Southern California Turfgrass Culture

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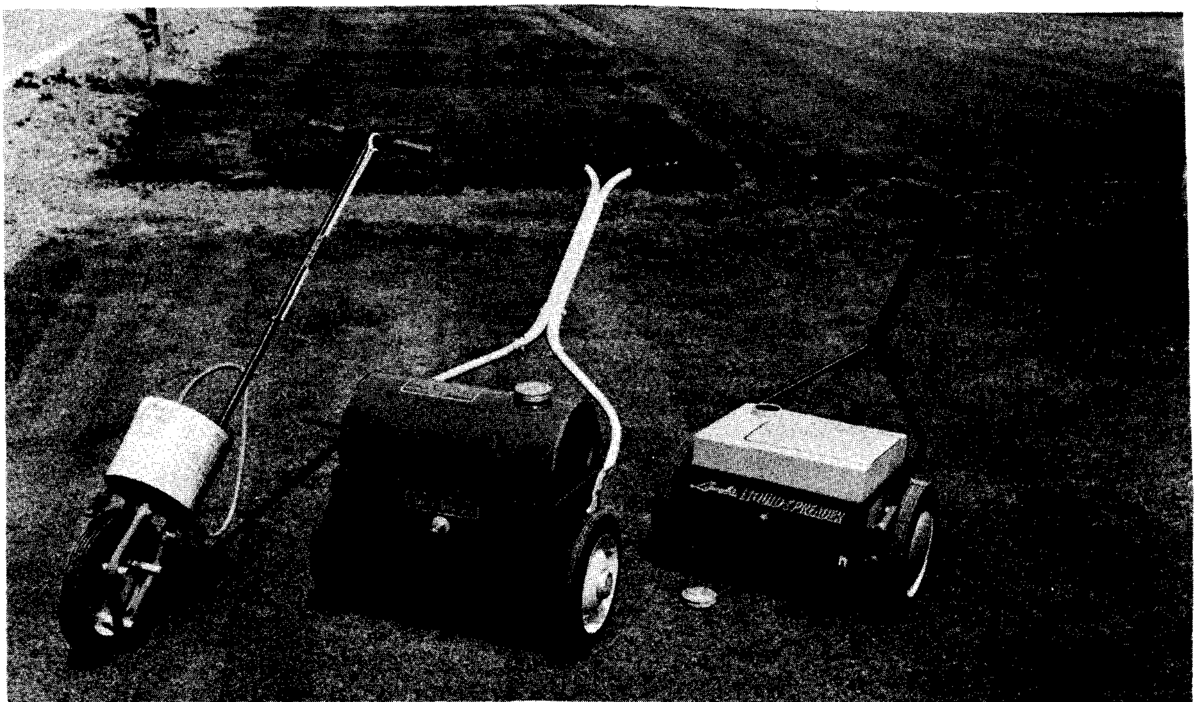
NEW LIQUID APPLICATORS FOR TURFGRASS



Illustrated above are the new sprayers for turfgrass introduced to the market this spring. They are designed to give controlled rate of flow and to stop spraying automatically when the forward movement of the sprayer stops. These sprayers are useful for the application of herbicides, fungicides and liquid fertilizers to any turfgrass area.

The Lawn Sprayer is manufactured by the Jackson Manufacturing Co., Harrisburg, Pennsylvania, and the Liquid Spreaders are manufactured by the 0. E. Linck Co., Clifton, New Jersey.

SOUTHERN CALIFORNIA TURFGRASS FIELD DAY

October 15, 1957 has been set as the date for the next field day by the Southern 'California Turfgrass Council. The day will start with registration at 8:30 A.M. The theme for the day will be Water Supply, Water Quality, and Water Management.

The morning program will consist of talks by various authorities on water and water use. Lunch will be served by a caterer at noon.

The afternoon activities will be in three sections running concurrently; a panel discussion on water problems, a demonstration of irrigation and other equipment, and a tour of the UCLA Turfgrass plots. Visitors will be divided into three groups which will be rotated among the three program divisions.

The committee on arrangements consists of Frank Stewart of Forest Lawn Memorial Park, Robert Berlin of Occidental College, Gordon Wyckoff of the J. C. Nees Turf Supply Company, and John Stark, Los Angeles County Farm Advisor.

A detailed program giving the specific location will be sent out several weeks before the field day.

