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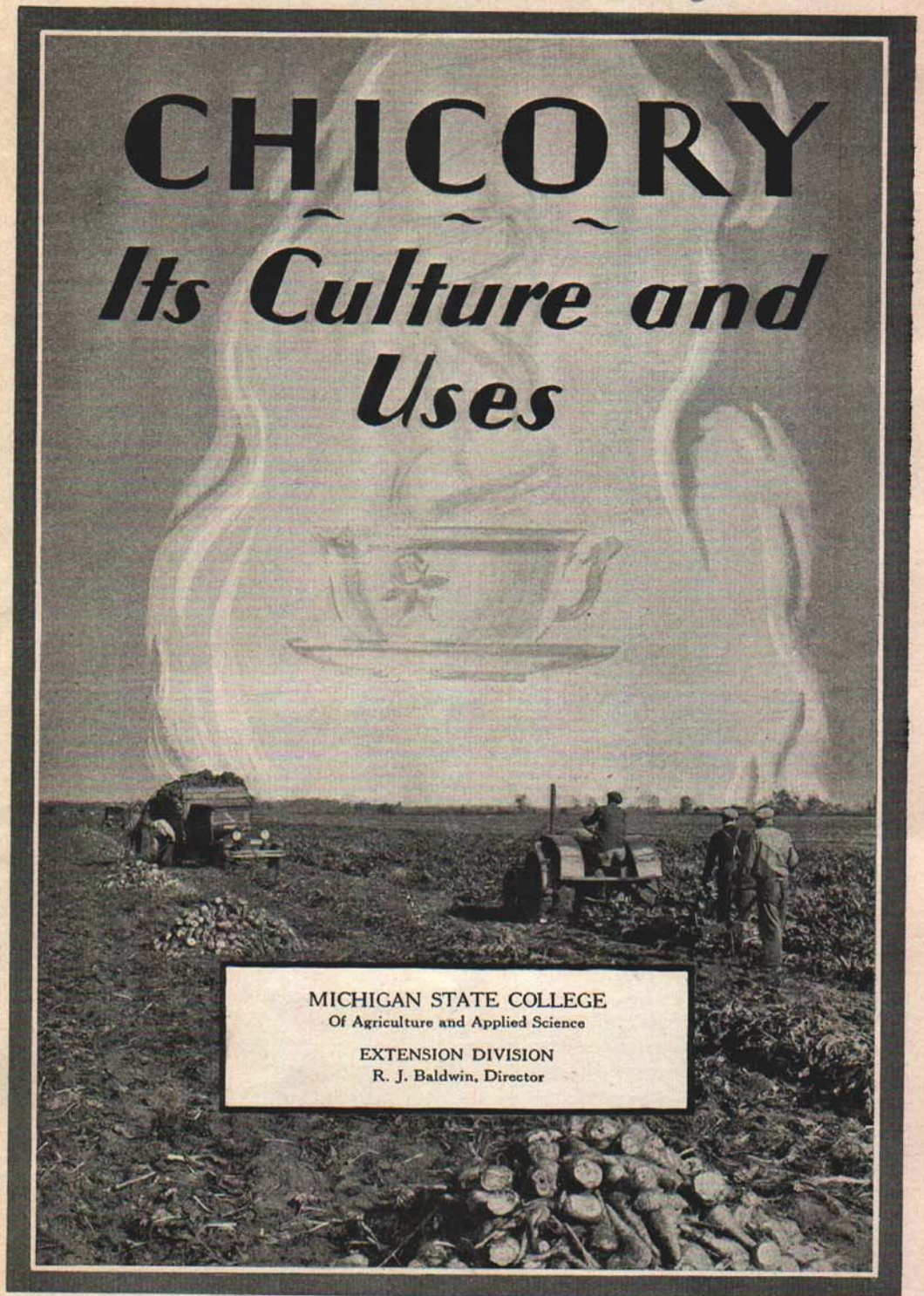

