FACTORS IN MANAGEMENT

RELATING TO THE COMMERCIAL PRODUCTION

OF CASCARA

Factors in Management Relating to the Commercial Production of Cascara

by

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INTRODUCTION

The peeling of cascara bark (Rhamnus purshiana) has, for many years, been one of the local industrials of homesteaders and farmers living in the narrow valleys of Western Oregon and Western Washington. From that region comes the majority of the world's supply of cascara bark --- the medicinal bark whose qualities are so highly prized for the relief of constipation.

Years of peeling has greatly diminished the natural supply of cascara, and some people think that it may prove profitable to raise cascara under cultivation for production of its bark. As a result, there has been a demand for information relating to the methods of managing cascara for commercial purposes. It is the object of this paper to gather information that may answer some of these questions.

This paper will deal strictly with the problems and methods of managing cascara for commercial purposes. Much valuable information was obtained from the observations and findings by Mr. Miller of Brownsville, Oregon. Mr. Miller has pioneered in the field of cascara-raising, and, at the present time, has a plantation of seventeen acres.

SILVICULTURAL CONSIDERATIONS

Soil and Moisture Requirements:

The cascara tree is quite exacting in its soil and moisture requirements. The best growth is made in deep, rich, clayey, sandy, rocky, or humus soils in low river bottoms, flats, valleys, and borders of streams. According to Stockberger, (2) trees have been found to grow better in a clay loam soil than in either sand or clay. In the dry, gravelly, or sandy soils throughout its southern range, it is shrublike in form. Soils suitable for cascara must be moist, but well drained. The tree will withstand inundation for long periods during its dormant season, but it is seldom found in places that are swampy the year around. The soil, moisture, and climatic conditions favorable to cascara are similar to those of red alder, Oregon ash, aspen, and Douglas fir.

The commercial distribution of cascara (Fig. 1.) is confined to Northwestern California, Western Oregon and Washington, and Southwestern British Columbia. This would seem to indicate that an annual rainfall of 30 inches, or more, is needed to attain the best growth. In areas of lesser annual rainfall, the tree appears stunted and shrublike in form.

Light Requirement (tolerance)

It is agreed by most authorities that the tree is exceedingly tolerant of shade in humid air and moist soils, but that it is much less so in the drier and exposed situations.

Fig. 1---Range of Cascara

The fact that it is a tolerant tree should favor its desirability in commercial plantings where it would be grown in close stands.

Seedlings will germinate and grow very slowly for many years in relatively dense shade, but will not make any appreciable progress unless the canopy is opened. If the dense shade continues, the seedlings will finally be killed. It, however, has the power of recovery and rapid growth after suppression, which indicates a high degree of tolerance. Under such conditions it is very hard or impossible to peel such trees. It shows intolerance by growing toward openings in the crown canopy and by the slender boled, short crowned form developed where overtopped. The best development is found in close stands with side shade but plenty of overhead light. (1)

Dangers to Which it is Liable:

Fungus Diseases:

No fungus, so far as is now known, has been reported as growing parasitically on cascara. An occasional tree has been noted with a whitish yellow, wet heart rot similar to that caused by Polystictus versicolor, a very common saprophyte. This fungus, together with three others, Polystictus hirsutus, Schizophyllum common, and Stereum, have been collected from the dead parts of the trunk and branches and appeared to be growing saprophytically, as they usually do, and not parasitically. (1)

Insect Pests:

Cascara is a very hardy tree and has few insect pests. No bark beetles are reported as attacking the tree, but the work of the flat-headed borers has been noted in old and damaged trees that were more or less in a weakened condition. Aphis are known to attack the foliage quite severely some seasons. The year 1925 was an especially favorable one for aphis attack in the Willamette Valley and a few trees were noted in a somewhat weakened condition due to these insects. A scale insect, resembling the oyster shell scale, has also been noted in great numbers attacking the bark of a few trees in more or less shaded situations. Where these insects were attached to the bark in abundance, peeling was found to be difficult and some of the bark could not be removed from the tree. More studies should be made on this scale insect, but at present, it is doubted if the damage to the tree over its commercial range from this source is of much moment. A small leaf miner was also observed wintering in the leaves of seedlings, but damage from this source is apparently negligible.