MEMBERSHIP IN THE SOUTHERN CALIFORNIA TURFGRASS COUNCIL

Membership in the Southern California Turfgrass Council is open to all who are actively interested in Turfgrass Culture. A member of the council is entitled to participate in all meetings and activities of the council. All council members also receive this publication, "Southern California Turfgrass Culture". Regular mailing of this publication is made only through council membership. An individual may join the council by sending the annual dues of three dollars to the treasurer, Mr. C. Gordon Wyckoff, J. C. Nees Turf Supply Company, 1055 Macy Street, Los Angeles, California. The dues for non-profit organizations are ten dollars annually and for commercial organizations, twenty-five dollars.

THE TURF-FORMING BLUEGRASSES

Victor B. Youngner
University of California, Los Angeles

The bluegrasses, Poa species, form a large andwidely distributed group of grasses. Hitchcock (9) describes sixty-nine species which are found in the United States. Of these only a few are of economic importance and only two, *Poa pratensis,* Kentucky bluegrass, and *Poa trivialis,* rough stalked bluegrass, are in general use as turfgrasses.

In addition to these two species, several others are used occasionally for turf purposes. *Poa compressa,* Canada bluegrass, is used on poorer soils in Northern United States and Canada. *Poa Nemoralis,* wood bluegrass, is used on rare occasions in cool shady areas. *Poa annua,* annual bluegrass, is found over most of the United States, but it is generally considered a weed and is seldom intentionally planted as a turfgrass. *Poa bulbosa,* bulbous bluegrass, may have some turf value but at the present time is used only as a range grass in northern California and the Pacific Northwest.

These species are not native to North America but have been introduced from Europe and Asia. There are a number of bluegrasses native to this continent, but these do not have any turf value to our present knowledge.

POA PRATENSIS, KENTUCKY BLUEGRASS

Poa pratensis may have been brought to this country by the early colonists. It spread rapidly over the cool humid regions of North America and flourished in the lower elevation areas of Kentucky, hence its common name Kentucky bluegrass. In the British Isles it is known as smooth meadowgrass and in some regions of the United States and Canada as June grass.

Kentucky bluegrass is one of our most popular and useful turfgrasses, being planted extensively over Northern United States and often in many southern areas, including southern California. It is a dense sod former, with a vigorous rhizome and a moderately deep root system. The leaves are dark green, smooth and soft.

The regions to which Kentucky bluegrass appears to be best adapted are the cool humid areas of the northeastern and northwestern states where it has become naturalized. It grows well, making a permanent turf, in much of northern and central California. On the other hand, in southern California it is relatively short lived yielding to bermudagrass, *Cynodon dactylon,* in three to five years.

Kentucky bluegrass requires a loose friable soil, well aerated and of high fertility. Hartwig (8) 1938, and Watkins, Conrey and Evans (16) 1940, observed that *Poa pratensis* was found growing in soils higher in phosphorus, nitrogen, and organic matter than the soils on which *Poa compressa,* a species of similar climatic requirements, was found. Evans (4) 1949, found that nitrogen fertilization greatly increased the number of shoots and rhizomes produced per plant. Kentucky bluegrass requires a good supply of phosphorus and calcium for best growth. It prefers a soil pH near neutrality, growing poorly on either highly acid or highly alkaline soils.

Observations on the turfgrass test plots at UCLA indicate that bluegrass requires a minimum of one pound of actual nitrogen per each 1000 square feet of area for each month of growing season for good turf quality. In much of California where the growing season is twelve months long, this means a minimum of twelve pounds of nitrogen a year for each unir of 1000 square feet. Liming is generally not necessary in California as most of this state's soils are not highly acid and contain ample calcium. Phosphorus and potassium must be supplied unless the soil is naturally rich in these elements. Kentucky bluegrass absorbed more phosphorus than any other grass in a test of fifteen varieties conducted by Beeson, Gray and Adams (1) 1947.

Kentucky bluegrass is not tolerant of regular close mowing. If cut below 1 1/2 inches in height for any length of time the turf will become thin and weak and thus easily invaded by weeds. An ecological survey of a number of golf courses in southern California showed that larger populations of Poa pratensis were always found in "rough" areas cut at 2 inches or higher than in the adjacent fairways cut at 3/4 of an inch ot lower.

