green of a lawn is usually grass, but not necessarily that.

It is also well established that the lawns can be made of almost any plant that spreads fairly to cover the ground, and in certain places ground covers other than grass are very popular, either as grass substitutes, or as companions for grass, to provide visual variety. However, despite the importance of the non-grass of ground covers, grass continues to be one of the favorite in open spaces and gardens. Hence, the leaves of the grasses are different in form and behavior from those of many other plants. They can grow from stem joints, first in one direction, then in another, and each leaf is divided into distinct parts. Moreover, many grasses flower in great clusters and individual flowers of which the clusters are composed are having neither fragrance nor bright color because these insect attracting characteristics are not needed. Grasses can be pollinated either by the wind or self-pollinating with their own seeds. A few-notably the bluegrasses often develop without fertilization and are able to reproduce either sexually or by a kind of self-pollination.

A fine lawn directly influences on suburban landscape practices that other ground covers have usually not considered. However, no other ground cover is as durable underfoot as a

grass lawn, or produces as satisfying a sense of orderliness. For a while, tufted grasses and bushes as well as a multitude of hybrids that plant breeders have developed over the years. In Figure 1, typical lawn and woody plant mixtures well organized in public area and effects value of its environments



Figure 1. Typical lawn and woody plant mixtures in public area

2. Lawn properties

Lawn variations

The gardeners like to intervene in the plants natural distribution with their natural breeding processes whenever the demand for lawn grasses grew. However, the scientists search new grasses as well as cultivation of existing grasses and explorers the lifecycle of grasses in experiment stations to improve current strains and create hybrids. Moreover, the painstaking search for naturally produced new varieties still continues. But these days, it is becoming more practical to create improved grasses in the laboratory than before. For instance, the bluegrasses that multiply by a type of asexual reproduction; more than 90% of the time they produce viable seeds without normal fertilization.

The search for new varieties has led to lawn grasses that are better than those of even a generation ago. The way of crossing one strain with another is to catch a plant during flowers open, before the seeds start developing and at that moment to fertilize it with pollen from another plant. As a result of those, there are currently so many strains and mixtures of lawn grasses, each of which has its own advantages and drawbacks that can be a careful choice, whether is to nature the established lawn, replant a small section or start an entirely new lawn.

Climate effects

It is well known that the choice of a lawn grass is governed by a variety of things, and one of the most important things of these are climate. In the north hemisphere, the lawn grasses are usually grouped into three major climate categories;

- Warm-climate grasses,
- Cool-climate grasses
- Dry-land grasses.

With-in these three broad categories, many individual species of grass have special preferences as to fertilizer and soil pH.

Cool-climate grasses have usually distributed east-west on the hemisphere. However, warm climate grasses predominate in the regions close to equator. On the other hand, the dry-land grasses are usually utilized in certain areas where the lack of moisture makes it difficult or impossible to grow other strains. Moreover, the territorial imperatives of the grasses are greatly influenced by elevation. While both cool- and warm-climate grasses can provide fine lawns, the dry-land grasses are coarse in texture and generally grayish-green in color.

Cool climate grasses survive during the winter months, decay in the heat of summer, but retain some trace of green during most of the year. There are a number of varieties for cool climate grasses but three major kinds are those most often utilized;

- Blue grasses,
- Fescues,
- Bent grasses.

Regular watering and fertilizing are essential, and so is attention to the control of disease on lawns. However, the bent grass is fine and soft, it is the grass often associated with well in the gentle, cool climate. Moreover, it is also host to much well known fungus that attacks lawn grass.

Typically, many of the cool climate lawns are planted in fescue and blue grass. Fescues are sturdy grasses that demand a well sharpened lawn mower. However, fescues tolerate sun or shade and can be grown in poor sandy soil, under dry conditions and with very little fertilizer. On the other hand, the blue grass is generally considered to be one of the best all purpose lawn grass because it combines both beauty and practicality. Its color is a clear, rich green and it produces a thick, soft turf that is both pleasant to walk on. Moreover, sturdy properties of blue grass are one of the choices for the turf of football fields.

The warm climate grasses suffer in hot weather and are killed by prolonged exposure to cool temperatures. Most of them survive mild frost, but when the weather gets cool in fall they become dormant and turn brown. The four most popular warm climate grasses are;

- Bermuda grass,
- Zoysia,
- St. Augustine grass,
- Centipede grass.

Of these Bermuda grass is most widely used because it spread very rapidly in a year.

Selection of grasses for mixture

Although, a lawn of one kind yields a superbly uniform turf, unvarying in color and habit of growth, and may be exceptionally resistant to certain kinds of lawn damage, the mixture of

the grass are usually combined together. But these have some drawbacks. Merion blue grass, for instance, requires more fertilizer than do other blue grasses. Also, a pure stand of grass makes a much more vulnerable lawn. However, one type may resist one disease or one kind of lawn trouble, its susceptibility to another leaves the lawn open to catastrophe. But, it is important to note that no single type of grass is likely to suit every part of a lawn.