No damage from insects has, as yet, been noted in the Thomas Miller Cascara Plantation near Brownsville, Oregon. Some aphis have been seen on the new leaves and buds in the spring of the year, but the aphis soon disappear and no noticable damage results.

Fire Damage:

Fire must be excluded from plantations if satisfactory

results are to be obtained. Because of its thin bark, tender foliage, and shallow root system, the tree is readily killed by fire. The heat and smoke of burning brush piles, even though the flames do not come in direct contact with the tree, has been known to totally kill or partially kill the tree.

Grazing Damage:

Live stock is a apparently the worst enemy of seedlings and small trees. Cattle, in particular, seem to be fond of the foliage. If reproduction from seedlings and coppice is to be successful, cattle and other live stock will have to be excluded from the planted areas.

Draught:

Cascara does not appear to be easily damaged by draught, although its best growth is in regions of medium moisture. Large quantities of moisture from one to five years of age have been found in open areas on south slopes of hills in the Willamette Valley which are very dry during the summer and fall months. Of course, this reproduction was not of average size. It was greatly stunted, being only eight inches in height at three years of age. Good coppice was also found on the dry exposures of the same site. (3)

In the early part of March 1939, the writer set out about three hundred transplants in a field near Yoncalla, Oregon. These transplants received no rain at all for a period of 65 days. Inspection of the transplants prior to the first rain showed that every one had survived the dry period. Most of them having healthy dark-green foliage and even putting on a fair growth in height.

Man:

Precaution must be taken against the theft of cascara bark. Plantations should be so located that a watchful eye can be kept on them at all times, for it would not be too difficult an undertaking for someone to sneak into the plantation, peel a number of the trees, and depart with a considerable amount of bark before their presence is discovered.

The theft of bark from wild trees is very prevalent throughout the range of cascara, even though there are state laws prohibiting its theft. Land owners are not anxious to take this risk, and it would be definitely unwise to plant cascara in remote areas where no watch can be kept over it.

Sun Scald Damage:

Trees growing in close stands and in shady situations protected from the direct rays of the sun are liable to sun scald injury if the protection is suddenly removed, allowing the sun to come in direct contact with the bark.

On the plantation at Brownsville, several trees were removed from the extreme southern end of the plantings. The removal of these trees exposed several previously protected trees to the direct rays of the mid-summer sun. The bark on the southwesterly side of each exposed tree became sun-scalded, resulting in the killing of the cambium, the drying and cracking of the bark, and finally in the decomposition of almost half the tree. No sun scald damage was noted on trees that had always been exposed to the sun.

SOURCES OF PLANTING STOCK

Home Nursery:

The artificial propagation of cascara plants by seed sown in a home nursery appears to be the most economical and most certain method of obtaining planting stock. (see Fig. 2.)

Cascara seed may be obtained by picking the ripened berry-like fruit from the trees in the fall of the year, or by purchasing it from outside sources. The seed should be planted in the fall, soon after maturity, or else it should be stratified in sand until ready for use. Germination is very poor if the seed is allowed to become dry. It is not advisable to plant dry seed in the spring because it has a tendency to lay dorment and not germinate until the next year.

The nurseryman of the Oregon Forest Nursery near Corvallis, Oregon advocates the removal of the pulp from the seed and stratification in sand over the winter months. The seed is planted in February, or as soon thereafter as possible. The pulp is removed by soaking the seeds in warm water until they become soft and then separating the pulp from the seeds by screening.

Mr. Miller of Brownsville obtains the best results by planting his seed in the fall of the year. He does not remove the pulp from the seed, but plants the entire berry.

By a special processing of the berry, Mr. Miller states that he can obtain a germination per cent of about 90, while the average germination per cent by other methods will seldom exceed 30.

The best practice with seeding in a home nursery is to plant the seed in drills or rows. The rows should be from 10" to 24" apart, depending upon the method of cultivation to be used. The seed should be spaced about an inch apart in the rows, averaging from 12 to 15 seeds per foot. The depth of planting should not exceed one-half inch. One-fourth inch is preferable.

