Plant Diseases

restrictive effect of California climate on vegetables, grains, and flowers

Kenneth F. Baker and William C. Snyder

The semi-arid California climate is an effective ally in eliminating or restricting many crop diseases.

Some growers are unaware that the climate aids them in their fight against plant diseases. For example, some diseases that cause serious losses in regions of high rainfall are generally absent from California. Among the important ones are bean anthracnose, bacterial blight of bean, black rot of cabbage and cauliflower, Septoria leaf spot of tomato, anthracnose of watermelon, and angular leaf spot and scab of cucumber. These and many other rain-spread diseases may be safely ignored by growers in this state.

Dry Climate

There are other diseases which, though present, are unimportant in California because of the dry climate. Loose smut of wheat, a destructive disease in humid areas, is essentially unknown here, and farmers are saved the cost of the hot-water seed treatment necessary for control. Black spot, the worst disease of rose in most areas, is rare in California outdoor plantings, a fact that saves nurserymen the large sums for spraying required elsewhere. Azalea flower blight necessitates an expensive spray program in gardens of the southeastern states, but occurs here only on plants grown in moist lathhouses. Septoria leaf spot of chrysanthemum is generally unimportant in this state, but in the humid east spraying is necessary to prevent losses in the cut-flower crop.

Other diseases are restricted here by limited rainfall to underground parts of the plant. Black leg is a destructive disease of brussels sprouts in New York, causing root rot, stem cankers, and spots of leaves and pods. Recently it was found in California—San Mateo County—restricted to subterranean parts of the plant. This occurrence of the disease is made possible by continuous cropping to sprouts, since the fungus does not persist in soil after decay of infected parts. Because of the absence of aerial infection, the locally grown seed is free of the fungus, and seedlings produced by them are infected only from crop residues. Similarly, the Gibberella blight of wheat severely attacks stems and heads in moist regions, but in this state is limited to decay of roots and stem bases, and then only on land continuously planted to cereals.

Ascochyta ray blight of chrysanthemum, an explosively epidemic decay of the flowers that necessitates frequent and costly spraying in the moist southeastern states, occurs as a harmless fungus on stem bases in California.

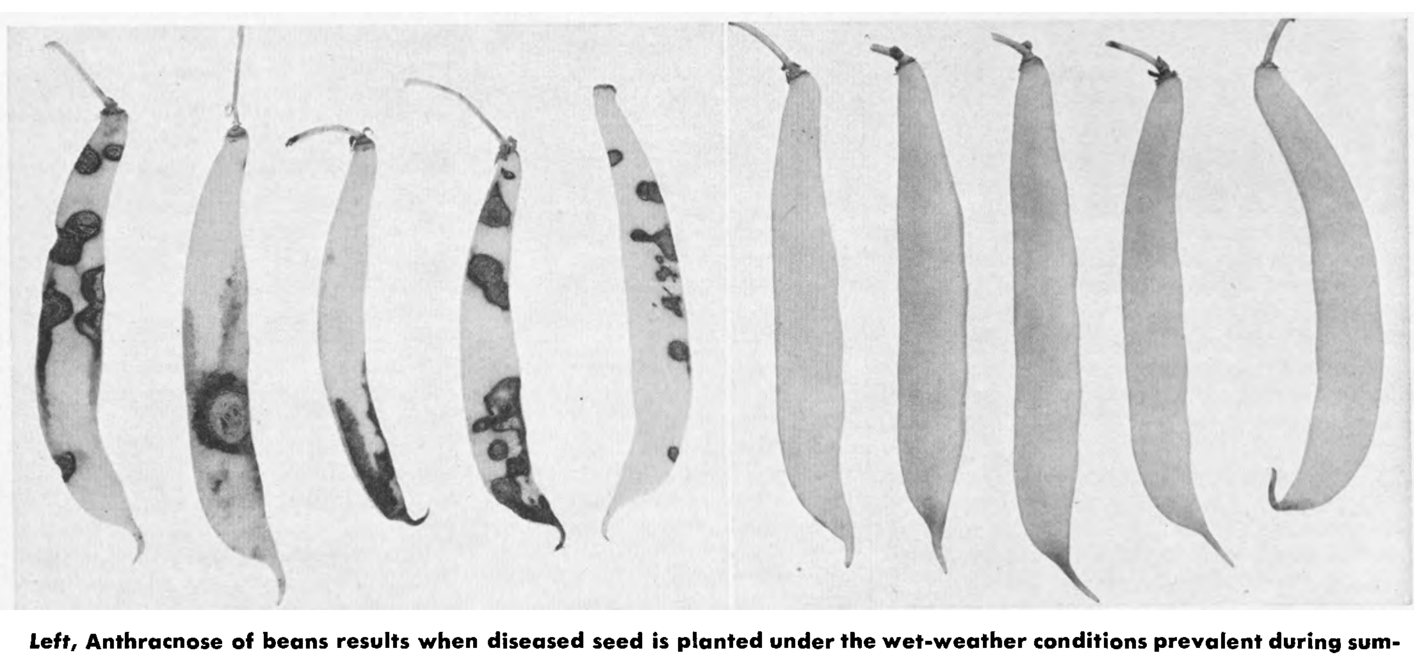
A different Ascochyta blight is the most destructive disease of canning peas in many regions, attacking aerial parts and roots when infected seed is planted. In the low-rainfall Imperial Valley area only a decay of underground parts results when diseased seed is planted. Consequently Ascochyta-free seed is produced there even by a crop grown from infected seed.

