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AGRICULTURE
LETTER: via--Frank Kuwahara
GUAYULE

3-22-43

OFFICE OF THE VICE PRESIDENT
WASHINGTON

January 26, 1943

Mr. Clarence E. Pickett
American Friends Service Committee
20 South Twelfth Street
Philadelphia, Pennsylvania

Dear Mr. Pickett:

The Vice President asked me to acknowledge your letter of January 16 enclosing a special study made by Professor Robert Emerson with regard to guayule rubber production by the Japanese-American colonists at Manzanar and Poston.

It is a matter, of course, which should receive careful attention but Mr. Wallace does not feel that he has, as Chairman of the Board of Economic Warfare, executive responsibility in this field. As you know, the Board of Economic Warfare works in the procurement of rubber from foreign countries. Mr. Wallace suggests, however, that when Professor Emerson comes to Washington he get in touch with Dr. Atherton Lee, Manager Natural Rubber, Office of the Rubber Director, War Production Board. We are taking the liberty of sending Dr. Lee copies of this correspondence so that he will be apprised of this situation.

Sincerely yours,

(Signed) Mary Huss
Personal Secretary to The Vice Pres.

P. S. Dr. Lee is located in Room 5006, and his telephone is Republic 7500, Extension 75575.

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AGRICULTURE
LETTER: via--Frank Kuwahara
GUAYULE

3-22-43

COPY

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Administration
Washington, D. C.

January 28, 1943

Dr. R. A. Millikan
California Institute of Technology
Pasadena, California

Dear Dr. Millikan:

This Administration and the War Relocation Authority have had certain correspondence with Professor Robert Emerson of the California Institute of Technology. In addition, several letters written by Professor Emerson to various Government officials, have been referred to this Administration for comment.

It appears that sometime during the spring or early summer, Professor Emerson organized some guayule projects in different areas in cooperation with the War Relocation Authority. Apparently, after a few months, he wished to expand his guayule activities and the War Relocation Authority felt that since they were not a research agency, they preferred not to enlarge the work to the extent that Dr. Emerson wished.

The War Relocation Authority inquired whether we wished to conduct guayule research at Manzanar, and if so, stated

they would provide us facilities and we could cooperate with Dr. Emerson. We pointed out that although we were interested in the Japanese evacuees and were glad to see everything possible done for them, we were not in position, nor did we desire to extend our research work to the Owens Valley where Manzanar is located.

We pointed out that we had a very definite and urgent responsibility to obtain certain information as quickly as possible for the use and guidance of the Forest Service in its job of rapid and large scale expansion of guayule acreage. We indicated to the War Relocation Authority that in order to meet out responsibilities, we had organized a Guayule Research Section with headquarters at Salinas, California (with Dr. Hildreth in charge), had made Departmental greenhouses available to Dr. Hildreth and had transferred to him several of our scientists, including geneticists, plant physiologists, horticulturists, etc. We stated that he had a comprehensive research program under way at Salinas and in addition had made 60 or more test plantings at selected locations from Texas to California, the supervision of which was keeping him and his staff quite busy.

In addition, it was pointed out that most of the research suggested by Dr. Emerson was already under way at Salinas or had already been suggested to us by the California Institute of Technology through Drs. Went and Bonner; that although we were not contributing funds to the California Institute of Technology, we were cooperating at its request

and were sponsoring its program and considering it a part of the U.S.D.A. guayule program.

We also stated that we had no objection whatsoever to the War Relocation Authority cooperating with Dr. Emerson in any way itcared to in guayule investigations and that we would be glad to furnish any surplus plant material from time to time which we might have at Salinas.