No shade need be provided for the protection of the young seedlings, but they should be supplied with plenty of moisture, and weeds kept out. The seedlings will attain the size of a lead pencil and be from 8 to 15 inches in height the first year. A light friable soil should be used for growing the seedlings to facilitate easy removal of plants with minimum of damage to the root system.

Commercial Nurseries:

Planting stock can be obtained from practically any of the commercial nurseries if sufficient notice is given them. At the present time, a limited supply of cascara seedlings may be purchased for $2.50 per thousand from the Oregon Forest Nursery near Corvallis, Oregon. Stock obtained from other nurseries would probably cost a little more.

Wildlings:

Some success has been attained by using wild seedlings

as a source of planting stock. It is advisable to put the wild seedlings in a transplant bed for one year, prior to planting in the field, so that a root system can be developed that will better withstand adverse moisture conditions.

A survival of about 50 to 80 per cent can be expected when planting or transplanting wild stock. This method will prove to be uneconomical if a large supply of stock is required, due to the excessive labor and time required in gathering it.

Plants can be easily identified by their characteristic open winter buds, as shown in Fig. 3. Seedlings (Fig. 2.) can be identified by their habit of retaining their leaves for the first winter, after which they become deciduous.

Cuttings:

Tests with cutting indicate that best results are secured in a greenhouse with underneath heat. From tests made in the college greenhouses at least five months are required before the cuttings are ready for outdoor planting. Cuttings less than one-quarter inch in diameter and tips of shoots did not prove successful in callousing and developing roots. This is probably due to a lack of sufficient stored plant food.

Layers:

Very strong plants may be obtained by layering. This is shown in Fig. 5, which illustrates results secured after one year in the nursery. In this method, lower limbs or sprouts are bent down to the ground and held there by a crotched stick or bent wire. Dirt is covered over the place of contact

