

Saving the Soil

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A. W. Christie, Chairman Los Angeles Avocado Department:

We are now ready to start the afternoon session of the Avocado Growers' Institute. Many activities of our government are referred to as "the new deal" and there is much comment as to the merits and demerits of various set-ups of the present administration. In years to come, we will probably be able to point to some things which have been a definite benefit and very much worthwhile. I think one of the services which the government has instituted in recent years, which will be remembered, is that of soil conservation. Certainly the soil of the agricultural districts of this country represents one of its greatest assets, and conservation of that asset is particularly advantageous from an agricultural standpoint.

Avocado growers, generally speaking, are interested in soil conservation because some avocado orchards are located on rolling or hillside locations, where soil erosion has been more or less an important problem. Loss of soil means loss of fertility. We are happy this afternoon to have with us Mr. Chas. W. Petit, Manager of this District of the Soil Erosion Service. His territory includes Southern California and Nevada. He will give an illustrated talk on "Saving the Soil."

Mr. Chairman, ladies and gentlemen: I have just returned from a three-day convention held in Salt Lake City, of the eleven Western States where we were considering the new bill which was signed by the President about two weeks ago, to be known as "The Soil Conservation and Domestic Allotment Act." Under the provisions of this bill, there will be funds appropriated by the federal government for distribution to agricultural centers in various states of the Union on the basis of soil conservation measures which they may adopt. A good deal of time was given to the consideration of the subject of soil depleting and soil conserving crops. On that basis, it is clear that a great deal of distribution of these funds was to be made. However, here in California we are especially interested in soil depleting practices and soil conserving practices, which comes down to the method of each individual's use of his own property. This convention in Salt Lake City was held for the purpose of passing certain resolutions which the Secretary of Agriculture will use in formulating the policy and plans for the distribution of funds for this year and possibly next year. After that, the law provides appropriations will be made directly to the states and the states in turn will work out their own methods by legislation.

However, for the next few months you will probably hear a great deal about this act,

which will be generally known as the "Domestic Allotment Act" instead of the "Soil Conservation Act."

"SOIL CONSERVATION" PERMANENT

The "Soil Conservation Act," as such, was passed a few years ago and created a new bureau in the Department of Agriculture, permanent in its nature and probably will not go out with the tide as some of the New Deal measures which the chairman referred to may do. In passing this legislation a few years ago, Congress recognized that the loss of soil and moisture resources on agricultural land, on grazing land and on forest land was a menace to the national welfare and this legislation empowered the Secretary of Agriculture to carry on demonstration work, experimental work, to bring to the attention of the American farmer and agriculturist the losses that he was suffering yearly through erosion of his soil. It seems strange that it would be necessary to have to institute a bureau of this kind for that purpose, but throughout this country there has been great damage already done through the erosion of the soil and in many cases, it has gone on year after year without the loser of the land appreciating what was happening. A visitor to the Tennessee Valley was talking to a farmer and remarked that he couldn't see how he ever managed to farm along all those rocks on the hillside. The farmer replied "You know, those rocks weren't there a few years ago." An examination of the land showed that year after year the soil erosion had been going on to the extent of two or three feet and the operator had not known what was taking place right under his feet. He thought that the rocks grew up right out of the ground or the surface of the ground grew down to the rocks.

This damage has been great throughout the South and California has not escaped, as you will see when we show some pictures here to illustrate to you visually what has been occurring and is still occurring in California.

SUBJECT TO SOIL EROSION HERE

It is probably true that in an area such as this of intermittent rainfall, and rain is not sufficient in quantity or proper distribution to maintain a permanent cover of sod, we are more subject to this type of land damage than they are in some of the other more humid parts of the United States. Also in other countries, countries that have similar climate to ours, agriculture has deteriorated to the point where it will no longer support much of the population. There are evidences of ancient cities surrounded by land which is nothing more than barren rock or yellow clay or soil that is unbelievably poor. To ward off that type of future, which is undoubtedly facing much of our agriculture, we must adopt correct methods of handling our soil.