Much of this information was transmitted to Dr. Emerson by the War Relocation Authority and also in letters from me. Dr. Emerson, however, continued to urge that we sponsor his program. Under date of August 3, I wrote to Dr. Went and in this letter referred to Dr. Emerson as follows:

> "Incidentally, I am wondering whether the research program which Mr. Robert Emerson is developing at Manzanar in the Owens Valley and the ones which he hopes to develop at Parker and Gila is part of the research program of you and Dr. Bonner. I do not recall having met Dr. Emerson, but he signed himself in a letter as Assistant Professor of Plant Physiology at California Institute of Technology. Mr. Emerson has secured tops which were removed from guayule seedlings before planting, as well as other seedling material, at Salinas and I believe has plant these at Manzanar. He has written to one or two of the agencies and has indicated that he is planning to conduct research at Manzanar and these other areas on: (1) experiments on the rooting of cutting, (2) experiments on the relationship between irrigation and rubber production, (3) weekly analyses of rubber content, (4) breeding and selection of guayule strains. I have suggested that Dr. Hildreth might like to stop and see him and advise with him concerning the program which he has under way, but I am interested in knowing whether his program is part of the program of you and Dr. Bonner or if this is a program separate from the one which Cal Tech is doing, other than the fact that it is being directed by one of your Assistant Professors."

Dr. Went wrote me on August 13, giving me a little histori-

cal account of Dr. Emerson's work, and one of the paragraph is as follows:

> "For many reasons it is undesirable that the California Institute of Technology sponsor this work, and although Bonner and Emerson keep close contact, the guayule work at Manzanar and other Japanese evacuation centers is not a part of our guayule research program. Cal Tech does not have the official status, nor authority or funds to take up a work program so far from its campus. Therefore, I would like to ask you to include Emerson's project in the U.S.D.A. guayule project. Emerson is writing you himself so that you can get an accurate picture of what has been accomplished and of what can be expected. I only should warn you that he is always depreciating his own accomplishments, so that in his statements the necessary grain of salt already has been added."

It was my thought that if Dr. Emerson's guayule program was a part of the program of Drs. Went and Bonner, it would then automatically become a part of the cooperative investigations between the California Institute of Technology and the U.S. Department of Agriculture and in this way would be sponsored, with Dr. Went giving it general supervision.

However, since Dr. Went pointed out that for many reasons it was undesirable for the California Institute of Technology to sponsor Dr. Emerson's work and since we were already cooperating with your institution, there appeared to be no special reason from a research standpoint why we should make additional and separate cooperative arrangements on practically the same research projects with another member of your staff.

In November, Dr. Emerson wrote me that the War Relocation Authority had informed him that they would be glad to sponsr the guayule work if given endorsement by Dr. Hildreth

and me, even though no financial support were extended by this Administration. We wrote Dr. Emerson in January, stating that we had no objection whatsoever to his arranging to conduct such guayule research as he cared to with the War Relocation Authority and that we had no objection to their supporting the research if they wished to. I also telephoned this information to the War Relocation Authority. At that time, I pointed out again that Dr. Hildreth and Major Kelley would be willing to furnish such surplus material as they had available for Dr. Emerson's studies. However, Dr. Emerson has recently written some additional letters to different agencies, which have been referred to me for comment.

For many reasons which have been stated in this letter, Dr. Hildreth prefers not to dissipate his time and energies by arranging for and helping to direct (as the War Relocation Authority might wish him to if Dr. Emerson's work were expanded) experimental work in the Owens Valley which would be similar to or a duplication of work under way, much of which is in cooperation with your institution. He feels that if he should start additional research there, his time and energy would be spread so thin that other phases of the program that are well established and well organzed and on which considerable money has been spent, would be jeopardized.

Some of Dr. Emerson's letters to other agencies that are before me for comment rather indicate that his long-time objectives include much more than research in propagating, growing and improving guayule. They apparently include the development of special skills in the Japanese, both to

help them in their present difficult situation and to provide some measure of assurance that they may find a useful occupation in the post-war economy that is non-competitive with our present agriculture. Such sociological and humanitarian objectives are praiseworthy, and I have no reason to doubt Professor Emerson's sincere devotion to them.

So far as our own work is concerned, however, we feel that under the extreme pressure of the emergency situation in rubber, we must limit our efforts to the responsibilities that are clearly those of the Research Administration and that every ounce of energy, and every moment of time, must be strictly devoted to speeding the research program for guayule production in order to provide the Forest Service with the facts that it needs currently in its guayule production job.

If you and your associates feel that it is proper for the California Institute of Technology to sponsor Dr. Emerson's program and combine it with the program at the California Institute of Technology with Dr. Went giving it some supervision in place of Dr. Hildreth, such action would, of course, tie Dr. Emerson's studies in with our own. In such case, the phases of Dr. Emerson's program that relate strictly to research on guayule would be sponsored by the U. S. Department of Agriculture to the same extent as are the investigations at the California Institute of Technology.