Fig. 2
Seedlings Of Cascara

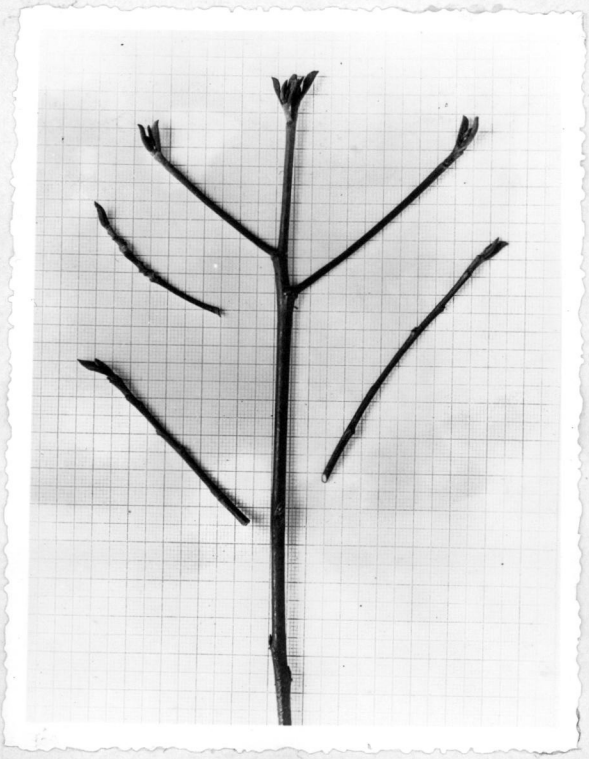

Fig. 3
Open Winter Buds Of Cascara

Fig. 4
Leaves and Flowers of Cascara

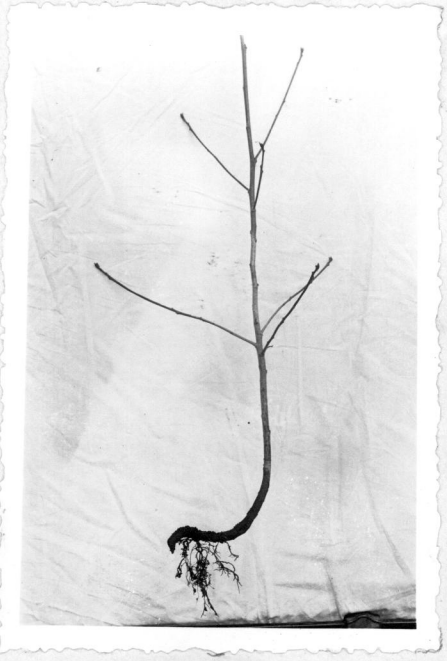

Fig. 5
New Plant From Layering

with the soil and the outer end is left free and uncovered. A slight injury by scraping of the covered portion assists in the formation of rootlets. Although this method gives good plants, it is more expensive than to secure wild stock, and should be used only if a few plants are desired.

Prepared Seed Spots in the Field:

Planting of seed directly in the field in specially prepared seed spots spaced at the desired distance would greatly decrease the cost of establishing a plantation. Enough seed would be placed in each spot to insure the development of at least one or more seedlings. If more than one seedling survived, the others could be weeded out.

ESTABLISHMENT OF PLANTATION

Preparation of the Planting Site:

Much care should be used in selecting the location for plantations, and attention should be given to the silvical habits of this species.

All competing vegetation should be removed from the planting site, and if possible should be thoroughly cultivated. On sites where cultivation is not feasiable, the existing vegetation and brush should be removed and kept cut down for a period sufficiently long to allow the cascara plants to become well established. Usually about three years.

The Spacing Desired:

A spacing that will necessitate the use of 1500 to 2200

trees per acre will give the best results. Any spacing that requires the use of more than 2200 trees per acre will tend to crowd the trees, resulting in decreased growth, and a possible early stagnation of the stand. Mr. Miller, in this first planting, used a spacing that gave him 2722 trees per acre. This caused an overcrowded condition indicated by the much better growth attained by trees located at the ends of rows where they received more growing space. (see Fig. 6.)

The approximate number of plants required per acre for various distances in rectangular planting is as follows: (7)

Spacing (feet)	No. of Plants per Acre
3 x 6	2420
4 x 4	2722
4½ x 4½	2151
4 x 5	2178
4 x 6	1815
4 x 8	1361
5 x 5	1742
5½ x 5½	1440
5 x 6	1452

Planting:

Planting in the field can be done by any of the methods in common use. The placing of plants in ploughed furrows is a simple method. Hazel hoes or mattocks can be used for small

Fig. 6
Portion of Thos Miller's Cascara Plantation at Brownsville, Oregon. (The trees are eleven years of age, average five to six inches in diameter, and are about twenty-five feet in height. The stocking of 2700 trees per acre is too dense. This is evidenced by the larger diameters of the trees at the ends of the rows.)

Fig. 7
Cascara Trees of the Miller Plantation
(The 11-year-old tree in the foreground measures seven inches in diameter at six inches above the ground.)

stock, and the use of a spade is necessary if larger stock is to be planted.

Precaution must be taken to keep the roots of the planting stock from drying out. A few minutes exposure to the sun will greatly increase the planting mortality. The roots can be kept from deying out by keeping them wrapped in damp burlap or similar materials.

One-year-old stock may be successfully used if planting is done on moist sites. Transplants should be used if planting is done on dry or adverse sites. The well-developed root system of the transplants cause them to become more quickly established and aid in survival over periods of draught.

Care of Plantation:

Best growth will result if the planted area is kept in cultivation, and cover crops grown to furnish nitrogen.

Cultivation is necessary for at least the first three or four years, or until the trees are good-sized and well established. If possible, cultivation should be continued. Mr. Miller disks his plantation about five times per year, planting a luguminous cover crop of peas in the fall and disking it under in May of the following year. Cultivation conserves the moisture and eliminates competition from grasses, weeds, etc.