Harrison and Hodgson (7) 1939, found that bluegrass regularly cut low produced a smaller quantity of roots and less total top growth than plants which were cut high or left uncut. Crider (2) 1955, showed that Kentucky bluegrass roots stopped growing following every clipping which removed 50 per cent or more of the top growth. The more severe the clipping the larger the number of roots which stopped growing and the longer the interval before full root growth was resumed. Root growth was not stopped if no more than 40 per cent of the top was removed in a single clipping. Therefore frequent mowing, removing a small amount of top at each mowing, will favor a strong root system and a vigorous turf. Infrequent mowing with the removal of large amounts of top growth will tend to produce a shallow root system and a weak turf.

Temperature is an environmental factor strongly influencing the growth of Kentucky bluegrass. Moderate temperatures are most favorable for top growth. In California, bluegrass produces rhe greatest top growth in the spring and fall of the year and very little growth during the hottest summer months and the coldest winter months.

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Naylor (14) 1939, observed that *Poa pratensis* plants grown at 15°C. had a much better root development than those grown at 25°C. Also, the plants grown at the 15°C temperature had greener color, greater green and dry weights, and longer leaves than the plants grown at 25°C.

Harrison (6) 1934, studied the effects of temperature, clipping and nitrogen fertilizer on the growth of bluegrass. He found that a 60°F. temperature and no nitrogen top growth recovery following clipping was slow; there was no new top growth from the rhizomes, but many new roots were produced. At a temperature of 80°F. there was neither root development in the plants given nitrogen nor in those given no nitrogen. The greatest production of new leaves and increase in length of leaf was found to occur at 15° C. by Darrow (3) 1939. At a soil temperature of 35°C. there were few new leaves formed and little growth of existing leaves. The plants remained short and rigid at this temperature; the leaves remaining erect when left uncut for a three month period. The roots at the 15°C. temperature were thick, white and nearly unbranched, whereas at 35°C. they were thin, light brown and finely branched. The root system was deeper at the lower temperature and was also heavier as measured by the total dry weight.

These temperature relationships should be considered carefully whenever Kentucky bluegrass is to be used for turf. It would be unwise to attempt to establish bluegrass at any time when prolonged periods of high temperatures are to be expected. Certainly there are many parts of California in regions of prevailing high temperatures where bluegrass should not be used.

Poa pratensis is susceptible to many fungous diseases. Howard, Rowe11 and Keil (10) 1951, list over twenty fungous diseases to which Kentucky bluegrass may serve as a host. Brown patch, dollar spot, melting out, leaf spot, and rust are those most likely to be serious in California.

A pound of bluegrass seed contains approximately two and one half million individual seeds. Good seed should have a germination of 80 per cent or over and a purity of 85 per cent or more. It should be seeded at the rate of two to three pounds to each thousand square feet of area for turf. Higher seeding rates will be only a waste of seed and may actually produce a poorer turf. A complete fertilizer should be incorporated into the soil at planting time.

Kentucky bluegrass is not a pure strain but consists of many individuals which, while similar in general characteristics, may differ in one or more characters from the rest of the population. It is therefore possible to select many distinct types from any bluegrass lawn or meadow. Merion bluegrass, Delta bluegrass and several other strains are selections of this type.

Merion bluegrass is a relatively true breeding strain because of the high per cent of apomixes occurring in the process of seed formation. Apomixes is the term for a bypassing of the normal sexual process of fertilization. In the case of the bluegrasses the embryo of the seed develops from a cell of the nucellus rather than from the egg cell which degenerates before it can be fertilized. Thus the plants growing from this seed are identical with the mother plant, just as would be plants established by vegetative propagation. Kentucky bluegrass ranges in degree of apomixes from about 50 per cent to nearly 100 per cent. The exact degree of apomixes in the Merion strain is not known at the present time, but it appears to be close to 100 per cent. When the degree is this high a true strain can be easily maintained. However, since apomixes is not 100 per cent in Merion bluegrass, occasional off-types may be found. These "rogues" must be removed from the seed production fields. Off-type plants may appear in Merion bluegrass turf as patches differing in color or texture. As some of these are more rapid growing than Merion, they should be removed as soon as observed.

There are several other characteristics of Merion bluegrass which make necessary variations from the management usually given to Kentucky bluegrass. Merion bluegrass is slow and irregular in germination and also slow in growth after germination. It should, for this reason, be planted alone if it is to be allowed to make its fullest development. If it must be included in a mixture, it should represent **a** fairly large proportion of the mixture. UCLA test plot observations indicate that it should make up nearly 50 per cent by seed weight of the mixture for best results. The inclusion of three to five per cent in a mixture is pointless as the Merion will be so suppressed that it will be unable to contribute anything to the turf quality.