Now, I will show you some of these pictures. I see we are late in starting, so possibly I can talk about them as I go along (showing slides). These two Missouri mules, living in California now, and hitched to an ordinary cultivator, illustrates one of the methods used which is laying our soil open to this type of destruction. The other two, which are not nearly so destructive, are overgrazing of unplowed land until all the vegetation is eaten down to bare ground; and fire in the brush land. Fire is more spectacular but not nearly

as damaging as the method shown before us. The fire does leave the root system and vegetation will return, while clean tillage goes on from year to year and all vegetative cover is removed.

This picture illustrates a field in California; a hill which has been carefully tilled during the winter months. As these gullies develop, which you see in the outline here, they are repaired by scraping the top soil into them. Now, you can't imagine a better method for carrying off that top soil. These could very well represent sluice flumes methodically filled with soil after each storm and the succeeding storm carries the soil on to the ocean.

Here is another picture taken in California and illustrates two types in which this soil erosion manifests itself. This picture is of a hillside and is by far the most destructive type of erosion—cultivated and plowed land carried down to the bottom of the slope. It is more destructive because more insidious and after the land has been thoroughly worked and smoothed up, you would think nothing had happened; it looks about the same as before, although possibly a quarter of an inch or a half inch of the soil may have been removed. You may think—"What is a quarter or a half inch?" Well, it doesn't amount to much if it is stopped there, but that type continues year after year, and if you add that up over twenty-five years or fifty years, in the life of agriculture—or the life of a nation, it would be a disastrous amount. If it could be concentrated in one year, we would regard it as a great national calamity, but it occurs from year to year and nothing is done about it. Later, erosion advances to the stage where there is nothing that can be done about it. The corrective measures necessary would not be economically feasible and the land goes out of use as an agricultural adventure. In the foreground, top soil has been removed and the erosion continues in the way of these gullies which penetrate far down below the level of the top soil into a more barren sub-soil.

EROSION STOPS AT COVERED GROUND

This is a picture taken in California. You notice here an orchard planted on the square with no protection at all during winter months. This has all been kept in clean cultivation. Note the amount of soil erosion which has taken place. Where natural vegetation grows, erosion stops immediately at the edge of the covered ground. That is nature's method of protecting the surface of sloping land.

This is a picture taken in Los Angeles County, out on the Palos Verdes Ranch, and the erosion you see here occurred during the five-inch rain which we had in February over a period of about ten days. That type of erosion can be very easily smoothed up and farming operations continued, but sooner or later, it will reach a point where the land cannot be farmed. We have no way to restore fertility to that land economically. As I stated in the beginning, farming practices are more important than crops, because this type of sheet erosion will carry away the plant food at least twenty times as fast as the crop grown there could do.

This is a picture of the same land taken at the same time, which illustrates that erosion will not continue into the vegetated portion of the hillside, even if it is steeper than the portion which was clean tilled for winter vegetables.

The next stage of erosion is the formation of gullies, this picture shows one that is about three or four feet deep and was formed during one rain storm. Before the rain, it was cultivated across. That type of erosion is more spectacular, but it is not as dangerous as sheet erosion. We can see that something serious is happening when gullies of that kind develop in one rain.

This picture illustrates what I mentioned before—dangerous farm practices. These are the tracks of the cultivating instrument. They represent about two feet from ditch to ditch, cultivated up and down the slope of the hill. Concentration of run-off occurs and soil is carried down onto the field below.

This is a hillside in Southern California. It looks a good deal like the surface of the moon. These gullies are thirty, forty, and fifty feet apart. The operator tried to control them by loose straw dams. His actual damage was occurring on the surface of the ground between the gullies. If the dam were successful, his damage would continue just as much on the surface of the tilled land.

This is another picture—an airplane view of the same section—it shows what happens to sloping hillsides. Note how close together these rills can occur on land that is cleanly cultivated and allowed to stay in that condition during the rainy season.