Pruning of the lower side branches of the trees should be done in about the fourth year after planting to aid in the development of straight boles, free from limbs. Care must be taken, however, to not prune the trees too severely. Trees,

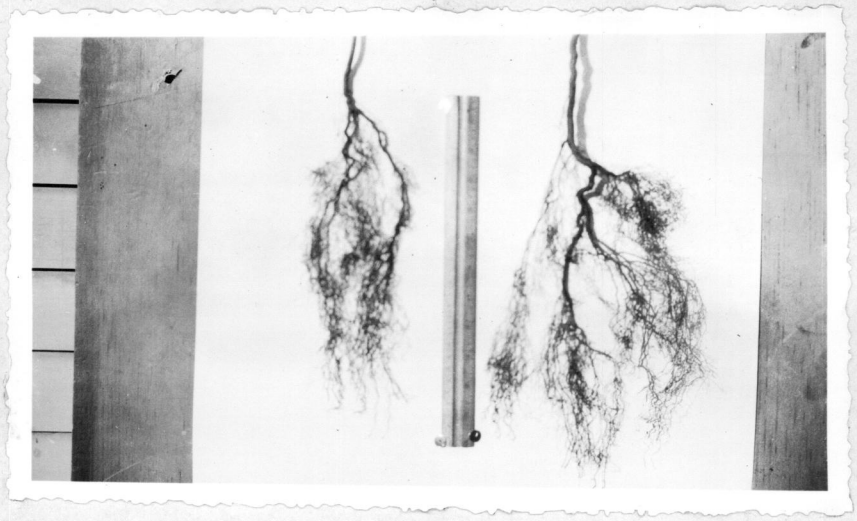

Fig. 8
Characteristic Root System of Transplants

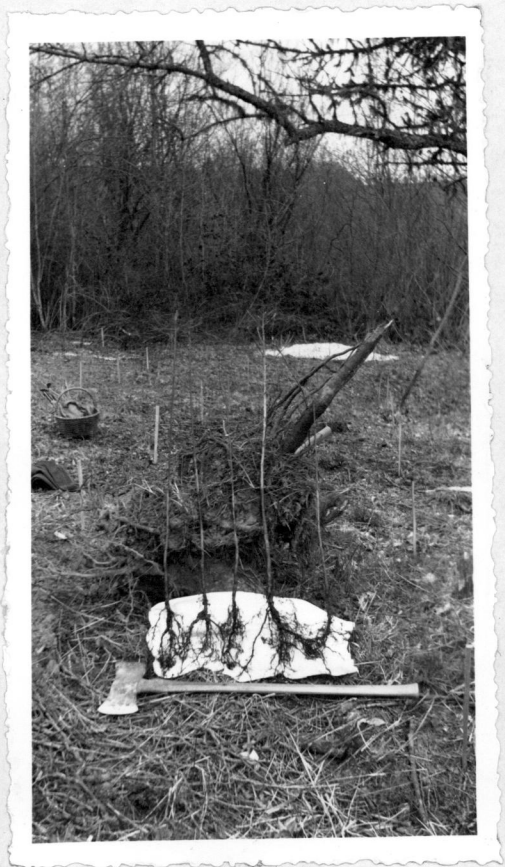

Fig. 9
Typical Size and Form
of Transplants

pruned too far up the stem, result in long, slender, topheavy trees without sufficient strength to support the crown. (see Fig. 11.) Trees in this condition are very suseptable to damage from wind or snow.

Prunings from the trees can be saved, ground up, and sold for about half the price of the bark. Mr. Miller sent in several samples of the ground up twigs. He found that twigs one-quarter inch and less in diameter had a medical content of about 50% of that found in the bark. Twigs one inch and less in diameter had a medical content of 38% of that found in the bark.

THE HARVESTING OF CASCARA

Collecting the Bark:

To date, little is known about the merits and the relative cost of harvesting by the various methods that can be used. The collecting season depends upon the season and locality. It is best that the tree be in full leaf before peeling begins; otherwise the bark will not slip.

One method of collecting is to cut vertical strips of bark from the tree, leaving part of the bark undisturbed. This process can be repeated about every three years if too large a portion of the bark is not removed.

The following method of harvesting has been suggested by the United States Department of Agriculture.(2) If the trees are properly pruned, a crop of bark may be harvested

Fig. 10
T. J. Starker in the Thomas Miller Cascara Plantation Near Brownsville, Oregon. The Above Five-Year-Old Plantings Have Received Proper Pruning.