Juska, Tyson, and Harrison (11) 1956, found that a high quality Merion bluegrass turf was more quickly established when seeded alone and given a high level of nitrogen feeding than if planted with any other grass or mixture of grasses. Merion was found to be more competitive with other grasses in a mixture if given high nitrogen fertilization. A three-fourth inch mowing height did not retard the development of the Merion bluegrass.

Hagan (5) 1956, states that Merion has more deep roots than does common Kentucky bluegrass and is therefore more drought tolerant. He has found that Merion bluegrass grown at Davis, California, was still green after four weeks without water while common Kentucky bluegrass in an adjacent plot was dry and brown.

hferion bluegrass is more susceptible to the rust disease than is common Kentucky bluegrass. There is no effective fungicide known at the present time for this disease. Lateer (13) has found that a combination of high 'nitrogen feeding and frequent mowing is effective in aiding the grass to outgrow the symptoms of the dis-

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The Turf-forming Bluegrasses

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ease and produce a high-quality turf. This disease is serious along the central coast of California and in the Sacramento and San Joaquin valleys. It is found in southern California but rarely appears to reach the epidemic proportions that it does in the formerly mentioned areas.

OTHER BLUEGRASSES

Poa trivialis, rough bluegrass or rough-stalked meadowgrass, next to *Poa pratensis,* is the most widely used bluegrass species for turf. It is well adapted to cool, moist, shady places where it makes a turf of excellent quality, It grows well in full sun in the cool humid parts of the world but will survive only in the shade in the warmer regions, and then only if given abundant water.

Rough bluegrass is a native of northern Europe where it is a valuable pasture grass as well as turfgrass. It is also used for this purpose in some parts of the United States. It spreads by a rhizome near or at the surface of the soil and has a more shallow root system than does Kentucky bluegrass. The color is a bright apple green, the top growth soft in texture and poor in ability to withstand heavy wear.

Although little is known about the physiology of this species, it appears to be somewhat more tolerant of soil acidity than Kentucky bluegrass and performs better in poorly drained soils. Its nutrient requirements are similar to those of Kentucky bluegrass. The seeding rates and methods used for Kentucky bluegrass seem to be satisfactory for this species also.

Poa compressa, Canada bluegrass, also a native of Europe, can be used as a substitute for Kentucky bluegrass where soils are too poor and dry for the latter. It is a good sod former with a heavy rhizome and a deep root system, but does not make a dense turf because of sparse leaf growth.

As has been previously mentioned, Canada bluegrass is more tolerant of low fertility and low organic matter in the soil than is Kentucky bluegrass. It may also be somewhat more tolerant of soil acidity and drought. It is, for this reason, sometimes mixed with Kentucky bluegrass to provide cover on the poor soil areas where the latter might fail. It is especially valuable for this purpose as it blends well with the Kentucky bluegrass in color and texture.

Poa nemoralis, wood bluegrass, can be used only in shady, cool, moist places and perhaps has little to recommend it over *Poa trivialis.* It is used occasionally for turf in the northern European countries.

Poa annua, annual bluegrass, and *Poa bulbosa,* bulbous bluegrass, have little value as turfgrasses by themselves. Their principal value may be as companions with our warm season grasses to provide green color during the winter months. Stoutemyer (15) 1954, reports that a beautiful turf can be obtained by overseeding bermudagrass in the fall with *Poa annua.* More recent studies at UCLA have shown that it will reseed itself year after year once established. Close mowing (one-fourth inch) or light fall renovation is necessary to keep bermudagrass thatch or mat under control, permitting the development of a uniform stand of annual bluegrass.

Kennedy (12) 1929, suggested that *Poa bulbosa* could be used for overseeding bermudagrass for winter turf. Recent studies at UCLA have shown that an excellent winter turf can be obtained in this manner. Those studies are being continued to determine what proportion of the plants will survive over summer and if practical management programs can be developed.

Poa bulbosa is a low-growing perennial grass of a beautiful dark green color. Its normal life cycle consists of vegetative growth during the fall and winter, production of flowers and “seeds” in the spring, followed by a period of dormancy during the summer months. This species does not produce true seeds in this country but instead bulblets develop in the inflorescence which dry on the plant, drop to the ground, and begin growth in the fall. No flowers are produced when the grass is cut as turf.