Because mixture offers many advantages, but gardeners must consider their components carefully before establishing. It is well known that in mixture “*nurse*” grasses, fast growing types that provide a temporary cover of green until the slow growing, more permanent and more desirable grasses can develop. The commonly used for this purpose is rye grass. It comes in two forms, annual and perennial, and both have been favored upon by most turf experts. However, rye grass is cheap and its seeds are large and bulky, so that a mixture provides less grass per kg than finer seeds do. Gardeners usually feel that in the role of nurse grass, steal moisture and fertilizer from the more valued grasses and should properly be called a ‘*robber grass*’. Moreover, new improved rye grass strains, have more or less removed coarse bladed and unattractive structure. These rye grasses may still steal other grasses of some food and moisture, but it has shiny dark leaves and a fine texture, and it is longer lived than the older rye grasses.

For most lawns are started from pieces of living plants. However, many of the finer varieties of warm climate grasses are hybrids. They may provide seeds, but the seeds of hybrids seldom produce new plants. Most of the warm climate grasses spread by sending out lateral stems from which new plants take root and grow at intervals. The rhizomes if they creep along the surface, are simply placed in the ground to spread and grow together, forming a lawn.

People who prefer a green lawn in winter use a technique known as *over seeding*. With this approach, they spread over the existing turf seeds of a cool-climate grass, usually an annual such as rye grass during the fall. The cool-climate grass quickly germinates and grows well, its green hiding the dormant brown, until warm weather returns and the permanent grass of the lawn takes over once more. One of the example as; Zoysia, which loses its green color at the autumn frost and stays brown until after the spring.

Ground covers selection and blending in lawns

Ground covers such as shrubs are as useful and decorative as grass, and sometimes more so, in many areas around the homes. However, the term “*ground cover*” applies to any vegetation that blankets the soil, from moss to forest. In horticulture, however, it means low-growing plants in close proximity, used to ornament lands that otherwise would have only grass.

For an average-size home a low-growing cover might be anything up to 30 cm high; for a small one it would probably not exceed 7 cm. On the other hand, Santa Cruz fire thorn, which attains approximately 100 cm in height, or Tamarix juniper, which may grow 60 cm tall, might well qualify as a low-growing ground cover on large lands. In any event, there are no rigid rules, and overall appearance as well as actual size might make a particular

ground cover seem perfectly suitable on an open, rolling terrain and wholly out of place in a confined area.

Plants need conditions like those they enjoy in the wild, and the ground covers that can grow best in garden are those that naturally grow in a similar habitat. If the area wish to cover lies under a heavy roof of conifers, it should be best to use such typical forest ground covers as ferns or mosses. But if the area receives full sun and is unprotected from the wind, better to put plants that grow naturally on open fields, for instance bearberry or cotoneaster.

Although nature provides ground covers for many conditions of climate, soil and moisture environment, these plants are usually categorized by their light requirements. Those growing on the forest floor and those growing in the wide open spaces even look different. As a general rule the forest habitats, the leaves of a dark green, indicating the added chlorophyll they contain to make the most of dim light for photosynthesis. However, plants that grow in full sun vary from the dark green of the cotoneaster to the red and yellow color.

There are many cultivation techniques and grass varieties. However, the choice of different grass types is limitless. Every types of grass belong to the same botanical family and within that family only a few botanically distinct groups are used for lawns. But if gardeners decide to cover ground not with grass but with the plants that are loosely categorized as ground covers, the choice broadens. Many of ground covers are distinctly different from one another in appearance and habit. Moreover, ground covers often do what grasses do and are often thought of as grass substitutes. For instance, of dichondra, ground covers commonly used for lawns in the desert or warm climate areas and cannot stand cold weather. A very tiny evergreen vine with round cup shaped leaves creates a smooth, turf sturdy surface and good enough to walk on.

Grown covers could be rough or fine, smooth or billowy, green, gray or bright color. They grow in the places where grass can grow and in other places where grass can not deep shade, rocky or moist soil, steep, rain washed slopes. However, grown covers combined with the grasses, provide the variety that enables to make grounds enjoyable and admirable.

It is well established that a well established lawn is pleasing when it is skillfully blended into the landscape. And its appearance is even more enhanced when some ground covers are blended in with the lawn itself. However, the possible variations are limited only by the availability of ivy and vines, juniper and bellflower, and all the other ground covers that can be interspersed with and contrasted with the even carpets of lawn.

One of the major advantages of many ground covers over grass is that they are colorful and decorative. The varied ornamental qualities of ground covers offer pleasing contrasts in texture and color. And they have added advantage of lasting longer than flowers. Evergreen ground covers are not only ornamental in areas where a lawn has turned brown for the winter, but their bright berries add color at the time is most welcome.

