Sprinkler Fertilizing System

continual feeding of crop plants by applying fertilizers with irrigation by sprinkler systems demonstrated to be effective

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Ferti-irrigation—injection of water soluble fertilizers into sprinkler systems—has proved to be effective and economical in three years of tests in San Mateo County.

Approximately 6,000 acres of San Mateo County cropland—planted mainly to vegetables, flowers, and pastures, with an annual return of over $5 million—are irrigated with portable sprinklers.

Sprinklers provide the most efficient method of applying water in the coastal area of the county, because irrigable lands have considerable slope, are many times odd-shaped, or are located in small valleys and canyons where water supplies are limited.

Nitrogen, phosphorus, and potassium are the fertilizers most commonly applied to the soils of the county. Practically all irrigated crops planted along the coast need nitrogen fertilization for maximum quality and yield. Many crops will respond to phosphorus and certain crops to potassium.

The injection of fertilizers into the sprinkler system is easily accomplished and in many cases is less costly than side dressing or broadcast treatment. Most nitrogen compounds—including ammonium sulfate, ammonium nitrate, calcium nitrate, and urea—are readily soluble in water and can be injected into a sprinkler system when completely dissolved. Injection of anhydrous ammonia or nitrogen solutions containing free ammonia is not practical because of excessive losses of ammonia into the air.

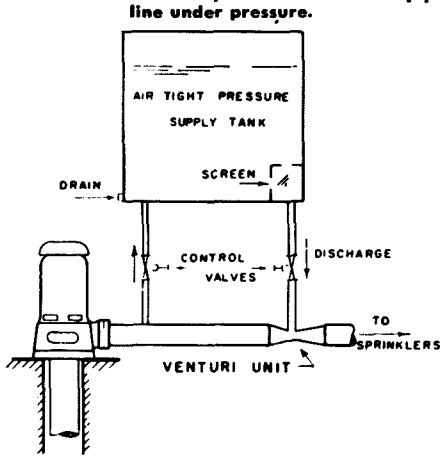
Most potassium salts are water soluble and can be applied by a sprinkler system; however, these fertilizers are generally applied before or during planting.

Phosphorus compounds are only slightly soluble—except phosphoric acid and ammonium phosphate—and are especially corrosive to brass and bronze fittings. Furthermore, it has been found with some crops that placement of phosphate at the time of seeding is important. For example, band placement of phosphate near the seed of lettuce, onions, sweet corn, cole crops, and peas produces better results than broadcast applications.

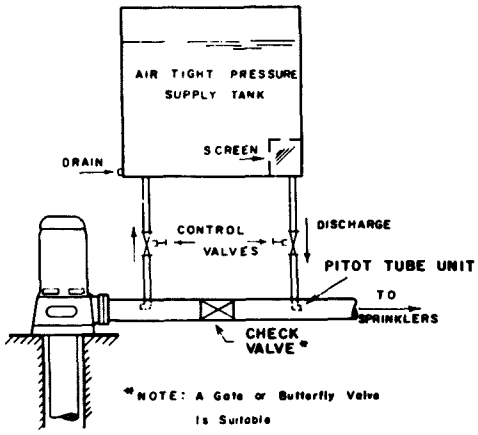
Experience with sprinkler ferti-irrigation in San Mateo County has shown that there is little hazard in corrosion of aluminum pipe or brass and bronze fittings when the fertilizer solution is in the sprinkler systems during the application periods only and the systems are rinsed immediately with clear water. There are injectors which can discharge the fertilizer solution through the lines in a matter of 30–45 minutes which allows clear water to rinse the system lines during the remainder of the irrigation period.

Ferti-irrigation is being used in San Mateo County by five vegetable growers on artichokes, Brussels sprouts, broccoli, and New Zealand spinach; by four flower producers with heather, strawflowers, daisies and calla lilies; and by two ranchers on irrigated pastures. Some of these growers have used water soluble nitrogen, phosphorus, and potassium compounds for as long as four years with no apparent harmful effects to the sprinkler systems.

Venturi unit used to inject fertilizer into a pipe line under pressure.



Pitot tube principle used to establish a flow of water between the two pipe ends.



Injection Methods

The ferti-irrigation equipment in general use in the county consists of an airtight pressure tank connected to a Venturi unit placed in the main line pipe. When the sprinklers are operating, water will circulate from the pipeline into the tank and back into the pipeline. By this method, the fertilizer solution can be mixed with the irrigation water. A commercial fertilizer injector—which makes use of this principle—can be installed as permanent equipment near the discharge pipe from the pump or can be made portable. The Venturi unit is available in different sizes and can be quickly coupled between two lengths of portable sprinkler pipe.

Another commercial injector also makes use of an airtight pressure tank for holding the fertilizer solution. The tank is connected to a Pitot unit placed in the main line pipe which causes the water to circulate through the tank.

Neither of these two units has any moving parts. A separate power unit is not required to inject the fertilizers into the sprinkler lines.