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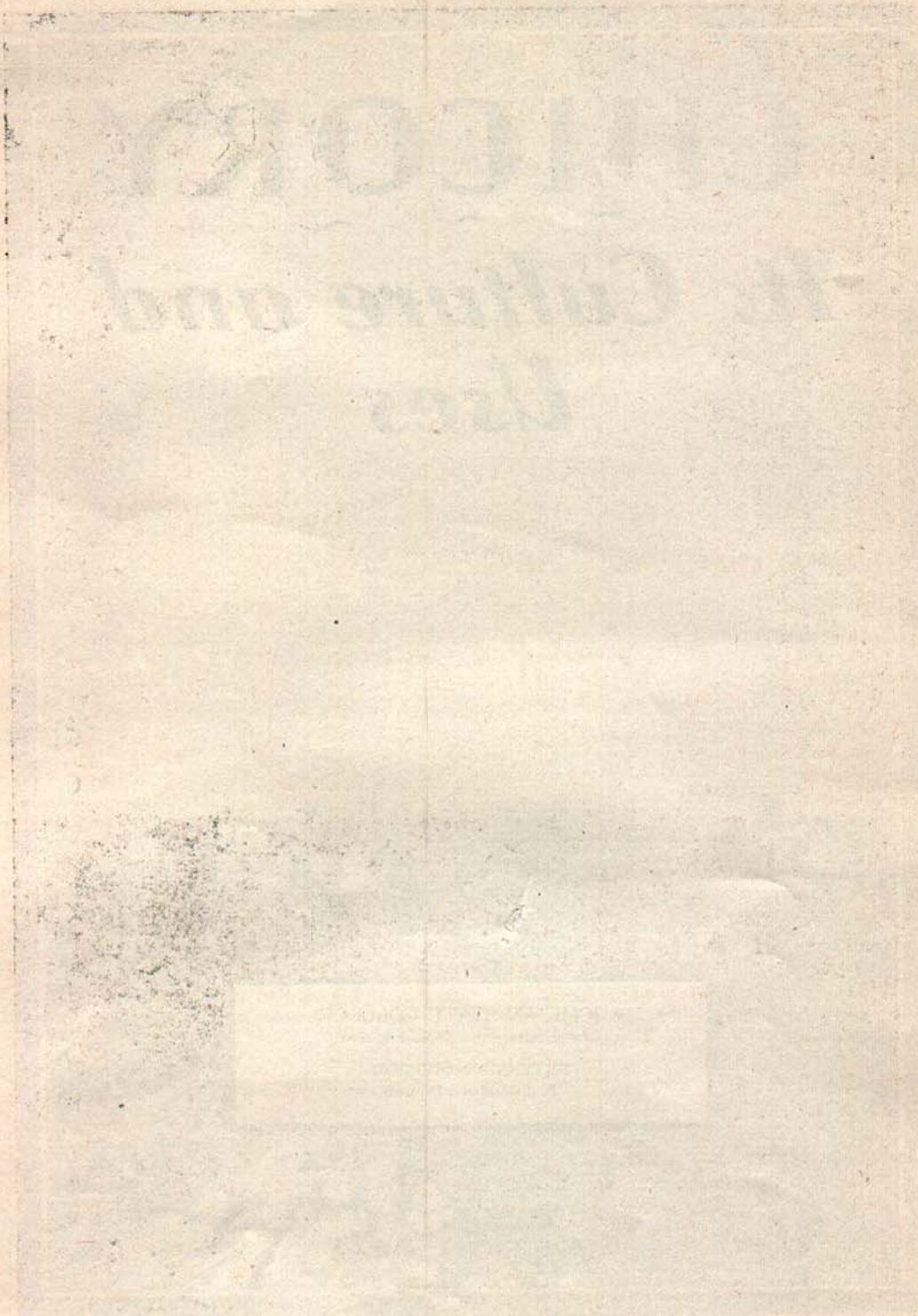

CHICORY

Its Culture and Uses

By H. C. RATHER

"What is chicory?" "Is it a forage or a grain?" "What does it look like?" "How does it grow?"

These are questions frequently asked even here in Michigan, the state that enjoys almost a monoply in the United States in the production and processing of chicory.

Those who see the growing crop or the roots on their way to the factory frequently confuse chicory with sugar beets. As a matter of fact, the two crops are somewhat similar in appearance and their cultural methods are much the same. And, in one respect at least, their use has something in common. The final product of the sugar beet is used to improve the flavor and palatability of coffee and the final product of chicory is placed in coffee to give it body, darken its color, and hold its flavor and aroma, at least so say its adherents and science seems to justify their claims, as shall be pointed out later.