As esthetic considerations help in the selection and matching of ground covers. Boxwood and periwinkle, for example, blend naturally and have been used together. The choice of

dichondra, which can flourish in rocky crevices, is perfect for the stone terrace, as is the use of arid-resistant for a low drive way border in the dry desert climates. However, contrasting ground covers are more effective than complementing ones, especially when the aim is to create borders upon borders, as in the case of the differing textures and zig zag patterns. In choosing a ground cover, it should be considering first the effect it may produce; then, among the plants that can achieve the effect.

A practical approach and a general rule from the point of view of landscape design are: create a border, which is planted in periwinkle, beside each path. Because periwinkle tolerates the shade of the boxwood hedge better than most grass would. However, annual periwinkle, which has rose, pink or white blossoms, is often preferred for its longer blooming season. It begins to flower soon after being set out in spring and continues to blossom until autumn.

However, apart from height distribution, ground covers vary in many ways. Evergreen ground covers such as ground covers that are herbaceous perennials-nonwoody plants die in the ground in late fall and reappear the following spring. Moreover, their foliage may range in color from the dark green through the gray green and in shape from smooth edged to serrate. Each of them does an outstanding function under the conditions for which it is best suited and each of them also deserves to be appreciated for its beauty as well as its utility.

If ground covers are chosen with well planned way, the opportunities for enriching grounds with beauty and interest are limitless. Hence, ground covers usually make a well contribution to the overall design of the landscape than grass can. A slope might look well if planted in green plants or yellow blossoms. A hot, dry area carpeted in any one of a number of plants that are capable of turning this garden liability.

However, ground covers can lighten the burden of lawn on steep slopes and rocky terrain, where mowing is sometimes dangerous and where a lot of hand clipping is generally required. Hence, ground covers need to be groomed less frequently than grass needs to be mowed. The sight of a billowing surface of Sprenger asparagus is pleasing, while a billowing stand of uncut blue grass is not. The ground covers need care, and the work usually done by hand. Unlike grass, which heals quickly when stepped on, most ground covers need further attentions.

Typically, ground covers are useful plants for trying different configurations. However, there are ground covers that can grow in wetter or drier places than grass can tolerate. Many of the ground covers usually prefer dense shade to sunlight, and over the years have acquired the ability to compete successfully with the roots of trees for the available supply of nutrients and moisture. Moreover, ground covers are a natural protect soil erosion. Hence, their roots stabilize the soil, but their thick foliage breaks the force of lashing rains and channels it into gentle dripping onto the ground beneath. They are also provided living mulch for rhododendrons, azaleas and clematis. In a bed of spring-flowering bulbs an evergreen ground cover not only sets off the blossoms, it also hides the fading leaves after the bloom is past.

With a few exceptions, the planting procedures for ground covers are more or less the same as those for grass. However, the following issues should be handled with care;

- Irrigation,
- Drainage,
- Soil preparation.

There might be fewer opportunities to alter them after the ground cover is in place. In Figure 2, typical well organized lawn in selected area and effects value of its environments



Figure 2. A well organized a lawn in historical sites

3. Lawn and ground cover maintenance

Maintaining a lawn involves using well planned approaches throughout the growing season. The following things should be considered all the time for a dense, healthy, well-quality lawn.

- Mowing,
- Fertilizing,
- Irrigation,
- Thatch control,
- Repeating,
- Restoring bare spots,
- Rebuilding from scratch,

However, fall lawn care somewhat depending on the location and type of grass. The cool season grasses, such as; Kentucky blue grass, fescue, and bentgrass, are as much green as in the cooler weather of spring and fall. These grasses usually sourt during the summer, the time of the year when the warm season species such as Bermuda grass, St. Augustine, and Zoysia hit their stride. But conversely, the warm season grasses turn completely brown when the temperature begins to decrease. On the orther hand, the warm season lawns, because of their earlier onset of dormancy, don't need much of autumn care.

Although there are a few ground covers that can grow in wet or soggy soil, the majority of them prefers well drained soil. Hence, the ground covers need frequent and regular supplemental moisture and good drainage. However, with the sprinklers, the drainage should be considered when the grading is done, particularly if water does not drain off from the site naturally.

For supplemental moisture, the spray heads can be set to the proper height and should be 7-10 cm above the height of the ground cover at maturity and there should be enough spray heads to cover the whole bed evenly. From time to time most ground covers develop one or two stem that must be clipped off, and occasionally a rambling branch can fail to come through the winter. However, pruning unwanted stems and branches is a regular routine of ground cover care and should be performed early in the spring. Moreover, species like Aarons beard, St.-John's-worth and Algerian and English ivy generally produce a dense mat of low-growing fresh foliage. Pruning is also vital for such fast-growing, invasive vines as Hall's Japanese honeysuckle, a useful semi evergreen ground cover that has a tendency to grow so rapidly that it can very easily get quite out of hand.