Poa bulbosa is used in northern California and the Pacific Northwest for livestock forage. The only commercial bulblet production is also in this region.

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The Turf-forming Bluegrasses

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16. Watkins, J. M., G. W. Conrey, and M. W. Evans. The distribution of Canada bluegrass and Kentucky bluegrass as related to some ecological factors. Jour. Amer. Soc. Agron. 32:726-728. 1940.

RECENT GIFTS

E. I. DuPont de Nemours & Co.
Los Angeles
400 pounds Uramite

Pacific Toro Company
Los Angeles
Fertilizer dispenser

Golf Course Superintendents Association
St. Charles, Illinois
$500.00

Golf Course Superintendents Association
of Southern California
Los Angeles
$500.00

U. S. Golf Association Green Section
New York
$500.00

American Cyanamid Company
New York
$350.00

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CHEMICAL CALCULATIONS IN TURFGRASS MANAGEMENT

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Through research and competitive marketing an increasing number of herbicides, both selective and non-selective, fertilizers in various forms and concentrations, and fungicides and insecticides of many descriptions are being made available to the public. As the numbers continue to increase and the already confused public becomes more confused as to the proper choice to meet his specific turf-management needs, one consideration remains constant; the required amounts of each product must be accurately determined and applied according to the manufacturer's recommendations. The claims made by the individual manufacturer are generally reasonable and correct. However, there are many uncontrollable variables which are quite often responsible for failures or partial control. These are - soil and air temperatures, light, soil type, pH, soil moisture, nutrient level, grass species and maturity of grass. Furthermore, failure to obtain satisfactory results can also be brought about by application at the wrong rates, improper timing of application application of the wrong material and uneven distribution.

FERTILIZER CALCULATIONS:

Today fertilizers in various forms and in almost any desired concentrations are available. With economy as a primary consideration we as consumers must select the fertilizer that will give us the greatest number of primary or major plant food units for the least cost. To determine this we ignore the size of the package and the trimmings and focus our attention on the analysis. (State laws protect the consumer by requiring all commercial fertilizer bags to display a guaranteed analysis). The analysis or grades refers to the percentage N, P_2O_3 and K_2O present without reference to the source of nutrients. The analysis is usually in whole numbers and the plant foods are always stated in the same sequence, for example a 10-5-3 fertilizer is one that contains 10% nitrogen, 5% available phosphoric acid and 3% water soluble potash. A normal fertilization for turf is one pound of actual nitrogen per 1,000 sq. ft. With this in mind we consider the first figure of the analysis and divide that number into 100. The answer is the number of pounds of that particular fertilizer which is needed to supply one pound of nitrogen, and it would also be the amount to be applied to a 1,000 sq. ft. area. By comparison of the quantitative costs between different materials to fertilize a given area we can select the best buys.

To determine the quantity to be used for 1,000 sq. ft. when a large-scale rate is known, multiply the number of pounds per acre by 16 to obtain the number of ounces, and divide the product by 43.56. For example, if a recommendation states to use 100 pounds of commercial product per acre, then apply: 100 pounds per acre, 2 1/2 pounds (approx.) per 1,000 sq. ft., or 4 ozs. or 113 grams per 100 sq. ft. If the recommendation is for 100 pounds of actual nitrogen per acre and the analysis is 5% nitrogen, then apply 2000 (.05 x =100)pounds of commercial product per acre, or 46 pounds per 1,000 sq. ft. or 73.6 oz. per 100 sq. ft.

If a large-scale application rate in pounds per acre is desired and a small-scale rate is given, calculate as follows: Multiply the number of ounces per 100 sq. ft. by 435.6 and divide by 16.

HERBICIDE, INSECTICIDE, AND FUNGICIDE: CALCULATIONS:

The proper calculation of application rates of selective herbicides is important. Many herbicides are selective only at low rates. At higher rates they are non-selective destroying all or most of the vegetation. The margin of selectivity may be quite narrow. Effective weed control with no injury to the desirable grasses may depend on localized conditions as previously mentioned. Attempts should always be made to apply the herbicide when the weeds are most susceptible and when the desirable species are least likely to be injured. A good example of this would be the use of phenoxy compounds which include 2,4-D (2,4-dichlotophenoxyacetic acid) and 2,4,5-T (2,4,+trichlorophenoxyacetic acid) to control broadleaved weeds in turf comprised of "coo1 season" grasses. (Concerning phenoxy compounds, the salt formulations of 2,4-D and 2,4,5-T are practically nonvolatile and are therefore much safer to use near valuable susceptible plants than ester formulations if spray drift is avoided). Careless calculation of insecticides and fungicides can also produce disappointing results.

