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Reasons for Strawberry Plant Failure at Planting Time

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REASONS FOR STRAWBERRY PLANT FAILURE

AT PLANTING TIME*

Oregon strawberry growers are experiencing difficulty in obtaining a full stand of plants at planting time. In some instances, a considerable percentage of the plants die outright or fail to become well established. Such plant failures occur with both certified and noncertified plants and do not seem to be associated with the incidence of virus or the red stele root disease. Considerable research work is being done in an endeavor to find the causes or factors responsible for this trouble, and the recommendations given in this circular are based largely on the observations made thus far.

From the data at hand, it is apparent that strawberry plant failure at planting time can result from a number of causes, chief among which are: (1) poor conditions of the plants, (2) unfavorable weather during and after planting, (3) faulty planting, (4) improper soil preparation, (5) poor cultural treatment after planting, and (6) root troubles. While the difficulty may result from a single cause, it appears likely that in most cases it is the result of several factors working simultaneously.

Condition of the Plants

The condition of the plants at the time they are set out in the field is probably the most important factor of all, and condition, in turn, is determined largely by the handling treatment the plants receive. That the plants must have been grown properly goes without saying, but more important still are the stage of dormancy attained by the plants at the time of digging and the way the plants are handled in storage.

The importance of dormancy at the time of digging cannot be overemphasized. Plants which are dug before attaining full dormancy, or are dug after dormancy is broken, are a poor risk so far as the strawberry grower is concerned. Such plants do not withstand refrigeration or long continued storage and are apt to undergo high mortality after planting, particularly when weather conditions are unfavorable.

A setback in growth, or even death of the plants, can be expected whenever strawberry plants are dug and transplanted after growth has started in spring. Because of their lack of dormancy, such plants wilt readily and are susceptible to fungus infection. If placed in cold storage, they are susceptible to freezing injury even at temperatures only slightly below freezing and, if held at temperatures above freezing, they tend to "heat" in the packages and may go down from decay. In this connection it should

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be pointed out that healthy and vigorous plants lacking dormancy at the time of digging are just as susceptible to handling damage as plants that are weak or diseased.

Dormancy is Induced by Cold Weather

Plant growers should bear in mind that dormancy in strawberry plants is induced by cold weather during fall and winter, and that the plants remain dormant only so long as the weather continues to be cold or cool. A few warm days in early spring, or even in late winter, are sufficient to break dormancy and to cause the plants to become active.

In the case of plants produced in the coastal areas of Oregon, lack of dormancy may be a problem in seasons when little or no cold weather is experienced during either fall or winter. In these areas, growth usually starts in early spring or even in late winter. To insure as much dormancy as possible, digging should be done in winter, usually not later than early March. Plants grown in the areas east of the Cascade Mountains, on the other hand, usually become dormant in the fall and remain dormant throughout the winter. Often they remain dormant almost to the time of planting in the Willamette Valley. This means that plant growers in eastern Oregon, as a rule, need not dig their plants as early as growers in the western portion of the state. Even under eastern Oregon conditions, however, the plants should be dug before any signs of new growth become apparent.

Storage is Important

Experience has shown that strawberry plants that are dug while fully dormant can be stored for several months without appreciable deterioration. In fact, fully matured plants dug in December and held in cold storage until April have been known to make better growth than plants dug in spring and set out immediately in the field.

While properly hardened or dormant strawberry plants can withstand fairly low temperatures without damage, it is usually best to store them at a temperature that is just above their freezing point. The ideal storage temperature appears to be from 30° to 32° Fahrenheit, and it should be made clear that the storage temperature must be constant. Fluctuation of the storage temperature is often the cause of heating and fungus development. Alternate freezing and thawing in storage is especially damaging to packaged strawberry plants. To insure satisfactory results in strawberry plant storage, it is imperative that the plants go under refrigeration immediately after they are dug. Deterioration takes place rapidly unless the plants are cooled thoroughly soon after they are packaged.

Since drying out of the plants may be a factor during the storage period, attention should be given to the matter of storage humidities. Serious desiccation, as a rule, does not occur in storage rooms when relative humidities ranging from 85 to 90 per cent are maintained. Storage establishments that maintain humidity conditions suitable for the long-time storage of apples and pears are usually satisfactory for the storage of strawberry plants.