Still other diseases are restricted by high soil temperatures to certain areas or seasons in this state. Rhizoctonia root rot of beans has been greatly reduced in the Salinas Valley in recent years by delay of planting until the soil temperature rises above 65° F. At these temperatures beans are much less affected by this root rot than they are in cooler soil.

Climatic Restrictions

The benefits to California growers from climatic restriction of plant diseases are very great, though not often appreciated or understood. Many fungi require moist conditions for extended periods in order to produce the spores necessary for their spread. Dissemination of the spores of many important pathogens occurs only in splashed, dripping, wind-blown, or running water. Infection by these spores requires continuously moist conditions for a period ranging from a few to 48 hours. Because of the low humidity and general dryness in California, plants dry off very quickly following a rain.

Continued on page 15



Left, **Anthracnose of beans results when diseased seed is planted under the wet-weather conditions prevalent during summer in eastern and midwestern states.** ***Right,*** **Healthy beans are obtained in California's summer climate, even when grown from anthracnose-infected seed.**

DISEASES

Continued from page 3

In the eastern states the humidity usually remains so high that plants do not dry for many hours after a rain. Because of the smaller quantity and shorter duration of rainfall here, and the more rapid drying afterward, many fungi are restricted in sporulation, dissemination, and infection.

These simple facts explain the absence of many diseases in California, the unimportance of others, and why some persist only as an underground phase. Reduction of those troubles that affect a farmer's ability to grow a crop—that is; production diseases—is a dividend received by growers, whether they realize it or not.

Additional Benefits

There are additional benefits that may be derived by consciously capitalizing on the climatic restriction of crop diseases.