The tools for grooming ground covers vary with the plant and the size of the grooming problem. For one or two dead branch, a small pruning tool can be useful, but if the clipping the surface of an entire bed, the most efficient tool is hedge shears. Low-growing ground covers like dichondra, which do not decay easily and are common grass substitutes in hot climate regions, can be cut with a rotary lawn mower. In Figure 3, ground covers, grass and shrubs shown together in a small home garden areas.



Figure 3. Ground covers, shrubs and grass together in home garden

Lawn moving

Mowing is one of the most repetitious and time-consuming maintenance practice. It is typically influence on the turf density, uniformity and aesthetic quality of a lawn. However, lower mowing encourages broadleaf weed invasion and invasion from grassy weeds such as creeping bentgrass and annual bluegrass. Hence, low mowing produces a shallow root system, making the lawn susceptible to arid stress. But, cutting a new lawn too short could damage the young plants permanently by preventing deep root growth as well.

Weed invasion can be kept to a minimum if a lawn is mowed in a timely period, at the proper mowing height, fertilized and irrigated properly. Due to dry grass cuts cleanly, and clippings distribute more evenly, it is best to mow a lawn when the leaves are dry. Moreover, if leaves are excessively heavy, they should be rake up and remove. On the other hand, clippings include nutrients and water, breakdown rapidly and do not contribute significantly to thatch. The amount of fertilizer (especially nitrogen) can be reduced by 15-30% by leaving the clippings on.

The sensitive young plants of a new lawn need gentle treatment. However, weed killers should not be applied for about a year after sowing seed. Nor should the lawn be mowed for some time. It should be waiting until the grass is almost half again as high as its recommended mowing height such as; 7 to 10 cm high if it contains grasses such as bluegrasses or fescues, which should normally be moved to 5 to 8 cm. Then mow no lower than the recommended height.

The sharp bladed mower cuts should be useful with a scissors action without pulling at the grass plants. If a rotary mower use, its blades could be very sharp; otherwise it may jar the tender plants, tear their blades and dislodge their tiny roots.

Fertilizing

Understanding and implementing a well-balanced fertilizer practices are one of the most important factors in maintaining an healthy lawn. Typically, there are three main nutrients for lawns;

- Nitrogen (N): It promotes dark green colour, leaf and blade development, and density of the turf.
- Phosphorus (P; P_2O_5): It is important for good root and rhizome development and promotes plant maturity.
- Potassium (K; K_2O): It contributes to the general vigour of the plant and promotes wear, drought tolerance and winter hardiness.

However, a lawn maintenance should be begun with a test to determine the soil's level of pH, which determines how easily grass can get nutrients from the soil. Moreover, a soil test can provide the amount of phosphorus, potassium, sulphur or lime required. Since potassium and phosphorus, along with nitrogen, are standard ingredients in all lawn fertilizer mixtures, chances are that a soil being treated for nitrogen deficiency can also be receiving adequate amounts of the other two chemicals.

Typically 1.5-2.0 kg/100 m² of nitrogen can be applied throughout the season, split into 2-4 applications. There are three numbers on the fertilizer bag represent the amount of nitrogen, phosphorus and potassium in that order. For example, the 20-5-10 fertilizer ratio represents 20% N, 5% P and 10% K respectively. On the other hand, without a soil test, a 4-1-2 ratio (N-P-K) such as 20-5-10% is recommended. It is important to note that nitrogen must be applied every year, while phosphorus and potassium are stable in the soil. However, on newly established lawns and sand soils, higher levels of phosphorus and potassium applications could be used.

The timing of fertilizer application is determined by the total amount of fertilizer required to use in lawn. However, late-fall practices with a quick-release nitrogen fertilizer is beneficial for home lawns. It can be applied when the lawn has stopped growing but is still green. These approaches can be effects:

- increases fall and spring root growth
- promotes a thicker lawn
- results in an early spring green-up

However, the added organic material creates a problem as it decomposes it uses up the soil's nitrogen. The practical way to compensate the loss of nitrogen is to mix in with the organic matter double the usual amount of fertilizer. In addition to the temporary deficiency in nitrogen that may be caused by the addition of organic matter, many soils typically lack other nutrients such as; iron, an important ingredient in the manufacture of chlorophyll, the green substance that makes grass grow. The acid-alkaline balance may require redressing with lime or sulfur. Iron is commonly added to soils in the form of iron sulfate. The usual dosage for iron sulfate is approximately 2 kg per 100 m² land area.