For ages, man has made use of chicory, both for himself and for his animals. Historians have stated that some of its varieties were regarded as table delicacies by the Romans. Other varieties were cultivated as pasture for sheep and cattle. In Europe, today, chicory is still widely used in salads and for greens, the esteemed *barbe de capucin* and Witloof salads of the Continent being chicory preparations.

Europeans Start Use of Chicory-Coffee Blend

However, the most important use of chicory in Europe and in America today is as an improver of coffee. Its use in this manner was firmly established in Europe during the Napoleonic blockade. When coffee, cocoa, and tea could be procured only with great difficulty, roasted cereals had their innings as substitutes for and adulterants of coffee. Even more than cereals, chicory was widely used in blends with coffee, sometimes the blend being a lot more chicory than coffee up to the point of entire substitution.

The curious fact is that while such coffee substitutes as roasted cereals, peas, and acorns have had their waves of popularity only to be abandoned, a great many users of chicory have continued its use, like its flavor, claim they feel better after consuming it, and demand the blend in preference to straight coffee. According to one writer (1), "So general has the use of chicory as a beverage become in Europe that many Continental powers have been obliged to enact laws to prevent its adulteration."

*Reference by numbers is to "Literature Cited;" see page 14.

Chicory Free From Harmful Ingredients

Probably because chicory was first used as an adulterant of coffee for many years it was on the defensive. Apparently, many of the ills and woes with which chicory drinkers were afflicted, just the same as other people, were attributed to chicory. When scientists began to inquire seriously into these allegations, chicory came through with a clean bill of health.

L. Ducamp (2), a French investigator, finds no foundation for suggestions that certain substances in it cause heart trouble. He states that the drinking of a chicory infusion has some laxative value and appears to result in no harmful effects whatever.

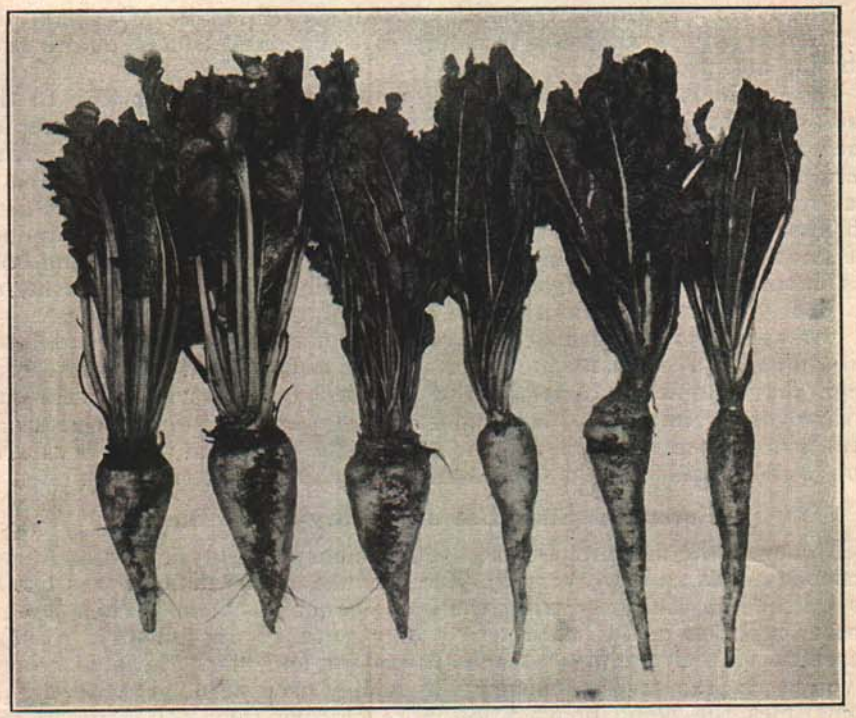

Fig. 1.—Chicory resembles the sugar beet in its outward appearance but the leaves are smaller and the roots are longer and more slender than those of sugar beets. The three on the left are sugar beets—the others are chicory.