We will wait word from you, therefore, before contacting the War Relocation Authority any further.

Sincerely,

E. C. Auchter
Research Administrator (TS)

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AGRICULTURE 3-22-43
LETTER: via--Frank Kuwahara
GUAYULE

January 29, 1943

Mr. John Collier
Chief of the Bureau of Indian Affairs
Department of the Interior
Washington, D. C.

Dear Mr. Collier:

You may recall that I wrote you last summer about my efforts to develop guayule rubber projects in some of the Japanese relocation areas. This work could be a valuable contribution to the war effort and to our civilian economy during and after thewar. It is also recognized as a potentially valuable means of building good-will between the Japanese in this country and the rest of the public.

In general I have enjoyed the good-will and cooperation of the administrators of the relocation areas. This was particularly true at Poston, where Mr. Mathiesen, Mr. Head, and Mr. Ward Sheppard have encouraged me to make every effort to achieve the objectives I had in mind. The Forest Service also has shown a spirit of cooperation, and has provided waste and excess guayule material with which to start the plantings in the relocation areas.

The War Relocation Authority at first seemed willing to give the experimental work on guayule at least a limited measure of recognition and support, but Mr. Dillon Meyer felt it necessary to first obtain endorsement from the Department of Agriculture, since the W.R.A. is not authorized to do agri-

cultural research. Guayule research is under the supervision of Mr. A. C. Hildreth, of the Bureau of Plant Industry. Unfortunately Mr. Hildreth has taken the attitude that the cooperation of the relocated Japanese is not needed for the rubber program, and therefore Mr. Meyer has thought it best to withhold recognition and support of the work. He has, however, permitted the work to be carried on privately at Manzanar.

The Japanese on the Manzanar project have done work of outstanding value along several lines, and qualified scientists who have visited the project have been unanimous in their judgment that the work merits abundant recognition and support, and that the Japanese are capable of contributing to the rubber program in a way which might have great value for their future relations with their Caucasian fellow citizens.

I am strongly of the opinion that we must find a humane and intelligent solution for our own Japanese minority problem, if we expect to construct a durable peace after the war, and I believe the guayule project can be handled in such a way as to be of constructive value to the minority problem. Therefore I have been trying to bring the guayule work to the attention of Vice-President Wallace. I believe he would appreciate its potentialities. Mr. Clarence Pickett, of the American Friends Service Committee, is trying to make an appointment with Mr. Wallace for me. If he is successful, I shall plan to go to Washington, and hope very much that there may be an opportunity to see you and discuss the possi-

bilities of the guayule work, before I see Mr. Wallace. Maybe you will think of other important angles to consider. I have wondered whether Secretary Ickes would be interested enough to help in obtaining the authorization which is so badly needed.

Hoping there will be an opportunity to see you,

Sincerely,

Robert Emerson (TS)

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AGRICULTURE
LETTER: via--Frank Kuwahara
GUAYULE

3-23-43

C O P Y

Sidney P. Osborn
Governor

Hal Mitchell
Secretary

EXECUTIVE OFFICE
State House
Phoenix, Arizona

January
Twenty-ninth
1 9 4 3

Mr. Robert Emerson
California Institute of Technology
Pasadena, California

My dear Mr. Emerson:

I am greatly interested in any phase of the program to forward the production of guayule in Arizona and the southwest. My interest is particularly keen in the possibilities of cultivating this rubber bearing crop commerically on desert and marginal lands of which Arizona has such a large acreage.

Every department of our state government which can be useful or helpful in this program will extend their fullest efforts and cooperation.

The possibilities of propagation of guayule settings by the Japanese internees at the Parker and Rivers Relocation camps, particularly from waste cuttings, should be examined thoroughly because of its tremendous possibilities.

I was glad to have my talk with you on this subject and to have you take up the matter further with me in your letter

of January twenty-first.

I am writing to Mr. Dillon S. Myer, Director of the War Relocation Authority, Washington, D. C., supplementing your suggestion that the possibilities and advantages of using Japanese internees for the production of guayule planting stock be thoroughly gone into. Enclosed is a copy of my letter to him.