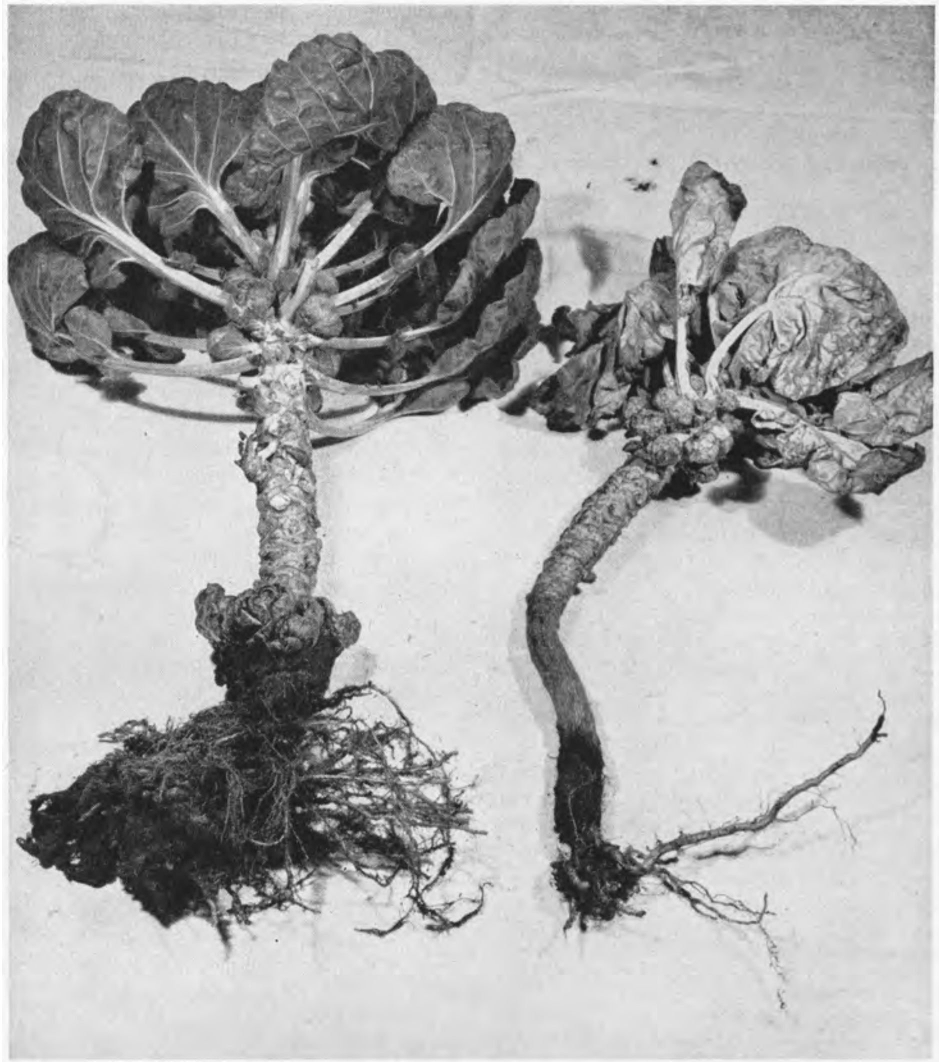
The absence of aerial infections by many fungi and bacteria guarantees that the seed produced is free of the pathogen. Such disease-free seed, the use of which is the only practical means of control of many troubles in large areas of this country, can be economically produced only in semi-arid regions. To avoid seed-borne black leg and black rot much cabbage and cauliflower seed is grown in California.

The freedom of the dry and snap bean seed grown here from anthracnose and bacterial blight, and of lima bean from bacterial blight, has given them a wide market. Pea seed produced in the Imperial Valley is free of Ascochyta and bacterial blights. Seed of watermelon, squash, and other cucurbits produced in California is free of anthracnose and angular leaf spot. The production in this state of disease-free cuttings of vegetatively propagated crops presents further opportunities for capitalizing on our climatic advantage.

The amount of seed transmission of viruses may be reduced by choosing seasons and areas in California that are unfavorable to development of the aphid carriers. Thus, there is comparatively little virus spread in June-planted seed potatoes in the San Joaquin Valley. The same is true of seed-borne mosaic of summer-grown beans in that area.

Climatic Variability

While capitalizing on the California climate, growers should never forget that it can be unusual. A rare period of late spring or early summer rains may negate the disease-inhibiting benefits of the normal dry season. Growers, seedsmen, and those who certify crops for disease freedom must maintain constant vigilance for the unusual if they are to avoid the pitfalls of blind dependence on a climate which is generally beneficial but not always perfect. The black leg fungus, probably introduced with imported infected seed, lurks in the soil of some California crucifer areas and may suddenly appear on susceptible plants in a year with unusually late warm rains.