Fig. 11
A Scene in the Thomas Miller Cascara Plantation Showing the Effects of too Severe Pruning. Trees of this Type are Easily Damaged by Wind or Snow.

each year without killing the whole tree, as is done in collecting the bark from wild trees. At the time of transplanting, the trees are cut to a straight stem about a foot high, from which all except the four uppermost buds are removed. The branches which afterwards develop from these buds are later deprived of their lower side shoots, thus causing the tree to grow a head of four long, stout branches instead of a single trunk. When the trees are large enough to yield a crop of bark, the longest of the four branches is cut off early in the spring flush with the trunk and a new branch is allowed to grow in its place. This process may be repeated yearly, removing only the largest branches of each tree in any one season. (1)

The method advocated by the Oregon State Forestry Department is as follows:

"All trees suitable for peeling were to be felled. The minimum stump diameter was fixed at four inches, one foot above the ground, with the stump to be at least six inches in height. Stumps were not to be peeled, thus insuring sprouting and the future regeneration of the stand. In case a number of sprouts originated from a common center, the smaller was to be left. All bark was to be removed from the limbs and the trunk down to a diameter of at least 1½ inches. Felling was to be carried on only during the season when the sap was up."

Mr. Miller intends to cut his trees and grind them up by putting the entire tree through a "fuel hog." If stable markets can be secured for cascara in this form, it will greatly reduce the cost of harvesting and also eliminate the problem of disposing of the wood. Mr. Miller has a novel method of insuring good coppice growth following the cutting

of trees. (see Fig. 12.) He bruises the base of the tree just above the ground line in the month of December. A number of sprouts arise from this bruised portion the spring following. One year later the tree is cut down, and the sprouts are left on the stump to provide regeneration for the next stand.

Curing of the Bark:

The bark must be thoroughly dry before it is sacked and stored prior to shipment. Bark, not thoroughly dry, will mold when stored, and a decrease in the quality and price of the product will be the result.

In the past, the method of curing bark was to spread the strips of bark on rocks in the sun, cambium down, for a period of two or three days. The dry strips were then broken up by a hay cutter, tromping, beating in sacks, etc. The later method is to chip the green bark first and then dry it. In this manner, it was found possible (5) to dry the bark in about half the time previously required. This also reduced the danger of degrade from mold in the larger pieces. The chipped green bark should be spread out on a canvas, a floor, or elsewhere where there is good air circulation. Bark will mold if left exposed to rainy weather.

Expected Bark Yields:

The cascara trees should be from five to seven inches in diameter and ready to harvest in about 12 to 15 years following planting if properly cared for. From all indications, 15 years seems to be the best age at which to cut.

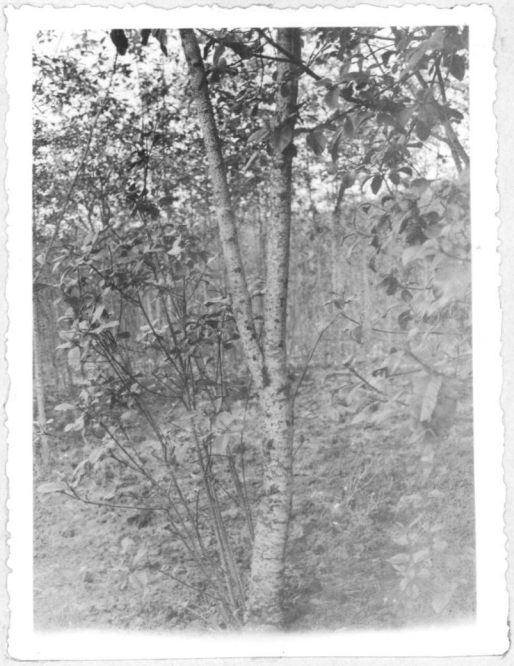

Fig. 12
Coppice Arising from Base of Tree That Has Been Bruised. The Tree, when Harvested, Will Be Cut Six Inches Above the Ground Line. The Coppice is Left Remaining on the Stump to Constitute the Growing Stock of the Succeeding Stand.