I am also making available to Dean P. S. Burgess of the College of Agriculture of the University of Arizona, and to Mr. George M. Roy, Secretary of the State Resources & Planning Board, all data which we have on the subject for their information and study.

I thank you kindly for your valuable assistance and cooperative action in bringing this angle of the guayule program to my attention.

Sincerely,

(Signed) Sidney P. Osborn

SPO:B GOVERNOR (TS)

AGRICULTURE
LETTER: via--Frank Kuwahara
GUAYULE

3-23-43 5

C O P Y

Sidney P. Osborn
Governor

Hal Mitchell
Secretary

EXECUTIVE OFFICE

State House

Phoenix, Arizona

January
Twenty-ninth
1 9 4 3

Mr. Dillon S. Myer
Director of the War Relocation Authority
Washington, D. C.

My dear Mr. Myer:

My attention has been called, particularly by Mr. Robert Emerson of the California Institute of Technology at Padadena, to the possibilities of utilizing the Japanese internees in the relocation camps at Parker and Rivers, Arizona, in the propagation of guayule stock. Mr. Emerson already has written you on this subject.

I am keenly interested in all phases of the guayule cultivation program, both because of the opportunity offered Arizona to contribute in this way to the war effort, and the further opportunity to introduce a new crop to the southwest. Of very particular interest to us is the possibility of cultivating guayule on large acreages of our desert and marginal lands.

The Japanese generally are well qualified by experience and training to the cultivation of guayule settings. I am advised that they have already made considerable progress in the propagation of cuttings in the Parker relocation camp from waste cutting material obtained from the nurseries operated by the United States Forest Service.

I strongly urge that you seriously consider the possibilities and desirability of using the Japanese internees in Arizona in this work.

The College of Agriculture of our State University and our State Resources and Planning Board are keenly interested in this matter and will welcome the opportunity to extend every possible cooperation and assistance.

Sincerely,

SPO:B GOVERNOR (TS)

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AGRICULTURE
LETTER: via--Frank Kuwahara
GUAYULE

3-22-43

UNITED STATES
DEPARTMENT OF THE INTERIOR
Office of Indian Affairs

February 1, 1943

Dear Dr. Emerson:

I have your January 29 letter. I am heartily in agreement with all its thought. However, I do not know why Mr. Hildreth has taken the position that he does not need the research by the evacuees. And indeed I would not assume that the Bureau of Plant Industry should be expected or entitled to monopolize plant research. I should be very glad to talk with you when you come, and it might be well to see me before seeing some others. I shall look forward to having time with you.

Sincerely yours,

(Signed) John Collier,
Commissioner

Dr. Robert Emerson
California Institute of Technology
Pasadena, California

JC/ks

(TS)

AGRICULTURE
LETTER: via--Frank Kuwahara
GUAYULE

3-23-43

CALIFORNIA INSTITUTE OF TECHNOLOGY
Pasadena

COPY

February 9, 1943

Dr. E. C. Auchter
Department of Agriculture
Agricultural Research Administration
Washington, D. C.

Dear Dr. Auchter:

I appreciate very much your letter of January 28th. I have talked the subject matter over with Dr. Went, and we would reply as follows:

Your letter has completely clarified the situation as it has developed between your Department, the War Relocation Authority, and our Dr. Robert Emerson. You have pointed out that Dr. Hildreth, in charge of the guayule Research Section, preferred not to dissipate his time and energies by helping to direct experimental work in the Owens Valley, since it would take his attention away from the other important phases of the research program. You also state that if the California Institute sponsors the research part of Dr. Emerson's program, and ties it in with the work of Dr. Bonner, it would be automatically sponsored by the U. S. Department of Agriculture to the same extent as the investigations under Dr. Bonner are sponsored by that Department.

As Dr. Went wrote you in his letter of August 13, it seemed at that time much more desirable to have the guayule

research work in the Japanese Relocation Center sponsored directly by you. Since you do not think this advisable for reasons you explain in full, and since you have no objections against combining Dr. Emerson's and Dr. Bonner's research projects, the California Institute is willing to sponsor the guayule research work at the Japanese Relocation Centers. Such sponsorship is essential, not only to justify the work in the eyes of the War Relocation Authority, but also because wartime restrictions make publication of results obtained with guayule undesirable, so that some one with knowledge of the different phases of guayule research carried out in different localities must act as adviser. We will be glad to have one of our Plant Physiologists perform this duty.