Brussels sprouts grown in California usually are free from the black leg disease *left*. When plants are grown in seedbeds or fields containing undecomposed residue from diseased sprouts, the fungus attacks the underground parts *right*. In regions of heavy summer rainfall, the fungus infects aerial stems, leaves, pods.

While the absence of typical symptoms of a disease in seed fields usually indicates that the causal organism is not present and that clean seed is being produced, this is not always true. Typical leaf and flower infections of Alternaria disease of zinnia are rarely produced in California seed fields. However, seed does become infected in coastal fields, and when planted in moist regions, results in severe disease losses. Night fogs and dew wet the flower heads, favoring development of the fungus and infection of the seeds. Zinnia seed grown under the drier conditions of the San Joaquin or Imperial Valleys appears to be free of the fungus.

The dry California climate largely prevents the fasciation bacteria from producing typical leafy galls on nasturtium here. However, the seed produced becomes contaminated with the bacteria from the soil, and when planted under moist conditions, produces fasciated plants.

The grower should devise methods of exploiting the climate to further reduce disease losses, and to avoid practices that counteract its benefits. For example, he should select the area and the season that will most effectively reduce the diseases of his crop. It is to be noted that only in California is it possible to produce some crops any time of the year, and thus take advantage of control by selection of the season.

Knowing that winter rains and fogs favor certain diseases, the grower should schedule his planting so as to permit harvest before that season. He should avoid the protracted use of overhead sprinkling on crops subject to aerial diseases fa-

Continued on next page

DISEASES

Continued from preceding page

vored by moisture. Bacterial stem rot of delphinium frequently decimates seed or flower crops grown with overhead sprinkling, but is insignificant when ditch irrigation is practiced.

Conditions that restrict air movement and rapid drying favor some diseases. For example, a recent outbreak of Botrytis gray mold on chrysanthemum flowers in San Mateo County was much more damaging under a complete than under a partial cloth-house cover.

The grower should understand how continuous cropping may lead to economic loss from the subterranean phase of a disease—such as black leg of brussels sprouts—that would otherwise be unimportant here. Use of clean seed of this crop to prevent either introduction of the organism to the land or its intensification if already present, is important even under dry conditions. The benefit from using disease-free seed is not limited to the single crop but extends to future ones as well.

Climate has been one of the factors that has made California a great agricultural state. It is a powerful ally in preventing losses from plant diseases, and growers should adopt cultural practices which will fully capitalize on it.

Kenneth F. Baker is Professor of Plant Pathology, University of California College of Agriculture, Los Angeles.

William C. Snyder is Professor of Plant Pathology, University of California College of Agriculture, Berkeley.

ALFALFA

Continued from page 9

factor on the capacity of any of the combines studied was in the cleaning ability of the machine, or in other words, the size and effectiveness of the shoe.

In some of the fields which had exceptionally heavy crops, the windrows were so large that it was a problem to reduce the forward speed of even the larger combines to the point where losses over the rear of the machine were not excessive.

For example, checks at three speeds with one of the larger combines taking a windrow from a 10-foot cut, gave the following losses: 10 pounds per acre at 0.8 mph, 35 pounds per acre at 1.2 mph, and 74 pounds per acre at 1.4 mph. These tests were in one of the heaviest fields observed. With another machine, the loss increased from 11 to 149 pounds per acre when the forward speed was increased from 0.9 to 1.3 mph.

In another field with exceptionally heavy growth, the combine had to be operated with one or the other of the main wheels upon an irrigation border for about one third of the windrows. The loss with the machine level was 52 pounds per acre, but was twice as much when the combine was tilted either way—at an angle of about five degrees.

The method and care used in cutting and windrowing the crop has considerable effect on the quality of the threshing job. Windrows which are bunchy and uneven cause the combine to be alternately overloaded and underfed, resulting in increased losses and damage to the seed. Also, considerable seed may be shattered and lost in the windrowing procedure itself.

