

ting or seedling in the full sun you are going to have "cook-out." The temperatures are going to raise havoc with the water loss, both by transpiration and evaporation. So we should see to it that our plants are protected from this rapid loss of water. Migrating shade will do the job better than mulching in the full sun. We also get good control over temperature with migrating shade. We get good control over water. Our beds would be sterilized with methyl bromide or Vapam rather than mulched. However, if you were to mulch, because you failed to practice weed control, a lighter mulch will do the job, if it were in the full sun. I don't know why, but this is my observation over a number of years. I find when I use wood chips I can get away with not much more than a half inch layer of wood chips. These wood chips, of course, come from a mill rather than from the chipper that the brush clean-up fellow use. These chips are of a size like nickels, dimes and quarters, laid down just like so many little plates. This will do a wonderful job of weed control.

MODERATOR DUGAN. Thank you, Harvey. We will pass now to Mr. Case Hoogendoorn for his comments.

MR. CASE HOOGENDOORN: Now you just heard the technical side of mulching. What I am going to give you is just my own experience, which of course is purely commercial. I have already found out that Harvey and I are on opposite sides of the fence.

Mr. Hoogendoorn presented his paper on mulching materials and methods of application. He supplemented his discussion with demonstrations of plant materials grown under this system of culture.

## USE OF MULCHES IN THE NURSERY

CASE HOOGENDOORN  
*Hoogendoorn Nurseries*  
*Newport, Rhode Island*

Since we do a lot of propagating, we had the same trouble everyone else has and that is to keep ahead of the weeds in the beds. This is usually all handwork, which is costly and consumes a lot of time.

Before we began to use a mulch, the soil in these beds, consisting of a heavy loam, was very hard in the spring, after the heavy winter rains and quick drying spring winds. Trying to break up that soil in the spring with a scratcher was slow work and was hard on the wrist, which has bothered me for years. So I started to look around for a better method to control these weeds and the hard soil condition. After looking around I started to eliminate various mulch materials for one reason or another.

I had seen the sawdust used, which I thought had disastrous results. It broke down too fast, robbing the soil of nitrate nitrogen. As a result the plants turned yellow and needed constant feeding with nitrat. For that same reason I did not dare to use wood chips, chopped straw or hay. Then we come to peat moss. That looked alright to me at first, but after analyzing the results, I eliminated that also, for these

reasons: in the first place, it is rather expensive, and in the second place, just as soon as you get some wind or dry weather it dries out and blows around to a certain extent. A bed, which has been planted to cuttings or seedlings is never perfectly level. Now what happens? If you water these beds with overhead irrigation sprinklers, or you get heavy rains, your peat moss will float to the lowest places in the bed. The result of this is that the higher areas in your bed have no peat moss, while in the lower areas the peat moss will bury the seedlings or cuttings. I also found that when the peat moss gets dry, it does not help to maintain the desired moisture content in the soil. This eliminated peat moss for me.

Then I started experimenting with sugar cane (also called Servall). This appealed to me since cane is pressed flat and would have no tendency to roll or blow around. Not knowing what this material would do to the plants, we started to experiment and used it under two shades of every item we had in the beds, in other words, two shades of yews, two shades of junipers, etc. Our beds are  $5\frac{3}{4}$  feet wide and we use lath shades which are 4 feet wide and 6 feet long. We then watched it for a year, especially since small rhododendrons, azaleas and pieris are very sensitive. If there was anything wrong with this sugar cane, these items would be the first to show it.

Everytime we examined this sugar cane, we noticed that the soil never baked but remained nice and loose, and, at the same time, there was always moisture in the soil and only a few weeds. Every item had a good color, even the rhododendrons and azaleas. After a year we examined the sugar cane. It looked darker than it did originally, it was weather beaten, and it had settled some, but it had not deteriorated to any extent. As far as I was concerned, the results were very satisfactory. Ever since then we have used sugar cane on everything we planted in beds.

Now to the application of the sugar cane mulch, which I think is important. This sugar cane comes in bales 24 x 24 x 20 inches and is hard, machine pressed being held together by 3 wires much like a bale of peat moss. We take a hatchet to snap the wires and break up the bale with a spade or hatchet into 3 or 4 lumps and throw it in a corn cutter with a blower, which is belt driven from the power take off a tractor. We generally chop up 100 or 150 bales at a time which takes only a few hours with 4 or 5 men. After it is passed through the corn cutter and blower in a big pile, it is thoroughly broken up, fluffy and ready for use. All we have to do now is back a truck up, load it and take it to wherever we are planting.