Digging and Packaging

Strawberry plants should be picked up and packaged as soon after digging as possible. The roots of these plants are damaged quickly when exposed to dry air or sunshine. Such exposure can cause injury to the cortex area of the roots, thus paving the way for the entrance of fungous organisms. It is believed that the organisms associated with the trouble known as "black root" gain entrance through injured cortex tissue.

Prior to packaging, all soil should be shaken from the roots, and most of the fully expanded leaves should be removed. These leaves can cause loss of moisture through transpiration, and they can harbor decay-producing organisms. If the plants are to be kept in cold storage for some period of time they should be well imbedded in packaging material, such as sphagnum moss that is moist but not excessively wet.

Planting Procedures

The handling procedures that apply to strawberry plants at the time of digging also apply at the time of planting in the field. Regardless of weather conditions, every effort should be made to keep the plants from drying out. The time during which the roots are exposed to the air should be reduced to the shortest interval possible. Plants should be left in cold storage up to the very time of planting. Serious deterioration can occur if the plants are permitted to warm up in the packages prior to planting.

The planting operation itself is of considerable importance. Particular attention should be given to the depth at which the plants are set. Planting that is too shallow can result in drying out of the roots. Planting too deeply, on the other hand, may result in smothering because the crowns of the plants become covered with dirt. Firming of the soil about the roots is important, since roots of newly set plants do not readily absorb moisture and nutrients from loose soil. Failure to compress the soil about the roots is known to be a cause of plant mortality, particularly during dry planting seasons. To insure proper contact with the soil it is also important that the roots be spread out before soil is placed around them. Leaving the roots in a "balled" condition often results in air pockets being left below the surface of the ground.

The Weather Factor

The weather conditions that prevail at planting time, or during the period immediately following, often have a marked influence on the subsequent behavior of strawberry plants. It is an established fact that plant failures are common in seasons when dry weather prevails during April and May. The best results are usually obtained when planting can be done when the weather is cool and cloudy. Rain immediately after planting is nearly always beneficial.

While the grower cannot control the weather, there is much that he can do to modify its effects. By taking advantage of the time factor he can often avoid the hazards of planting in soil that is either too wet or too dry.

Often he can employ irrigation which can go a long ways toward overcoming the bad effects of a dry planting season. Irrigation immediately after planting not only supplies the plants with needed moisture but aids in firming the soil about the plants, thus aiding the roots in becoming established. It should be pointed out, however, that irrigation of newly planted strawberry fields should never be heavy or excessive under Willamette Valley conditions. Heavy rains following a dry spell in early spring frequently occur in this region, and a condition of excessive wetness may result if such rains come shortly after a heavy irrigation has been applied. Light irrigations usually suffice to supply the water needs of newly set strawberry plants.

Soil Preparation

Most strawberry growers are aware of the need of proper soil preparation prior to planting and have learned how to handle their soil so as to obtain good tilth or structure. As a precaution, however, it should be stated that proper preparation of the soil at planting time can be attained only by working the soil at the right time. Soil that is either too wet or too dry often remains lumpy or cloddy after tillage, and soil in this condition does not form good contact with the roots of newly set plants. Too many large air spaces are left between the soil aggregates, and these spaces are a hindrance to absorption of water and plant nutrients.

Cultural Treatments After Planting

To insure a good stand of plants and to obtain proper growth during the first season, it is important for the grower to get his plants growing as quickly as possible after planting. This can often be influenced by the cultural treatments the plants receive. Moreover, strawberry plants during the first season in the field do not normally go into dormancy or into a resting stage in summer. This means that with proper care the plants should continue to grow and increase in size during the entire season.

When moisture is ample, the application of a nitrogenous fertilizer shortly after planting may be of considerable value in stimulating early vegetative growth. Such a fertilizer can be applied through irrigation sprinklers, or it can be spread on the ground around the plants. A nitrogenous fertilizer applied in the form of a booster solution to newly set plants appears to be practical as indicated by experiments carried on in the State of Washington.