Irrigation

It should be kept in mind that to ensure lawn quality, the lawn must be watered. Even a mulched lawn needs regular watering, especially during hot or windy weather. The water should fall on the ground as a gentle mist without wash the seed loose; such a fine spray can be produced by any of several types of sprinklers. However, during the growing season, grass goes dormant and turns brown if normal rainfall does not provide enough moisture. The best time for watering and better water distribution is in the early morning during a day when there is little or no wind. However, evening watering may cause disease development due to most disease causing fungi require several hours of leaf wetness for infections. Moreover, too much water can cause thatch, fertilizer leaching, increased grassy weed problems (i.e., creeping bentgrass, annual bluegrass or rough bluegrass). In contrary, too little water applications can cause shallow rooting of the turf, which makes the lawn susceptible to disease, drought stress or winter injury. It is well established that the amount of water required to achieve clearly depends on soil characteristics. Hence, the water should be use with required amount to be ensure healty lawn. The lawn areas such as, slopes, areas near buildings, curbs, sidewalks and light soils needing more water while low-lying areas, shaded areas and heavy soils may not need as frequent irrigation.

Thatch control

Thatch is simply referred to the mat of dead stems and clippings that collected along the surface of lawns. Hence, it is a layer of organic matter made up of decaying grass leaves, stems and roots that build up in between the lawn and soil surface. However, it is a common problem that has been established for several years and over watered and over fertilized lawns. Heavy watering and fertilizing could cause some new vigorous growing grasses produce such thick turf that, particularly if clippings are not raked up. Thatching associated primarily with warm-climate creeping grasses like Zoysia and Bermuda grass.

For a typical lawn, it is beneficial to have a shallow layer of dead plant material around the base of the grass plants. This layer acts as a mulch to retain moisture and keep soil temperatures cool; it discourages germination of weed seeds; and its decay adds nutrients to the soil. But when the layer becomes more than 1.5 cm thick, it acts like a thatched roof; air, water, soil additives and fertilizers cannot pass. It also harbours insects and diseases and can restrict grass roots from growing into the soil root zone, resulting in a shallow rooted lawn.

However, a thick lawn is one of the best prevention approach against weed invasion. A dense stand of turf can compete successfully with weed seedlings for light and nutrients. But a well maintained lawn can be defense against insect invasion due to the fact that insect damage is usually less severe on well-watered lawns. On the other hand, insects damage of lawns are usually difficult to notice and their presence goes undetected until significant destroy has been done. If the lawn remains brown or shows signs of thinning out despite watering, closer examination for insects should be made. Regular control of the lawn including leaves, stems, roots, thatch and soil will help to determine if the problem is insect-related.

Repearing

A lawn repair practice should be begun with a test to determine the soil's pH level, which determines how grass can get nutrients from the soil. Typically, there are two equally simple corrective steps such as; raise the cutting height of the mower 1 to 3 cm, and give the lawn an extra application of fertilizer. These practical approaches usually result in dramatic improvement. However, it is usually difficult to determine what a disaster in lawn. Some lawns do not thrive because they are planted in the wrong grasses. The lawn problem may be;

- Poor drainage,
- Tightly compacted soil
- Thatching

All these three conditions interfere with root development by cutting off the roots' supply of moisture and air, and all these are controllable.

Restoring bare spots

If a lawn has bare patches that need seeding, Autumn is the best time to do for cool-season grasses. It is well established that it's hard to put in new seeds in the spring because the soil heats up too fast and even with watering, the root usually dry up before they get a chance to develop. Warm-season grasses, however, are best sown in late spring or early summer months.

If the spots are larger than 20-30 cm across, however, new grass must be put in them. Sodding is a reliable way to cover the spots immediately. But many gardeners are put off by the high price of sod and use springs, plugs or seed. Any of these methods work well-if the suitable procedure has been followed.

Sprigged and plugged grasses spread by moving along or under the ground on lateral stems called rhizomes. Thus pieces of plant set in at intervals soon fill the bare spots between them.

Rebuilding from scratch

An old lawn, no matter how bad its appearance, still consists of a dense mat of dead and living plants together. However, when dug up of that, this turf becomes a mass of root filled parts that may not disintegrate and cannot be raked smooth. Hence, if gardener decides to establish the lawn again, it must first strip off this turf with a sod cutter, or chop it up into small pieces with a rotary tilling machine.

However, the sod cutter slices off the top of lawn, taking with it the heaviest part of the root growth, and thus practically eliminates the material that forms clods. The drawbacks of the sod cutter lead to utilize rotary tiller. Moreover, the rotary tiller does two jobs at once, chops up the turf and tills the soil. From this point onward the task of preparing the ground is practically the same for rebuilding an old lawn as for starting a new one.

If the soil has not been properly prepared with sufficient nutrituent and organic matter, sodded grass soon thins out and loses vigor. And if the soil is bumpy or uneven, the sod may conform, producing a lawn that is bumpy and uneven as well.

Sodding is an excellent way to patch persistent bare spots and to establish lawns on steep slopes and the crests of embankments, where seeds tend to wash out with the first rain. Hence, sodding provides a lawn immediately, and for this reason it is used everywhere, on cool-climate as well as warm-climate lawns. However, in laying sod the time that elapses between cutting and laying is critical for success.