If we are mulching evergreen cuttings we put it on about 1 or  $1\frac{1}{4}$  inches deep. In larger cuttings, like Magnolias or cherries, and Red Japanese maple grafts, beech grafts, etc we put it on about  $1\frac{1}{2}$  inch deep. In small cuttings and seedlings we use maybe one half inch or even less. Now, of course, this does not eliminate weeds 100 per cent, but we get from 50 to 75 per cent control, depending on how thick or thin we can apply it. We feel that we save a tremendous amount of hand weeding as we have 8 or 9 acres in beds alone. In fact, I just

counted the beds and came up with 195 beds, 6 feet wide and averaging 200 feet long, which requires a lot of handwork to keep free of weeds. Weeding these sugar cane beds is much easier on the fingers and scratchers as well as being much faster.

When we plant small cuttings and seedlings in the early summer, and can only apply a small amount of sugar cane, we add to it in the fall after they have made some growth and the plants are a little larger. When we put this sugar cane in the beds, we take it off the truck in wheelbarrows, big planting boxes, or bushel baskets and just throw it around on the beds by big double handfuls. It naturally falls very uneven. Then we cut some wild cherry branches with the leaves on and use these as brooms to brush out the sugar cane evenly. Another important factor about sugar cane is that it does not mat like chopped straw or hay and therefore gives you excellent aeration, as it allows water through very easily.

Now a word of caution, don't try to go after 100 per cent weed control by putting the mulch on three or four inches thick or more as that will have disastrous results. We also discovered since we used a mulch that we have a better root system. By having a looser soil which has a better moisture content, we produce a lot of white, soft feeder roots near the surface of the soil giving us a plant which responds quicker after transplanting. We have also learned another advantage about the use of a mulch. Years ago we used to transplant seedlings in September, but it never was advisable to transplant seedlings later than that. If we planted later, the plants would partly heave or heave out altogether, resulting in poor stands. Of course, you realize that I am talking about our New England conditions.

Since we started to use this sugar cane mulch, we can plant anytime during the fall, even in November, as long as the ground is in good shape. We use eight inch boards around the beds and then mulch the cuttings or seedlings. We then put lath shades over the frame and our heaving troubles are eliminated.

Now to sum up the advantages of using a mulch. We control 50 to 75 per cent of the weeds. We maintain a higher moisture content in the soil, and consequently have to do less irrigating. We are getting a better root system. We are getting much better growth as our beds are never buried under weeds. Being able to do a lot of bedding out in the fall, takes that much pressure off the spring planting season. At the same time, fall planted seedlings and cuttings will produce much better growth than spring planted stock.

Now I would like to add one more thing about a mulch we used 25 and 30 years ago, that is, rotted cow manure. We used to plant our beds in the spring and early summer and then top dress them in the late fall with one year old cow manure. That was a wonderful mulch as that would give you excellent growth, beautiful color on the stock and it acted as a fertilizer at the same time. But it too created a weed problem since it resulted in the production of a lot of clover, which is hard to pull, plus the usual chickweed and pigweed, etc. The weeds, being well fed would grow very fast and gave us a battle all summer

long. Therefore we eliminated the use of cow manure as a mulching material.

\* \* \* \* \*

CHAIRMAN DUGAN: Thank you, Case.

Next we have Dr. Bob Miller from Ohio Agricultural Experiment Station. I don't believe he has as big a bag of tricks as Case has, but as you will see, he has a lot of good practical information.

DR. R. O. MILLER (Wooster, Ohio): Thank you, Dave. What I would like to do is to discuss one point I think touched upon by both of these gentlemen, that is, the fact that mulch materials vary. Not only do they vary in composition, but the effects also vary. I think it is important to put these two considerations together. We have summer mulches and we have winter mulches. The objectives of using a summer mulch are different from the objectives of using a winter mulch. Summer objectives, going over it briefly, are weed control, moisture control, and temperature control.