Fig. 13
Dense Coppice of Wild Cascara.

Cutting at this age will take advantage of the rapid growth in the early life of the tree. Under proper management, a yield of one pound of dry bark per year can be expected in a fifteen year rotation. It is possible that yields of 1½ pounds or more of dry bark per year can be expected under optimum growing conditions. Larger yields can be expected from the more rapid growing coppice that will form the stand during the second rotation. Mr. Miller expects a yield of 18 pounds of bark per tree in the first 12 year rotation, and that he will get an annual increase of nearly one-half inch. The above yield estimates are based on the method of harvesting whereby the entire tree is cut down and all the bark removed. No definite yield estimates are available for the other methods of harvesting cascara.

Income from the sale of prunings and seed can also be expected. Mr. Miller sells seed, in berry form, at $1 per pound. He also sells planting stock that he grows in his own home nursery.

THE INDUSTRY

The future of commercial plantings looks promising. The cascara bark industry is, at the present time, laboring under two difficulties. First, a great portion of the accessible woods have been cut over and the men engaged in the industry must look to remoter districts for the supply. Every year it becomes necessary to go farther and farther back into the mountains to gather the bark. Second, the supply has been decidedly variable, changing excessively as stimulated by

sudden fluctuations in price. (1)

The price paid the peeler since 1912 ranges from 2½¢ to 16¢ per pound of dry bark. The highest price being in 1924. The highest price paid in recent years was 11¢ per pound in 1937. The price, at present, is varying between 4¢ and 5¢ per pound. The average price paid the peelers since 1912 is about 8½¢ per pound. This price is that paid by jobbers who in turn sell to the large drug companies. Plantation owners who have a large annual output would find it profitable to deal directly with the larger drug firms.

During 1938, 791.6 tons* of cascara bark was shipped by water from the various parts in Oregon and Washington. (6) 384 tons being shipped to the Atlantic Coast and the rest to various countries throughout the world. England, Australia, Holland, France, and Germany being the main importers.

Total production of cascara bark, as estimated by E. P. Callison & Sons, averaged about 2000 tons per year from the years 1919 to 1930.

There is a large demand for cascara bark. In order to meet this demand, commercial plantings may have to be resorted to.

Without doubt, the supply of bark is being rapidly depleted, for it is necessary to gather it from the remoter and more inaccessible areas to meet the increasing demands. Much of the original cascara acreage has been cleared for agricultural purposes, thus lessening the possibility of second growth. Areas are already being peeled over for the second and third

*ton equal 2000 lbs.

time. This second and third peel is said to come from trees that were too small to yield heavy enough bark at previous cuttings. (1)

Mr. Miller has had no difficulty in finding a market for his cascara. In fact, he has orders far in access to the amount that he can produce.

CONCLUSION

Information pertaining to the costs and yields of cascara grown under management is decidedly lacking. Until further information is obtained, there can be no definate statements made as to the profitability of growing cascara for commercial purposes. It is fairly safe to say, however, that a small profit can be expected if the land is not too valuable. Plantings on cheap or unused land that are of the right site will probably bring in somewhat greater returns than the growing of commercial timber. This is due to the short rotation required to grow cascara, a probable increase in prices, and the additional income from the sale of prunings and seed. This may be further augmented if satisfactory markets can be established for the entire tree in the ground-up or "hogged" form. The instalation of a private extraction plant may prove to be a profitable venture if a sufficient volume of cascara is available.

Information from all available sources indicate that the supply of cascara bark is being rapidly diminished. This condition is evidenced by the fact that collecting of wild bark

is now being done in the more remote and inaccessible regions, and that old areas have been repeeled two or three times. This cannot go on forever. A shortage of the supply in the near future seems inventable. The growing of cascara under cultivation may have to be resorted to in order that the demands for the product may be met.

Even though the demand for cascara be great, it is fairly certain that the price of the bark will never rise to any high mark. The competative mineral compounds will take the place of cascara as a laxative in the event that its price becomes too high.

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