When recommendation calls for 1 gallon per 100 gallons and the commercial product is a liquid, use 100 gallons of clean water and 1 gallon of the commercial product, or 1 gallon of water and 10 teaspoons, or 38 milliliters of commercial product or 1 quart of water and 2 1/2 teaspoons, or 9 1/2 milliliters of commercial product.

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Chemical Calculations in Turfgrass Management

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When recommendation calls for I pound of product in 100 gallons of spray, and the product is a powder or solid, use 100 gallons of water and 1 pound of commercial product, or 1 gallon of water and l/6 oz. or 4 1/2 grams of commercial product or I quart of water and 1 gram of commercial product. Note that the number of pounds per 100 gallons is the same as the number of ounces per 6 1/4 gallons. Application rates are often recommended at 100 gallons or sometimes less per acre. 100 gallons per acre is 10 quarts per 1,000 sq. ft. or 1 quart per 100 sq. ft.

It is necessary to dilute most commercial products that are found on the market today. This entails calculating equivalent quantities of concentrate for various quantities of water. The following equations may be found helpful for determining these dilutions:

To make up a spray solution containing a given percentage of toxicant by weight (of an emulsion or solution concentrate), multiply the number of gallons of spray to be made by the percentage of toxicant desired, and divide by the percentage of toxicant in the concentrate times its specific gravity. (Where the specific gravity is unknown it may be omitted and a fairly accurate determination still obtained).

Example: A 60% emulsion concentrate having a specific gravity of I.4 to be used to make up one hundred gallons of spray containing 5% of concentrate by weight

$$\frac{100 \times .05}{.60 \times 1.4} = 5.95$$

gallons of concentrate needed. Water is added to make 100 gallons.

To determine the quantity of concentrate necessary for a given percentage of toxicant in the diluted spray, multiply the number of gallons of spray to be made by 8.345 and by the percent of toxicant desired. Divide this answer by the percent of toxicant in the concentrate.

Example: A wettable powder, containing 50% of toxicant is to be used to prepare 100 gallons of spray containing .5 percent of toxicant.

$$\frac{100 \times 8.345 \times .005}{.50} = 8.35$$

pounds needed. To calculate the quantity in grams, substitute 3,785.3 for 8.345.

Occasionally emulsion and solution concentrates must be diluted by parts to obtain a spray containing a desired percentage of toxicant. Dividing the percent of toxicant in the concentrate by the percent desired in the finished solution will give the quantity or number of parts of the finished solution that must contain 1 part of the concentrate.

Example: A solution containing .5 percent of toxicant is desired and the concentrate contains 80 percent of the toxicant. .80 + .005 = 160. The equation shows the dilution as 1 part of concentrate in 160 parts of spray solution or I part of concentrate to 159 parts of water.

Sometimes concentrations of solutions are expressed in terms of parts per million. This merely means the number of parts by weight of the chemical in one million parts by weight of the solvent. One part per million of a chemical in a water solution would be equal to one pound of the chemical in one million pounds of water. One gallon of water weighs 8.345 pounds.

If a concentration of 100 parts per million is desired calculate as follows: 100 parts per million = 100 ounces of the pure chemical in 1 million ounces of water = I ounce in 10,000 ounces of water = 1 ounce in 625 pounds of water = 1 ounce in 75 gallons of water (625/8.345).

CALIBRATION OF SPRAYERS:

In applying the chemicals the amount of water applied per given area is usually not as critical as the actual amount of the chemical. Calculation of the application rate for weed sprayers may be determined by the following method suggested by Dr. R. J. Aldrich and Dr. D. A. Schallock of Rutgers University

(1) Divide the width of the boom into 43.560 (square feet per acre).

(2) Measure off the travel distance (answer obtained in step (1)).

(3) Fill the spray tank with water and spray the measured distance with <u>tractor speed and pump pressure set exactly as they will be when applying chemical.</u>

(4) Measure the amount of water needed to refill the spray tank upon completion of step (3). This quantity is the number of gallons required to cover an acre of ground with your sprayer.