Having received reports of the research activities of the Japanese in the Relocation Centers we do not share your doubts regarding the effectiveness of work carried out there. We think that interruption of the work at this stage would constitute a distinct loss for the guayule program. This is sufficient reason, quite apart from any sociological and humanitarian angles, to continue the present work and expand it as necessity arises.

Success in research depends on available talent, right attitude, suitable equipment, and workable problems. Although these conditions are not ideally met, they are sufficiently realized in Relocation Centers to warrant their utilization. Concerning the available manpower, there are

not only many college and university-trained men, but also highly skilled nurserymen with a special ability to handle plants; their spirit is right; and the equipment, while rather primitive, would suffice for some phases of the work. Besides, official sponsorship will enable the WRA to assist the project materially. Concerning which must be solved at each locality. Among these, Manzanar seems of special interest since it represents conditions at the extreme limit of the range of guayule growing. As an interesting example we might cite the result of corsses made last year by the Japanese between Salinas varieties, which are not very frost resistant, and some hardy Texas strains. This winter all seedlings from selfed Salinas strains died at Manzanar due to heavy frost, but the hybrids survived.

We hope that our willingness to back up Dr. Emerson's project will enable you to notify the War Relocation Authority of your approval of the guayule research program in the War Relocation Centers, as sponsored through you, by the California Institute of Technology, and supervised by this Institute.

With Much appreciation of your attitude, I am

Very cordially yours,

R. A. MILLIKAN (TS)

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AGRICULTURE
LETTER: via--Frank Kuwahara
GUAYULE

3-22-43

February 10, 1943

Mr. John Collier
Commissioner of Indian Affairs
Department of the Interior
Washington, D. C.

Dear Mr. Collier:

Thank you for your letter of February 1st. I have delayed sending you a reply because there are indications that the attitude of the Department of Agriculture toward guayule research in the Japanese relocation areas is undergoing a change. Mr. Auchter of the Department of Agriculture has suggested a basis upon which endorsement of the work might be given, Dr. Millikan of the California Institute has replied, expressing the hope that Mr. Auchter will recommend to the War Relocation Authority that the guayule research in the Japanese relocation centers be made an official part of the Government guayule research program, and that it be carried on under the supervision of the California Institute.

Much as I would like to see you and discuss with you the results and potentialities of the guayule work in the Japanese camps, it now seems best to await the outcome of Dr. Millikan's letter to Mr. Auchter. I hope very much that endorsement by the Department of Agriculture will enable the War Relocation Authority to authorize the guayule work in time for the Japanese to make substantial plantings this spring. If proper authorization is forthcoming, I have no

doubt that I shall have abundant cooperation from Mr. Wade Head and Mr. Mathiesen at Poston.

Many thanks for the interest you have taken in this work. Perhaps further developments will make it possible for me to discuss it with you at some later date.

Sincerely,

Robert Emerson (TS)

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AGRICULTURE
LETTER: via--Frank Kuwahara
DIVISION OF TRUST FUND

3-23-43

February 14, 1943

Dear Frank:

Could you speak on the forum this Thursday nite? The topic is "How Shall We Divide The Trust Fund?" We would like to have you speak on the general setup of the factory in regards to working condition, earnings, etc. I'll see you this P.M. or tomorrow.

Mr. George Katow, Franklyn Sugiyama, Mr. K. Nakane and one worker will speak for their respective groups on how to divide the money. Will see you later.

Sincerely,

(Signed)Tom Sakai (TS)

AGRICULTURE 3-22-43
LETTER: via--Frank Kuwahara
GUAYULE

COPY

UNITED STATES DEPARTMENT OF AGRICULTURE
Agriculture Research Administration
Washington, D. C.

February 16, 1943

Dr. R. A. Millikan
California Institute of Technology
Pasadena, California

Dear Dr. Millikan:

Your letter of February 9, in reply to my letter of January 28, concerning the investigational work which Dr. Robert Emerson of your Institution is doing with guayule at some of the War Relocation Centers, has been received.