4. New lawn foundation

The foundation of a problem-free lawn is land that has been proper drainage and watering system. However, the ground should slope gently and evenly so that rain water is carried steadily away from the land. Moreover, there should be no low spots in the lawn to collect

and hold water as well. Most land has a general slope in one direction, and a well-planned lawn and its surroundings (house) are placed to take advantage of it. It is well established that the following steps should be considered all the time for a new, healthy lawn foundation. They are;

- Soil preparation
- Plants preparation
- Nutrition adding
- The Bed preparation
- The time selection for plant grass
- Seeds selection and sowing
- Springs, Plugs and Sodding

Soil preparation

The preparation of soil for lawn foundation has some steps. The first step is to loosening of the subsoil because the heavy traffic may have packed the soil hard that nothing less than a pickax can penetrate it. Obviously neither water nor roots can pass such a compacted soil. Thus, after the rough grading is done, but before the topsoil is replaced, it is recommend that the entire area be tilled with a rotary tiller to a depth of 10-15 cm. These effects the health of the lawn subsequently planted in the area.

Organic matter, with proper fertilizer, can convert subsoil into a satisfactory growing medium for grass. Hence, in heavy clay soils organic matter opens the soil's structure, improving drainage and allowing air and water easier access to the root zone. In light, sandy soils it can acts as a sponge, soaking up and holding moisture and nutrients.

Aeration is also important step and done by a machine called an aerator (a drum-shaped device) that fitted with hollow tines, pulls plugs of soil from the lawn, leaving holes that permit movement of air, nutrients, beneficial microorganisms, and water as well as creating more growing room for the grass roots. However, when rough grading is completed and topsoil put back, the soil conditioning should be start immediately. Some organic material to improve the soil's texture, with a fertilizer may be needed to bring the soil into the proper pH range. Moreover, soil amendment may be needed to alter the pH factor at this stage. It can reduce future maintenance if in selecting a ground cover that pH preferences are close to the natural pH of the soil. Hence a numbers of organic materials are suitable for ground covers such as; well-rotted manure, spent mushroom soil, compost, leaf mold etc.. One of the most popular and most widely available types is peat moss.

A 5-8 cm layer of peat moss spread evenly on the surface and thoroughly incorporated to a depth of 15-20 cm could be adequate for most soils. However, it is important to note that ground covers do not have the same fertilizer requirements as grass. But it is advisable to add some nutrients to the soil to get the young plants off. Moreover, ground cover fertilizers, have less nitrogen and higher amounts of phosphorus and potassium than grass fertilizers. These produce strong roots and healthy top growth. Hence, the fertilizer should

contain N, P and K elements in the right proportion. Spread the fertilizer evenly over the soil at the rate of 10 to 15 kg per 100 m² area it in thoroughly along with the peat moss. The peat moss, fertilizer with other materials can be useful into the soil quite satisfactorily with a four-tined spading fork if the area is small; when the area to be useful is of any appreciable size, it is easier to use a rotary tiller.

After the soil is prepared, the land should be prepared for planting. However, on slopes, a diamond pattern can help prevent gullies forming during a rainfall. For that reason, there are two steps that should be taken to protect the soil around the roots of new plants.

- The first step; setting the plants into scooped-out pockets, which serve as catch basins for rainfall and act as moisture reservoirs for the young plants.
- The second step; the entire area should be mulched. The kind of mulch depends on the size and scale of the plant. Around woody plants like juniper and bearberry, coarse mulch like wood chips is suitable. On the other hand, for small creeping plants like Corsican mint or thyme, fine-textured mulch like buckwheat hulls or finely ground bark is more appropriate.

Plants preparation

It is well known that the cost of ground covers is important criteria for selection. However, although some varieties can be started from seed, for quicker results most are purchased as young plants, and plants in large numbers can be expensive. But gardeners who want to economize can purchase only enough stock for one small area, and then propagate their own new plants from that parent stock. Moreover, many ground covers root and transplant rather easily.

One of the most common form of propagation is to take cutting from the ends of the stems. A cutting should be 7-15 cm long. Strip the cutting of its lower leaves and dip the end of the cutting in a rooting hormone powder. Then plant the cutting in a 7 cm pot filled with coarse sand, peat moss, perlite or a mixture of equal parts of coarse sand and peat moss. Water the cutting well and then slip it, pot and all, inside a clear plastic bag that will serve for the rooting period as an individual "greenhouse." However, the place the encased cutting in a warm, partly shaded place until new growth begins, indicating that roots have formed. If a number of cuttings are being grown, they can be set in a flat, a shallow box in which seedlings are started, filled to within 2 cm of the top with damp rooting medium. Once the roots have formed, remove the cutting from the plastic bag or the glass-topped rooting medium, knock it out of the pot, soil mixture and plant it wherever need in the garden. It is also important to note that the ground covers should not transplant any rooted cutting outdoors later than two months before frost is expected. Hence, if in complicated situations, it is a good idea to keep the plants through the winter in a cold frame and set them out in the spring.