INCORRECTLY LAID-OUT ORCHARD

Here is another picture. One of the problems which we have in all of California is these orchards, some of which might be also true of avocados. This is an apple orchard in Northern California. When planted, no account was taken of the slope of the land. The trees were planted straight up and down the hill and set square so cultivation followed directly up and downhill and offered the greatest encouragement to erosion. I told you about the man in Tennessee who had a surface of ground washed away without knowing what was happening, but with this man the level of the ground when original trees were planted was at least eighteen inches higher than at present judging by the man standing beside them. As your soil goes down, you cannot lower your trees to fit it.

Here is another orchard in that same section in Southern California and illustrates the fact that trees set on square spacing of that kind, with no other protection, offer very little resistance to soil erosion.

This picture illustrates damage by deposit which, of course, follows active soil erosion in any area. If the stream doesn't have a clear channel to the ocean, somewhere along the line it deposits its load of debris. This is a walnut orchard and shows how deposits may occur. The damage is probably as great as the one where the soil is being lost.

This is not the Grand Canyon, but merely an illustration of the depth of gullies and the amount of land they will actually consume when once they are allowed to extend up through agricultural land when unchecked. In many cases, the cost of controlling one of these gullies is probably prohibitive for small size tracts of land. In many cases, it becomes a community effort. If unchecked, it will cut back until it goes through the entire valley. Such land as this we consider completely ruined for any future agricultural development. The cost of reclaiming that would be prohibitive, based on the value of the land.

This picture illustrates how these gullies grow up and grow through and finally occupy the best part of rolling hill country, leaving the barren hillsides for cultivation.

GULLEY EROSION

Here is another picture—in Ventura County—this gully has traversed up to the head of the valley and numerous side fingers have developed which will follow any little water course. While that is more spectacular, it is not as destructive. Little by little it washes off the surface of the field without giving ample warning.

This illustrates a field in Ventura County—all of these smaller ones developing through the surface of the land. This is fairly flat land and would be considered very valuable for citrus or walnut orchards. This one also illustrates the type of soil which usually underlies the surface. Two feet thick of top soil and as far as this gully has penetrated forty or fifty feet—almost barren and will support no vegetation at all. If the soil were the same all the way down, we would always have a good top soil. Unfortunately, as all of you know, the values are concentrated very largely in the first foot of soil. Many soils are completely ruined if they lose as much as ten inches of top soil.

This illustration is a side view of an area which was burned off—and is the other type—which laid the soil open to damage. This shows you the transporting power of water running down the hillside. When you increase the volume of water to double the amount, you probably increase the velocity to double and you increase the carrying power thirty-two times. Now, what can be done about it? The government organized the Soil Conservation Service to see if some method could be developed and demonstrated that agriculture could be protected. Soil erosion is common to all types of agriculture that is carried on, on sloping land. The only land that can escape is so flat that the run-off carries none of the soil with it. The first thing that is necessary is the practice of cultivating on a contour and not up and down hill. That is the first step of controlling erosion damage.

This picture represents a tool that was developed to alternately raise and lower so that it will dig holes on sloping land as a cultivation operation. We call it a pocket-digging cultivator. It helps to prevent the run-off of the rain. This is the type of hole which is dug, each one holding five gallons of water and will hold a two inch rain without run-off, even if no percolation occurs. It is a method which we have found successful on some of our hillsides.

This is a picture of a hillside treated in that way and in a few places where it was so steep it was ineffective. Many slopes are protected by that type of cultivation. Hills that are steeper than this should not be cultivated and should not be kept clean during winter months. The next type of protection is that of building ridges with road graders or other suitable tools. This type of protection located on the level or a slight fall forming ditches and ridges and maintained in that shape during the winter months will prevent a great deal of run-off.

A CLOSELY TERRACED FIELD

This illustrates a field treated in that manner. This is called terracing. If the terraces carry water in one direction, some method must be provided to allow the excess water to be carried down into this deep gully without starting an additional gully. Here is a close-up view of a terraced field in San Luis Obispo County. If the terraces are placed sufficiently close together, a great deal of erosion is prevented. As flowing water gathers volume, the amount of erosion increases very rapidly. In the distance is a hill unprotected and shows very bad erosion.