I note that the California Institute of Technology, as stated in your letter, is willing to sponsor Dr. Emerson's guayule research work at the Japanese Relocation Centers and will, as we understand, consider it as a part of the guayule research projects of Drs. Went and Bonner. As stated in the last paragraph of my letter to you of January 28, the sponsorship of Dr. Emerson's program and its combination with the other guayule research program of the California Institute of Technology, with Dr. Went giving its supervision in place of Dr. Hildreth, ties Dr. Emerson's studies in with our own. Accordingly, we are willing under these conditions to sponsor those phases of Dr. Emerson's program that relate to research on guayule, to the same extent that we sponsor the investigations of Drs. Went and Bonner and we have so inform-

ed the War Relocation Authority.

Copies of this letter are being sent to the War Relocation Authority and to Dr. Hildreth and I shall be pleased if Drs. Went and Bonner will explain the present status to Dr. Emerson.

Cordially yours,

E. C. AUCHTER
Research Administrator (TS)

AGRICULTURE
LETTER: via--Frank Kuwahara
GUAYULE

3-22-43

February 24, 1943

Mr. Wade Head

Project Director

Parker Relocation Area

Poston, Arizona

Dear Mr. Head:

I enclose a copy of a letter from Mr. E. C. Auchter, Research Director of the Department of Agriculture, to Mr. Millikan. You will note that Mr. Auchter has sent a copy to the War Relocation Authority. I hope it will now be possible for the W.R.A. to authorize the experimental work on guayule in the relocation areas, and I shall be glad to take up the work at Poston again as soon as official approval can be given.

Mr. Dillon Meyer informed me last fall that the W.R.A. would be in a position to give the guayule work some financial support, provided authorization was received from the Department of Agriculture. I hope it will still be possible for the W.R.A. to support the work, because the proferred sponsorship of the California Institute and the Department of Agriculture carries with it no offer of financial support.

I am sending copies of this letter and the letter from Mr. Auchter to Mr. Millikan, to Mr. Mathiesen. Mr. Mathiesen has doubtless shown you copies of further correspondence relating to the guayule work, which I have sent him recently.

3-22-43

I am also sending copies of these two letters to Mr. Frank Kuwahara, who is still interested in the development of a guayule project at Poston.

Sincerely,

Robert Emerson (TS)

172

AGRICULTURE
LETTER: via--Frank Kuwahara
GUAYULE

3-23-43 S

Report to Mr. Leslie N. Gooding on analysis of guayule shrub collected in various localities in Arizona, in January, 1943

Locality of Collection	% Acetone solubles (Resin)	% Benzene solubles (Rubber)
South of Tucson, 593	7.1	5.3
South of Tucson, 406	6.1	7.4
South of Tucson, Intercontinental, 20 yr. old	9.2	6.7
Queen Creek, 593	6.6	5.3
Collected 11/21/42:		
San Rafael Valley (593)	9.0	4.1
Streets Plot (593) U. of Ariz. Farm	6.95	3.6

Robert Emerson

Padadena, March 3, 1943 (TS)

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AGRICULTURE
LETTER: via--Frank Kuwahara
GUAYULE

3-23-43

Report on Guayule Project at the Manzanar Relocation Area, for submission to the U.S. Forest Service and Bureau of Plant Industry, February, 1943.

Three principal lines of experimental work have been carried on at Manzanar: propagation of guayule from cuttings, observations on the suitability of different strains to the Manzanar climate, and experiments on the extraction of rubber.

Tabulated data supplementing the information given below is being prepared, and will be submitted as soon as possible.

I

Propagation of Guayule from Cuttings

From August 13th to November 23rd, over 90,000 cuttings were made. They were cut from different parts of the stem, treated with different chemicals, and set to root in sand and gravel of different grades.

Portion of stem and location of cut for best results. Long shoots were cut into top, middle, and bottom sections. Under a given set of conditions, the top sections showed 70 per cent rooting, the middle sections about 50, and the bottom sections about 35 per cent rooting.

If instead of cutting top, middle, and lower sections all at the same time, the top only is removed, then the stump will soon regenerate a new growing tip. After two week's time the next cutting can be taken, and the percentage rooting will

be nearly as good as for the top cuttings.