However, there are some ground covers that should not take cuttings until before frost, when the growth is mature. The best rooting bed for these cuttings is a flat, 7 to 10 cm deep, containing a mixture of equal parts of peat moss and coarse sand. If kept in a cool place (5-

12 °C), they should have rooted by spring. At this point it is better to plant them outdoors in a protected spot until they have become well established; the following year they will be sturdy enough to flourish.

Another method of propagating, especially for herbaceous plants, is by division these plants develop thick crowns of roots and stems, which can be broken apart. Plant the separated sections quickly, before the roots dry, watering thoroughly, and they should flourish as additional plants in your ground-cover bed.

A third method of propagating is by layering. However, layering is best begun in early spring. To layer a woody plant, notch the underside of a stem and dust it with rooting hormone powder, then pin it against the ground with a forked stick or a loop of wire and cover it with a mound of soil. Moreover, the soil should be kept steadily damp. Roots will eventually sprout from the notched section of the stem, which can then be removed from the ground, severed from the parent plant and set out as a new plant.

Nutrition adding

Ground covers, like other plants, benefit from an annual application of fertilizer in the spring just as their season of new growth begins. As mention above, a typical fertilizer application would be 10-15 kg per 100 m² used in setting out the plants. However, fertilizer should be sprinkled over the surface of the ground on a day when the foliage is completely dry, and watered in thoroughly as a result none remains on the foliage to burn it.

After that, maintenance is of minor concern for the balance of the season. About the only left is the removal of leaves that fall among ground cover plants, and they can be dispatched easily with a stream of water from a garden hose.

The bed preparation

The simplest way to get these soil supplements into the ground is to till them in all in one operation. For that, first spread them on the topsoil. Then, with a rotary tiller, go over the soil in a crisscross pattern until the added materials and existing soil are well blended to a depth of 10 or 15 cm. After the surface dries out, it should be raked with a garden rake to remove stray roots and stones. However, this is one that many gardeners find frustrating, mainly because they do not handle the rake properly.

Raking, no matter how carefully it is done, often leaves small irregularities in the soil's surface. However, the best way to level out these high and low spots is to use a drag a ladder. The texture of the top of the soil need not be very fine; in fact, it helps if the soil clumps are a little rough, 0,3 to 2,0 cm in diameter, so that the grass seeds will fall into the crevices in the surface.

However, most new beds of ground cover benefit from a mulch to help hold down weeds and keep the soil moist. Not only does the mulch shade the ground to prevent weed seeds from sprouting, its soft texture also makes stray weeds easier to pull out. Moreover, weeds can be very troublesome in ground cover because they are so inaccessible, and perennial

weeds can be a particular problem because they will continue to sprout from any stray pieces of root left in the ground. In pulling a perennial weed, always pull all of them properly.

Mulching not only keeps weeds away from ground covers but also insulates the soil, keeping it cool and moist. However, even after the ground cover has overgrown it, the mulch will continue to serve as a water absorbing medium beneath the plants. For the first year or so, a bed of ground cover will usually need a frequently watering even in areas where the annual rainfall is sufficient. This is especially important during dry spells. Moreover, mulching protects the soil and seeds from driving rain, especially on slopes, holding them in place until the grass roots are well developed.

One of the cleanest mulch for a lawn is straw. One bale of straw is enough to cover 100 m², since only a thin layer is needed, three or four straws deep. The soil should still be visible through the mulch. However, straw has one drawback: it may contain seeds of undesirable plants. It is better, therefore, to put the straw several weeks in advance, and to open it and wet it down; this will allow any grain or weed seeds to germinate and die before using the straw on the lawn. But, it is important to notice that not use hay instead of straw. Straw is the stems of cereal grains wheat, buckwheat, oats all of which are annual plants that die after one season and there is no trouble for lawn. But hay is full of seeds of wild perennial meadow grasses and their presence can create problems for years. Moreover, salt hay is the exception which is native to shore areas and its seeds normally do not germinate in ordinary garden soil.

In windy locations, straw mulch should be anchored with string stretched between pegs and kept moist so that it will not blow away. Natural mulches like straw can be left in place to rot into the soil, or can be raked up when the seedlings are 3-4 cm high.

In cold climates, the aim of winter protection is not to keep the ground warm, but to prevent it from thawing and freezing, with the resultant heaving that forces plant roots out of the soil. However, one of the best protections any ground cover can have is a blanket of snow. The protective covering should not put before the ground is frozen, and do not remove it until the ground has thawed in the spring.

The time selection for plant grass

The ideal time to plant a lawn is at the beginning of a period when grass growth is most aggressive and weed growth is slow. Although, this period varies with the region and the climate, cool-climate grasses begin new growth in early spring, reach a peak of activity during the late spring and early summer, and then lapse into relative inactivity during mid-summer. But by summer's end, when autumn rains begin, they grow luxuriantly again until slowed by cold weather late in the fall.