Another illustration of the same type. The main water ways carry water down the hill—all draining their surplus water into that down draft. By putting these ridges in, the velocity is now very much retarded and we have much greater percolation into the soil than if allowed to run off naturally. Here is an attempt to remedy the condition which was illustrated before—an orchard planted on the square without reference to the contour of the field. After the orchard has been placed, irregular ditches are maintained so run-off water will follow them instead of flowing down through the orchard.

Here is a close-up view of an apple orchard in Santa Cruz County, showing the type of ditch necessary in connection with such treatment.

Here is a picture which is not in California, illustrating the same thing I have been talking about. These ridges or terraces are probably five or six hundred years old on the western slope of the Andes, and constructed by a people who knew nothing about agriculture, yet they have been maintained for agriculture four or five hundred years.

This is a type of work with which we are all familiar—the contour planting of citrus and development of bench terraces which are kept vegetated and no attempt to clear the vegetation on the slopes.

COVER CROPS AND CONTOUR PLANTING

In San Diego County they use only the basin around the tree where the water supply is limited and the area between the basins is unprotected and all rainfall can run down out of the orchards. I imagine that you appreciate that one of your problems is to conserve every drop of rain that you can and possibly induce it to percolate into the ground.

This is an aerial view showing an orchard in which these conditions were taken into account when laid out. All the rows of trees follow the contour.

The next method which we are trying to demonstrate, although familiar to you, is that of using cover crop during the winter months, which we consider the most effective. During the rainy season—and it seems fortunate in California at least that the rain is concentrated in a few months, this cover crop can be grown and the soil protected without any run-off at all.

This picture illustrates an orchard which is protected by cover crop.

This picture illustrates terracing and is introduced here to show what could be the ultimate gain of terracing on a steep hillside separated by cross ridges. No possible rain could run off, even straight down the hill. That hillside has come through this winter

without a bit of run-off.

This picture is introduced as a typical hillside to show how thin the top soil is. One foot of good soil and below that the soil is sterile. Some small dams are used to control these gullies as they form. Here is another picture showing the efforts made to try to refill a gully already developed in an orchard. This is merely a protection of water course, with which you are all familiar here in California.

This picture shows the construction of another dam in a gully—these following pictures will illustrate to you some of these structures which can reach considerable expense if we allow the damage to reach the point where large structures of this kind have to be built to effect restoration of the original condition. Here is one which would probably cost \$1,200 or \$1,500—it is of concrete—twelve feet across and fifteen feet in depth. This type of control is built in the bottom of these deep gullies in order to allow vegetation to start and help us mend the damage by reversing the process by which it occurred.

Here is a large gully about one hundred and fifty feet wide and sixty feet deep. This structure was built to refill this gully and cost about \$30,000—for one structure—so you see, they are beyond the means of any ordinary rancher.

DEMONSTRATION PLOT AT EL TORO

CHAIRMAN: Before Mr. Petit takes his seat, I would like to have him explain what type of demonstration will be available for visitors who might wish to see the work that is being done on this problem of soil erosion. I would like him to say a word about that.

MR. PETIT: Our set-up is changing so rapidly that what I might tell you today might not be true tomorrow. At the present time, we are conducting at El Toro, California, a demonstration area of some of our work. If you are living any place in California and have a problem of erosion, you should address your request to your Farm Advisor and he, in turn, can have us delegated to investigate it if we have the personnel to do it.

I think we will be called upon a great deal, due to this enlarged program of the Domestic Allotment Act. There will be a State Committee and a County Committee who can call on us for a great deal of assistance in working out their program for the distribution of these funds to those people who wish to avail themselves of it. They will only be distributed to those who make a request and comply with conditions laid down. There will be no contact made with any individual.

This program is being worked out now and you should make any requests necessary to your Farm Advisor and he will handle it from there on.