Cuts perpendicular to the long axis of the shoot were used, rather than diagonal cuts. Best results were obtained when cuts were made at the node. When cuts were made between nodes, rot would set in at the cut surface and work up to the first node before rooting. Roots generally sprout close to the lowest node, and root formation is delayed if the cut is at an intermode.

Grade of sand used. Small soft cuttings rooted best in sand that would just pass through ordinary fly screen. Harder cuttings did better in slightly coarser sand, about 10-mesh. Winter cuttings have been more successful in the coarse sand.

Deep beds were generally made of coarse sand, for long cuttings. Short cuttings were often set in flats 2" deep, in finer sand. Best results are obtained with cuttings 2" long set in sand passing through fly-screen.

Chemical treatment. The cut ends were treated immediately after cutting, and before setting in sand beds, by dipping in dry powder. Commercial root-forming powders were used, as well as home made powders prepared by mixing the desired chemical (napthalene-acetic acid, indole-butyric acid, etc.) with talc.

Controls receiving no treatment often shoed just as high a percentage of rooting as the treated cuttings, but the root system of untreated cuttings was weak, and the resulting plants were inferior to those grown from treated cuttings.

"Rootone" powder produced a small number of very long

spindly roots per cutting. These roots were easily broken or damaged in transplanting.

"Hormodin #2" powder gave a dense growth of strong roots, but the tops of the cuttings receiving this treatment had a tendency to die.

"Hormodin #1" powder gave excellent results. A strong "brush" of roots was formed, giving a root system that was easy to transplant. The transplanted cuttings book hold quickly, and started a vigorous healthy leaf growth. Top cuttings treated with Hormodin #1 gave 90% rooting.

Time required for rooting. This depends on conditions, especially temperature. In September, when the weather was still warm, roots started two to three weeks after cuttings were made. During the cold weather of winter, unprotected cuttings require two months or longer to root. The cutting beds have been frozen solid repeatedly, but this appears to do very little damage to the cuttings if the foliage is not wet at the time of freezing.

Time required for making cuttings, density of planting, etc. Experienced cutters can make from four to eight thousand cuttings per day. Cuttings have been planted in large redwood frames built up off the ground, and with sand 6" or 7" deep, and also in nursery flats. A flat 18" square will hold 300 cuttings.

Experiments with direct field planting of cuttings. It is possible that cuttings might be machine-planted directly in the field, before the formation of roots, thus avoiding the operation of transplanting from sand beds to field after

formation of roots. To test this possibility, cuttings have been made and treated, and kept in a moist atmosphere until roots were just ready to start. Cuttings were then set out in open ground. Results of these experiments are not yet sufficiently abundant to justify definite conclusions, but preliminary trials have been favorable.

Experiments with cuttings brought from Alisal Nursery, Salinas. The experiments described above were made with cuttings grown in Manzanar. In January, about 25,000 cuttings were picked up at Alisal, just as they were left by the topping machine. These cuttings were taken to Manzanar and set in sand beds in a small glass-house. Percentage rooting is not yet definitely established, but promises to be above 80%.

II

Field Tests with Guayule at Manzanar

Results with seedlings planted in summer of 1942. Approximately year-old seedlings were planted in various locations, in June, July, August and September. Varieties 406 and 593, and also about 500 seedlings from four different localities in Texas were planted.

The plants set out in June and early July made a good growth. They showed only about 1% benezene-solubles by September. Recent analyses (month of January) showed about 3% benzene solubles in the Salinas varieties, and about 6% in the Texas varieties. The number of plants analyzed is still too small to justify definite conclusions, but the results indicate that the Texas varieites may be better adapted

to Manzanar conditions than the Salinas varieties.

The plants set out in the middle or late summer made but little growth before winter. An inspection at the end of January indicated that many of these plants may not survive the winter, although there have been almost no losses in plots planted in early summer.

Tests with seed harvested and planted at Manzanar. The Texas plants showed much higher pollen viability than the Salinas strains, and a better seed-set. Seed from Texas plants runs 240 to the gram, and Salinas seed (593) about 360 to the gram.

Small amounts of seed have been planted out-doors from time to time during the winter. The seed germinates well, but hard frosts kill off most or all of the Salinas variety seedlings. The Texas seedlings, on the other hand, survive the hardest frosts without damage. Night temperatures have been down to between 0° and 10° F this winter.