Research in the nine-year experiments on mulching have shown fairly conclusively that Wooster silt-loam was a heavy soil which contained a great amount of moisture and that mulching has had an effect on that moisture. In dry years the mulched plots yielded better than the unmulched. In years when there was adequate rainfall, the mulched plots were still as good or better than unmulched plots. In years when we had heavy rainfall the yield on the mulched plots might have been down considerably. This shows that over a nine-year period the primary effect on plant growth was an effect on the moisture content of the soil and the amount of moisture available to the plant. Moisture control then is one primary objective of a summer mulch.

Let us look at temperature control since there has been considerable research to show that mulches do affect soil temperatures. Unfortunately, no one is really able as far as I know to say exactly what the effect is. High soil temperatures are temperatures that are bad, but how bad are they? I don't think we know for sure. It certainly is likely to vary with the type of material produced. Lower soil temperatures may contribute to the beneficial effects derived from summer mulches. Summer mulches also add considerably more organic material to the soil which in turn improves soil structure and improves soil fertility. Assuming that we add enough nitrogen to correct this carbon-nitrogen unbalance that we sometimes get by adding easily decomposed inorganic matter, such as straw, sawdust, and so forth, the net long-term effect of any mulch material will be an increase in soil fertility. This comes about even though the organic material initially ties up nitrogen. This nitrogen, however, does become available in later years. During the first years of the experiment on mulching it was found necessary to add additional nitrogen to mulched grapes. However, in later years, as the accumulated nitrogen and bacteria broke down and became available to the plant, there was a net increase in nitrogen as well as in phosphorus and potassium.

Another thing to think about is the fact that mulching improves soil structure. This was touched on by Mr. Hoogendoorn when he said that the soil is loose. Why is it loose? One reason conceivably is that the mulching materials provide food for bacteria in the soil which acts to aggregate the soil. They build up quite rapidly and the net effect is a gross improvement in soil structure.

I would also like to point out one other possible advantage of a summer mulching, something that I think is generally neglected. It seems to me quite conceivable that summer mulches could also improve soil aeration. How? Certainly, they prevent packing of the surface of the soil, which might increase the amount of oxygen which goes into the soil. They also very definitely could keep the roots in the upper layers of soil which are looser. This might be very definitely an improvement as far as aeration is concerned. Soil aeration is important, and as I say, we don't know just what the effects of mulched material are on this important subject.

Now let's take a look at winter mulches. We have said we need to control weeds, to control moisture, to control soil temperature, perhaps to increase organic matter, to increase fertility and to improve soil structure and increase aeration. The soil, as I see it should have a winter mulch as insulation to protect the soil from alternately freezing and thawing and to prevent plant losses by this process of heaving out.

In plants that have underground storage structures or herbaceous plants which have no above-ground parts during winter, the idea is very definitely to apply a mulch to insulate the soil. This keeps the soil from freezing and thawing, by keeping it in a frozen condition from the time the mulch is applied until the time it is removed.

Now there is only one major objective, as I see it, for a winter mulch, namely for insulation. What materials give you good insulation? First of all, the ideal insulation material is snow. Again, as far as the mulch is concerned, many plants can be grown in containers on top of the ground in other parts of the country that are not as hardy as this part in Ohio. The main reason for this is the fact that snow covers them all winter. This protects them from freezing and thawing and prevents losses in this particular plant. We can't all have snow when we want it. What other materials are good? Let's keep in mind what we want in an insulation material that aren't wet and soggy since they tend to insulate better than materials which are easily wet. The sugar cane as Case pointed out, did not pack, or become wet, and this apparently provided good winter protection. Those who live along the East Coast know that salt hay is available and this also, does not pack and become soggy.

When you get into this part of the country, the good mulching materials available locally are not quite so numerous. Certainly, straw, corn cobs to a lesser extent, and sawdust materials, do become packed during the wintertime. So perhaps this sugar cane might be a pretty good material for this purpose. Personally, I have had no experience with it. Remember, in the wintertime the thing we are after is insulation. For those of you who are thinking about liners, and so forth, in beds, maybe the insulation is a disadvantage, because we are holding the

soil heat in the soil and it is not getting above the beds. By the same token, we are keeping the cold air temperature up above the plants and the cold is not penetrating the soil. It is an insulation layer we are providing. I can see where insulation of this type might not be desirable since it might contribute to the winter killing of the above ground parts just above the mulch. Perhaps there may be some questions on that later.

I would like to emphasize the point that I feel quite definitely that the choice of materials is going to depend on whether we are talking about the application of a summer mulch or a winter mulch. Both of these uses have different objectives in mind. Thank you very much.