For smaller areas substitute 1,000 sq. ft. for 43,560 in step (1). Step (4) in this case will give the quantity in

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gallons required to cover each one thousand square feet with your sprayer. Any equipment with the same nozzles and nozzle spacing can apply material at a varying rate by changing pressure and the rate of travel. If you wish to increase the rate per given area, increase the pressure or reduce the tractor speed. Conversely, if you wish to reduce the rate, reduce the pressure or increase the speed. The rate of application will be uniform only if speed and pressure are kept constant.

REMOVING 2,4-D FROM SPRAY EQUIPMENT:

The normal precautionary practice of rinsing the sprayer immediately following use and just preceding re-use should suffice as long as the sprayer is to be used exclusively for turf grasses. In most cases, however, there comes a time when the spray rig must be used to apply other materials such as insecticides, fungicides and fertilizers to trees, shrubs, and other vegetation. Thorough cleaning of the rig then becomes imperative to remove all 2,4-D residues. There are a number of different recommendations given for removing the amine salt and ester formulations of 2,4-D. An important step to bear in mind is that of thoroughly rinsing or flushing the rig with water both preceding and following the use of the cleaning agent. It is also important that the cleaning agent be allowed to remain in the rig from I8 to 24 hours - 18 hours with the use of hot water.

The following materials were reported as cleaning agents by Murray Pryor, Field Supervisor of Weed Control in California Weed Circular 41:

I. For alkaline forms of 2.4-D 2.4.5-T or similar herbicides:

(I) 2 lbs. sodium hydroxide (lye) - 100 gallons water; 2) 5 Ibs sodium carbonate (sal soda) - 100 gals. water; 3) 10 Ibs. trisodium phosphate - 100 gals. water; 4) 10 Ibs. household ammonia - 100 gals. water; 5) 2 Tbsp. ammonia - 1 gal. water; 6) 2 Tbsp. trisodium phosphate - 1 gal. water; 7) 1 Tbsp. sodium carbonate (sal soda) - I gal. water.

II. For ester forms of 2,4-D or 2,4,5-T or similar herbicides:

1) 2 lbs. sodium hydroxide (lye), add soap or emulsifier, 5 gallons kerosene or Diesel oil - 95 gallons of water; 2) 5 lbs. sodium carbonate (sal soda), add soap or emulsifier, 5 gallons of kerosene ot Diesel oil - 95 gallons water; 3) 10 lbs. trisodium phosphate, add soap or emulsifier, 5 gallons of kerosene or Diesel oil - 95 gallons of water.

TABLE OF EQUIVALENTS

The following table of equivalents is given for your convenience. In large quantity mixtures, it is wise to weigh the ingredients; for lesser quantities, it may be more convenient to measure them. For measuring, a standard measuring cup and a set of spoons is preferred to the household "tablespoon" which probably is nqt one at all.

1/2 fluid oz. = 1 Tablespoon
8 fluid oz. = 1 cup
32 fluid oz. = 1 quart
128 fluid oz. = 1 gallon
12 fluid oz. = 1 pound
3 teaspoons = 1 tablespoon
16 tablespoons = 1 cup
1/2 pint = 1 cup
2 cups = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
8 pints = 1 gallon
I6 cups = 1 gallon
29.57 milliliter = 1 oz.
28.35 grams = 1 oz.
453.59 grams = 1 pound
16 oz. (dry measure) = 1 pound
1 acre = 43,560 sq. ft.

For detailed information concerning conversion tables and specific chemicals reference is made to the following excellent publications:

1. Harvey, W. A., Outline of Types of Herbicides, Paper prepared for Southern California Turfgrass Field Day, October 16, 1956.

2. Nelson, R. H., Conversion Tables and Equivalents for Use in Work Relating to Insect Control, USDA, E-517, Revised, May, 1952.

3. Entoma, a Directory of Insect and Plant Pest Control, The Entomological Society of America, 1953 Entoma 424pp, 1530 P. Street, Washington 5, D.C.

4. Suggested Guide for Chemical Control of Weeds, Agri. Res. Service, USDA, Special Report 22-23, April, 1956.

5. Chemical Calculations in Turf Management. The Mamlon Company, 1091 Whalley Ave., New Haven 15, Conn.