III

Experiments on Rubber Extraction

Many samples of shrub in various stages of maturity have been brought from Salinas to Manzanar, and the rubber has been extracted by different methods. The original purpose of this work was to find a quick method for estimating the rubber content of samples, without resorting to acetone-benzene extraction. Since the methods tried seemed to have some potential value for commercial extraction of rubber, the work has been continued with this in mind. At the present time, three different methods are being studied. These will be

referred to as the "blendor" method, the "latex" method, and the "pressure" method.

The blendor method. A small machine like a Waring blendor is used. The ground shrub is mixed with water and processed for about four minutes. The rubber floats to the surface, and the fibre sinks. A detailed report on the factors important for this method was submitted last fall. Since that time, samples of the extracted rubber have been compounded, cured, and tested, and the results indicated that the rubber was superior to the mill product sold as "guayule", to local rubber manufacturers. However, the rubber contained about ½% dry weight of fibre, and this was regarded as objectionable. New tests will soon be made on blendor-extracted rubber, freed as far as possible from fibre.

The Waring blendor type of machine on the market has a capacity of about a pint of liquid. A similar machine of about 5 gallons' capacity is being built, and will be tried out shortly.

The latex method. The fact that guayule rubber does not occur naturally in latex form is regarded as a certain limitation on its commercial use, since many manufacturing processes now depend on latex rather than smoked sheet as a starting material. Also, it has been suggested that the harch mechanical treatment to which guayule rubber is subjected during extraction may be partly responsible for its inferior quality, compared to Para rubber. For these reasons, attempts were made to prepare guayule latex.

It was found that if the ground shrub was treated with gasoline under about 10 pounds steam pressure, filtered, and the gasoline removed by steam distillation, a white stable latex was produced. Under the microscope this latex looked similar to Hevea latex. Rubber could be coagulated from this latex without mechanical treatment, just as it can be from Hevea latex.

Up to the present time, not enough rubber has been prepared by this method to permit the making of standard tests on vulcanized samples. It is hoped that such tests can be made before long.

The pressure method. The ground shrub can be mixed with water and subjected to about 150 pounds steam pressure for one or two hours. This temperature seems not to damage the rubber provided the air is first thoroughly displaced with steam. At the end of the treatment the container is cooled rapidly, and a granular mass of clean fibre-free rubber is found floating on the surface of the water. The fibre sinks.

Samples of this rubber have been subjected to standard tests, and the results have been somewhat better than with the blendor-extracted rubber. This may be due to the freedom from fibre, rather than to the quality of the rubber itself. Since the quotation of the test results is of no significance withouth knowing the formula and cure, these data are included:

Rubber	100
Zinc oxide	5.0
Carbon black	36
Sulphur	3.5
Stearic acid	5.0
DOTG accelerator	0.50
Agerite white	1.00

Rubber prepared according to this formula was cured 40 minutes at 65 pounds pressure, 310° F. Results of tests were:

Elongation at breaking point	650%
Tensile strength	2330 lb. sq. in.
Shore hardness	60

Another sample:

Rubber	100
Carbon black	50
zinc oxide	5
Stearic acid	2
Sulphur	2.5
Dibenzothiazyl disulfide	0.8
Zinc diethyl dithiocarbamate	0.1
Agerite white	1.0

Cured 10 minutes at 65 pounds, 312° F, gave results as follows:

Elongation at breaking point	575%
Tensile strength	2575 lb/sq.in.
Shore hardness	57

The rubber used for these tests had not been de-resinated or refined in any way after extraction. According to the two rubber manufacturers who were kind enough to prepare and test these and other samples, the results of the tests met the specifications for many kinds of manufactured rubber goods. Both manufacturers expressed interest in the extraction process, because, they said, the underesinated commercial guayule with which they were familiar was unsuitable for manufacturing use unless compounded with large proportions of other kinds of rubber. They were surprised that 100% guayule rubber could be successfully milled, compounded, and cured, and they thought it possible that our extraction process might be responsible for the unexpectedly good outcome of the tests.

We would appreciate it if we could obtain a small sample (from one to five pounds) of guayule rubber extracted by the standard mill method, so that we can have some samples prepared, cured, and tested for comparison with the guayule rubber extracted by our method.

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