MODERATOR DUGAN: Thank you, Bob. I was afraid the panel members wouldn't mention our favorite mulch here in Ohio, known as snow. All of you had a demonstration of how that is applied the other day.

I now call for questions from the floor.

MR. LOWENFELS: I think, Mr. Gray, you mentioned one point about erosion. I have a place in our area where we mulch with leaves and it stops soil erosion. I don't think leaves were mentioned, but I am wondering what Mr. Gray thinks about oak leaves?

MR. GRAY: There are some leaves, because they tend to stick and shingle, are objectionable. However, because of the resiliency of oak leaves you have a perfect mulch.

MR. FRED NISBET: I wrote an article for Flower and Garden Magazine a while back on mulches, and I have been flooded with objections, requests, and so forth, from mulch manufacturers ever since. The one that was furthest off-base as far as I was concerned was a cork manufacturing outfit, who wanted to know if I had ever used cork for a mulch, and wanted to know if I would try it. I said I would. They wanted to know the specifications the material should have. I said a quarter to three-quarters of an inch for particle size and less than two per cent fines. Has anyone here ever used cork for mulch and do you agree with the sizes I set up? Would this be about right, or should I change the specifications?

MR. GRAY: Just a comment. I would say your three-quarter inch is a little bit large, maybe a quarter to a half inch would be better.

DR. CHARLES HESS: The only problem I can see, is that the cork might tend to float away.

To enlarge a little bit on the point Bob Miller made, John Creech did some work with azaleas and mulching. He measured the temperature above the ground and at six feet and definitely found that there was an insulating effect from the mulch. As Bob pointed out, the air temperature above the mulched plots was actually colder than the air temperature above the unmulched plots. In other words, the insulation held the cold out from the soil, but it also held the heat that is released from the soil from the top of these plants. In plants which are borderline he actually incurred greater loss from mulched plots than from plots not mulched. As Dick said, there was about five degrees difference.

DR. MILLER: One comment I would like to make along that line. It again depends on your objectives. For perennials growing in the spring, they are interested in getting the plants up and in flower, so they can be dug and sold in a fairly attractive condition. Now early removal of a mulch at that time of the year will let the soil warm up considerably whereas it would stay frozen for a longer period of time if it were mulched.

MR. ROLAND DE WILDE (Bridgeton, New Jersey): As Charlie brought out, we found out 20 years ago that if you use salt hay for azaleas you run into the problem of early frost hazard because the hay insulates the soil and keep the heat from going up around the plant. I am talking now about the type where buds are formed fairly late in the fall, and you can take an awful licking in getting your buds set. If a frost or cold sets in and it gets down to 25, it might even kill the plants and we have had that happen, too. So we don't mulch azaleas any more with that type of material. We do mulch rhododendron. They form their buds much earlier. They stop growing sooner, and the danger of damage to that particular plant is not as great. Otherwise, I think mulches are ideal, as Case said, for weed control.

There is one thing I wanted to ask him. Some years ago when we first got a load of sugar cane we got a brand called Staydry, which is used on Paul Tryon's in South Jersey. I used it also in some areas and I think it was put on sometime in May, without any shade over the azaleas. It promptly killed the whole shooting match and we haven't used it since. I don't know whether or not they were putting some preservative in the stuff at that time. Have you ever run into that? I don't suppose you have or you would have said something about it.

MR. HOOGENDOORN: No, I have been using this material for about ten years. First, I used it on an experimental basis, as I pointed out. I have never had any damaging effect. You may have put it on too thick, trying to get 100 per cent weed control. As I said, that is a very important point.

MR. DE WILDE: Maybe that was too thick, and I was two weeks late in applying it. I used it mostly because it is easier to put on and easier to get comparative results with the material.

CHAIRMAN DUGAN: I am sorry, we have to cut this off, but our time is up. Thank you very much, panel.

Mr. Hill resumed the chair.

MODERATOR HILL: Thank you very much, Dave, and the entire panel for your discussion on mulches.

I am sure none of us want to miss one word of this talk we now have coming up. Your inimitable Dr. Charles Hess is going to talk to us here about this "X" factor that I named earlier. We can certainly depend upon Charlie to be searching, provocative and erudite. Charlie!

Dr. Charles Hess discussed the work he is doing on the identification of auxin systems responsible for rooting of cuttings.

\* \* \* \* \*