Continual Feeding

Ferti-irrigation has worked satisfactorily on vegetable and flower crops because water soluble fertilizers—particularly nitrogen—can be applied in small amounts at each irrigation. In the coastal area the irrigation cycle is generally from 14 to 21 days depending on weather conditions. The seasonal fertilizer requirement is determined for a crop. The total amount is then divided by the number of irrigations and the resultant applied at each irrigation. As an example: About 150 pounds of actual nitrogen per acre is considered to be the seasonal requirement for Brussels sprouts. For a five month irrigation season this amounts to about 30 pounds nitrogen per month. If ammonium nitrate, which contains 33% nitrogen, is used, then about 100 pounds per acre would be applied through the sprinkler

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system each month. If two irrigations are applied each month, then 50 pounds of ammonium nitrate per acre can be added to the water during each irrigation.

The amount of fertilizer to dissolve in the tank at each sprinkler set can be decided by determining the area each sprinkler supplies with water which is equal to the distance between sprinklers along the lateral line multiplied by the distance the lateral lines are moved. The following table shows the area in acres irrigated by each sprinkler for different spacings of sprinklers and lateral lines. The sprinkled area, multiplied by the number of sprinklers operated at one time, gives the total area irrigated at that setting. The area irrigated multiplied by the desired application rate of the fertilizer in pounds per acre gives the amount of fertilizer that should be placed in the supply tank. This method of determining the correct amount of fertilizer is particularly useful where the number of sprinkler heads used varies from set to set.

Area Irrigated by One Sprinkler

Sprinkler and lateral spacings	Area in acres
20' x 40'	0.0183
30' x 40'	0.0276
40' x 40'	0.0367
20' x 50'	0.0230
30' x 50'	0.0344
40' x 50'	0.0459
20' x 60'	0.0276
30' x 60'	0.0413
40' x 60'	0.0550

Where the number of sprinklers operated at one time is fairly constant, the proper amount of fertilizer applied at each irrigation can be found by multiplying the length of the lateral line by the distance the lateral line is moved for each setting. This area in square feet divided by 43,560 gives the number of acres irrigated at one time.

The uniformity of ferti-irrigation will only be as good as the distribution of the water. Therefore, it is extremely important that the sprinkler system be properly designed and operated so that the irrigation distribution is as uniform as possible.

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SURVIVAL

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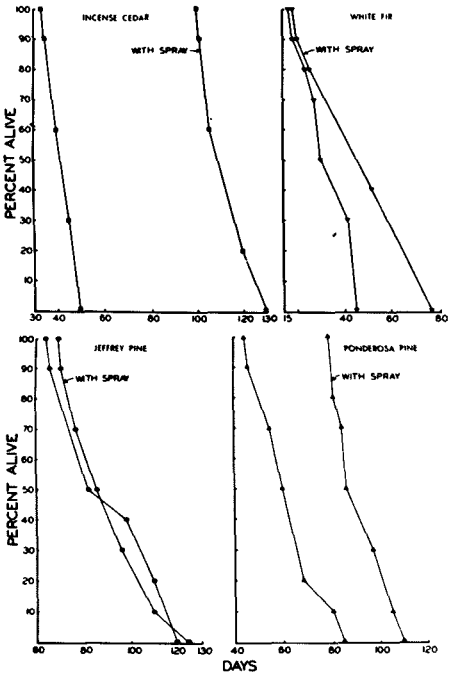
ments—with a larger sample—ponderosa pine seedlings probably would have shown a significant reduction of the soil moisture as would perhaps some of the other species. Actually the moisture content in only two of the 10 cans of ponderosa pine seedlings was out of line. Had it not been for the results with these two cans the average soil moisture reduction would have been highly significant.

When the seedlings were not exposed to spray at night, white fir died after 35 days, the incense cedar after 44 days, the ponderosa pine after 65 days, and the jeffrey pine after 95 days.

Survival in the presence and absence of spray at night.



When the seedlings were exposed to spray at night the picture changed. White fir again was the first to die although spray at night did prolong its life 20 days. Ponderosa and jeffrey pine died next at approximately the same time. This meant that the spray exposure was effective on ponderosa pine, prolonging its life 30 days, while it was not effective on jeffrey pine. Finally, the last to die was incense cedar whose life was prolonged 72 days.

Although the length of time the different species were able to survive after the sunflower had died was increased by exposure to spray at night, the exposure was not equally effective in prolonging the survival of the different species of seedlings.

The differential ability of the conifer seedling to survive after the sunflowers had died indicated a basic physiological difference in the drought resistance of white fir, incense cedar, ponderosa pine, and jeffrey pine. The experimental evidence indicates that white fir is the least resistant to drought and jeffrey pine is the most resistant with incense cedar and ponderosa pine somewhere in between. However, without additional testing it can not be assumed that the behavior of canned conifer seedlings, grown in the greenhouse, will be duplicated in the field. Only a small difference in the relative root growth rate of these species under field conditions would be required to alter the picture. For example, if white fir developed a more extensive root system in a particular soil than did jeffrey pine, then white fir might not be subjected to soil drought while jeffrey pine would.

Nevertheless most students of relationships between plants and their environment who are familiar with the distribution of these four species in California would probably rate jeffrey pine the most drought resistant, and white fir the least resistant since white fir is rarely found on dry sites and is particularly favored on northern exposures while jeffrey pine is often found on the very driest sites.

The relative response of these four species to spray at night was entirely unexpected. The lack of response of jeffrey pine and the very marked response of incense cedar can not be explained readily.

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PLUMS

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showed that some of the seedlings of myrobalan plums that are propagated by seed become infected when planted in soil containing root-knot nematodes. It is therefore important to use one of the vegetatively propagated rootstocks of known resistance in any soil that might be infested.

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