Perennial weeds such as; mouse ear, chickweed, dandelion, ground ivy and others developed in cool weather; they are in direct competition with desirable grasses throughout the year and the choice of planting time has no effect on competition from them. But annual

weeds are easier to deal with. While many such as common chickweed, mayweed and pepper grass compete with grasses in early spring, all slow or stop their growth in fall.

In cool-climate regions, it is typically practices; one of the best possible times to sow grass seeds in cool-climates is in late summer or early fall, up to two months before the ground freezes. From that point on, it is advisable to start planting early spring. However, seeds may be sown after the ground is frozen, so that they will begin to grow with the first warm weather of spring and get an early start in their competition with weeds.

In warm-climate regions, it is better to start new lawn not with seed but with pieces of growing grass. Live grass can be installed in three forms:

- Sod, large rectangles of turf cut free of the ground,
- Plugs, which are small pieces of sod each about 5 to 10 cm across and 5 cm deep,
- Springs, which are bits of stems with several blades of grass and bits of root attached.

However, the habits of grasses dictate planting times, and variations in weed growth structure cannot easily be taken advantage of warm-climate grasses, such as Bermuda grass, Centipede grass, Zoysia grass, St. Augustine grass, Carpet grass and Bahia grass, are at their best during the hot days of summer. The time to start a new lawn in warm regions is just before this period of rapid growth begins, in the spring or early summer. Hence, grasses started then from sprigs and given proper care will become well established before they enter their dormant period and turn brown in fall.

Seeds selection and sowing

As mention above, mixtures contain some grasses that thrive in sun and others that grow in shade, since most lawns have areas of both; each type of grass eventually predominates in the area best suited to it. But before establishing a mixture, it is better to know about the nature of each of its ingredients.

Most grass seed is usually sold by weight, and the package specifies what percentage of the total weight is accounted for by each type grass, as well as how large an area the seed should cover. Kentucky bluegrass, for instance, has about 5,000,000 seeds per kg; fescues average 1,200,000 seeds per kg; rye grasses contain only 500,000 seeds per kg. Thus a mixture labeled 52 per cent bluegrass, 80 per cent germination; 35 per cent creeping red fescue, 80 per cent germination; 35 per cent creeping red fescue, 80 per cent germination; and 10 per cent Chewings fescue, 85 per cent germination, might seem to contain about half bluegrasses, a sun-loving type, and half fescues, which are shade tolerant (the remaining 3 per cent is inert matter). In fact the mixture contains more than four times as many useful bluegrasses as fescue seeds.

Once a seed selected, there are two important things to consider when using it. That are;

- Sow the seed as evenly as possible,
- Cover it with a very thin layer of soil.

As like spreading fertilizer; first lay down a double swath of seeds at each end of the lawn as a turn-around areas, then overlap all rows slightly to prevent bare strips.

Seeds of fine-textured grasses, which make the most attractive lawns, should be covered with soil to a depth no greater than 2-8 cm; more than that and the seeds may not germinate. There are two methods for covering seeds lightly; neither covers all the seeds, but the first watering will carry most of the unburied seeds down into the soil crevices.

A practical approach especially useful for small areas as; a leaf rake is inverted and dragged with slight pressure across the seeded surface; the inverted tines bury some seeds and leave behind small stripes into which others fall, to be covered when the stripes disintegrate during the first sprinkling. However, for larger areas, employs a piece of chain link fencing or a flexible wire and rubber door mat, to which a rope is attached. When it is pulled, it tumbles the soil, covering seeds as well as footprints and leaving behind a crumbly surface percipient to moisture.

Another approaches as; after seeding a lawn it has been rolled it once lightly. It is suggested that simply water the lawn; sprinkling is necessary, and it will settle the surface sufficiently in most cases.

Springs, Plugs and Sodding

Springs are cheaper than plugs. However, plugs are easier to handle. Springs are generally set 15 cm apart, plugs 9 cm apart, on a planting grid marked in the soil. Plugs are set into the ground upright, with the leaf bases level with at least part of the leafy portion above the surface. After planting, firm the surrounding soil to assure contact between the dirt and the roots, then water the lawn gently but thoroughly. Mulching is not necessary because the plants spread rapidly and soon come together. Until they do, weeds can e kept down by hoeing; using weed killing chemicals on a newly sprigged or plugged lawn is as dangerous as it is on a newly seeded one.

Sodding that are laying a growing turf in place piece by piece, is one of the fastest way to create a lawn. However, sod can be supplied from sod farms and nurseries in strips a 30 cm to 40 cm wide and up to 2.0 m. long. Ideally, the strips should be cut from their original growing bed so that the root zone in the strips is no deeper than 2 cm. This requirement may seem contrary to good garden practice, which ordinarily demands the deepest roots possible for transplanting. But in fact, thick sod will take a long time to push roots down into the soil beneath and take hold, while a 2 cm sod, given plenty of moisture, will begin to send out new feeder roots that will knit to the soil beneath it in a few days.

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