The two types of equipment observed were the windrow-swather which cuts the material and conveys it to one side by means of a draper, and the standard mower with curler attachment which relies upon dragging curved bars and contact with the stubble to roll the material over into a windrow. The latter involves the least investment in equipment, but tends to give bunchy windrows, especially where the growth is light.

Another source of loss is seed shattered by the windrow pick-up device on the combine. It is highly desirable that the pick-up be driven from a ground wheel, with a peripheral speed perhaps 10% greater than ground speed. This will result in a minimum amount of disturbance as the windrow is picked up. Of the various types of pick-up units noted, the most satisfactory was the belt-type, operating with a rather flat slope.

The machines under observation in this investigation harvested 600,000 pounds of seed from 1,120 acres, for an average yield of 535 pounds per acre. The yields from individual fields ranged from 100 pounds to slightly over 1,000 pounds per acre. Visible seed damage averaged 17% for the 16 combines as initially operated, and 5.3% after the machines had been adjusted. The average germination loss caused by the combine—compared to hand-threshed seed—was reduced from 15.3% to 5.3% by the adjustments.

L. G. Jones is Associate in Agronomy in the University of California College of Agriculture Experiment Station, Davis.

R. A. Kepner is Lecturer in Agricultural Engineering and Assistant Agricultural Engineer in the University of California College of Agriculture Experiment Station, Davis.

Roy Bainer is Professor of Agricultural Engineering and Agricultural Engineer, University of California College of Agriculture Experiment Station, Davis.

J. P. Fairbank is Associate Agricultural Engineer in the University of California College of Agriculture Experiment Station, Davis.

NEW PUBLICATIONS

Single copies of these publications or a catalogue of Agricultural Publications may be obtained without charge from the local office of the Farm Advisor or by addressing a request to: Publications Office, 22 Giannini Hall, University of California, College of Agriculture, Berkeley 4, California.

TOMATO PRODUCTION IN CALIFORNIA, by John H. MacGillivray, A. E. Michelbacher, and C. Emlen Scott. Ext. Cir. 167, June 1950.

DONATIONS FOR AGRICULTURE RESEARCH

Gifts to the University of California for research by the College of Agriculture accepted in June, 1950

BERKELEY

Dow Chemical Company .... 5 gallons Dinitro Compound
Agricultural Extension Service

E. I. du Pont de Nemours Company .... 200 pounds EPN 2%
Division of Entomology & Parasitology

McLaughlin Gormley King Company .... 1 drum of insecticide
Division of Entomology & Parasitology

Naugatuck Chemical Company .... 12 4-pound bags of Aramite 15 W
1 50-pound sack of Aramite 15 W
Division of Entomology & Parasitology

Tobacco By-Products Company .... 336 pounds of 14% Dry Nicotine concentrate
Division of Entomology & Parasitology

Wilson Laboratories .... 10 pounds liver fraction L
Division of Poultry Husbandry

DAVIS

California Committee on the Relation of Electricity to Agriculture $3,125.00
Division of Agricultural Engineering

Kaiser Aluminum & Chemical Sales, Inc. .... 48 sheets of aluminum
Division of Poultry Husbandry

Mr. Howard A. Mansfield .... 4 Individual Laying Cages
Division of Poultry Husbandry

Merck & Co., Inc. .... 50 grams of Crystalline Procaine Penicillin
1-pound bottle Streptomycin mixture for oral veterinary use
Division of Poultry Husbandry

LOS ANGELES

Dow Chemical Company .... 4 pounds Octa-methylpyrophosphoramide C-1014
3 pounds Dow spreader-sticker S-1198
Division of Entomology

Julius Hyman & Company .... 50 pounds 1% Dieldrin Dust
Division of Entomology

Pestless Products Company .... 30 gallons Liquid-Gro
Division of Ornamental Horticulture