Another means of hastening early growth in strawberry plants is blossom removal. Blossoming and subsequent fruiting definitely retard vegetative growth in young strawberry plants.

Since weeds compete for water and plant nutrients, weed control is important in new strawberry fields. Cultivation, however, should never be deep or close enough to the plants to cause damage to the crowns or to the roots. Cultivation should be practiced only for weed control or for the purpose of breaking up crusts formed by heavy rains or irrigation.

The moisture factor is especially important in the case of young strawberry plantings. Lack of moisture can seriously curtail growth and reduce plant stands, particularly during dry seasons. This is true because newly set plants are shallow rooted at least during the early part of the growing seasons and suffer for lack of water unless the upper layer of soil remains moist. Soil which may contain ample moisture for deep-rooted or well-established vegetation may prove to be too dry for new strawberry plants.

The moisture problem, of course, is solved easily by the grower who is prepared to irrigate at fairly frequent intervals, but is not so easy for the grower who does not practice irrigation. In this case, the grower needs to pay attention to moisture conservation practices. If his land is in cover crops prior to planting, he should turn the cover crops under before they deplete the soil of moisture, and he should keep weed growth down at all times. He should also avoid such tillage practices as result in needless exposure of moist soil to the air. Turning under the dry surface soil and replacing it with moist soil from underneath can result in considerable moisture loss if done at frequent intervals.

Root Troubles

Strawberry plants are susceptible to a number of root troubles that can result in plant failure. Among these troubles are the red stele disease and the condition commonly known as "black root" rot. Red stele is characterized by reddish discoloration of the stele of the individual roots, and is caused by a specific soil fungus. While not usually detectable from external examination, red stele can be identified by cutting into the roots and noting the color of the central core area. Black root rot, on the other hand, is characterized by blackening of the roots, a condition that is identifiable by external examination. This trouble is believed to be caused by a number of factors, among which are root desiccation and a complex of soil organisms including fungi, nematodes, and possibly bacteria.

Strawberry plants which have been well grown and properly handled are usually free of serious root troubles at the time the grower receives them. Freedom from root troubles is one of the requirements of strawberry certification in Oregon. It is always a wise procedure, however, for the grower to make sure that his plants are relatively free of these troubles at the time of planting. Black root rot has been known to develop during the storage period.

In the case of black root rot it should be pointed out that the presence of a few black roots in what is otherwise a healthy root system is probably of no serious consequence, but in cases where one-third or more of the roots show the condition, the plant is almost certain to make a poor showing in the field. Plants which show symptoms of red stele, on the other hand, should always be discarded even though only traces of the disease are found.

It is true, of course, that plants apparently free of root troubles at the time of planting sometimes develop the condition in the field and fail to make satisfactory growth. Losses from this source are serious, particularly during some seasons. In this case it is believed that desiccation of the roots either

before or after planting is at least one of the major contributing causes. It is believed also that planting in fields which have recently been in crops such as potatoes, tomatoes, egg plants, and cane fruits may result in an increased amount of black root, because such fields may harbor organisms that are associated with the trouble.

SUMMARY OF RECOMMENDATIONS FOR HANDLING STRAWBERRY PLANTS

<u>Operation</u>	<u>What to do</u>
Digging plants-----	Dig while dormant--before March in the Willamette Valley. Shake soil from roots. Remove all old leaves from the crown. Cut off all expanded leaves.
Holding or storing plants-----	Place in cold storage, 30° to 32° F. Keep temperature constant. Pack or hold plants so they do not dry out.
Soil preparation-----	Prepare a fine, loose soil, Smooth and firm the surface. Maintain proper moisture.
Planting-----	Make sure that soil is pressed firmly against the roots. Plant at proper depth (crown at ground line). Spread out roots and plant deep. Avoid exposing roots to drying wind or sunshine.
Kind of plants-----	Plant only dormant plants if possible. Select average size for the variety. Choose plants with good root systems. Clean roots. Remove all expanded leaves.
Care following planting-----	Irrigate, if possible, immediately after plants are set out when weather is dry. Use booster solution at planting or immediately following. Apply a nitrogen fertilizer. Remove blossoms. Control weeds. Set first runners. Practice shallow cultivation.