Likewise, Adolph Bickel (3) reporting in a German publication in 1929 on experiments which he had conducted found no ill effects from chicory consumption.

One of the earlier publications by the United States Department of Agriculture, a bulletin on chicory growing by M. G. Kains (1) in 1898 discusses the effects of drinking chicory and includes this statement, "Analysis of both the raw and prepared product have so far failed to reveal the presence of any positively harmful substance."

Kains further concludes that the very general use of chicory for the last 150 years and the proportions which its cultivation have assumed indicate that it is beneficial and agreeable to at least some constitutions.

One of the more recent experiments with chicory as a beverage was conducted by the Home Economics and Chemistry Sections of the Michigan Experiment Station (4). This study dealt with the influence of chicory on respiratory metabolism; that is, its effect, if any, on the amount of heat produced by the body.

In these trials, chicory was added to coffee and the resulting beverage analyzed for caffein and caffetannic acid. This analysis showed that the resulting brew contained neither more nor less caffein than did the straight coffee. Two hundred c.c. of coffee brew made with 30 grams of coffee and containing 0.25 grams of caffein increased the respiratory metabolism of three persons who used it in the experiment by approximately 6 per cent. A brew made of 10 grams chicory and 200 c.c. of water had no more effect on metabolism than the pure water itself, which was none at all. When a brew of coffee was made to include 10 per cent of chicory, its effects on respiratory metabolism were essentially the same as those of the coffee alone.

Flavor and Aroma Held in Coffee-Chicory Beverage

If the case against chicory thus seems to have fallen down, how about the case for it? Is there any basis for the preference of multitudes of Europeans, and Americans, too, for the blend of coffee-chicory over coffee alone?

In dealing with human tastes, it must be appreciated that a very intangible and variable characteristic is being considered. Not only is taste a matter of the reactions of soluble material on nerves on the surface of the tongue, but appearance, aroma, and the feel of a substance all influence people in their likes and dislikes of that which they eat and drink. Some people like strong coffee, others prefer it moderate or even weak. Some people flavor sliced tomatoes with vinegar, others put on sugar. Some people like olives and some don't. Every food or drink meets the whole gamut of human likes and dislikes. It is a curious fact that the great majority of coffee drinkers who get a taste of the coffee-chicory blend generally prefer it over the coffee alone.

This preference for the coffee-chicory combination was demonstrated in trials by Smith and Bartell (5) of the University of Michigan. Five persons were presented with samples of coffee or of coffee containing chicory, without their being given any information as to the liquid they were about to test. When the tests for pleasing aroma and taste were conducted after the beverages had stood for one hour, there was little consistency in the selection of one beverage over another. When the same tests were conducted with beverages which had stood for 18 hours, three of the persons preferred coffee with 10 per cent chicory, two preferred that with 3 per cent chicory, and none gave first preference to pure coffee.

These tests, according to Smith and Bartell, tend to indicate that the aromatic constituents of coffee are in some manner held in the brew by the presence of the chicory.

By chemical tests, these investigators determined that the presence

of chicory in coffee brew does not cause more of the soluble portions of the coffee to go into solution; but the presence of chicory in the coffee infusion apparently does cause the aromatic constituents of the coffee to be held in the brew. The lasting flavor and aroma of coffee containing some chicory is not a mere matter of the imagination of those who prefer the blend, apparently it has a sound chemical basis.

Possible Healthful Attributes of Chicory

Dr. Charles W. Green (6), a New York City physician, believes there is real merit in the coffee-chicory combination. He states that chicory with coffee, unless used in too heavy proportion, which is distasteful, greatly enhances the coffee-like aspects and attributes of the drink. Clinical observations according to Dr. Green point to a relief from "bilious" distress when the chicory admixture is used and the patient very often experiences freedom from such previously existent symptoms as wakefulness. Dr. Green's comments are based purely on observation rather than on experimental evidence. He says, however, that, whether or not there is any basis for the coffee-chicory consumer's freedom from wakefulness, the favorable influences exercised upon the hepatic function as a result of consumption of this beverage, rather than straight coffee, have a sound physiologic basis.

Commercial Use of Chicory-Coffee Blend

The object in quoting at some length various experiments which show not only that chicory is harmless, but that it has positive benefits when used as part of the coffee beverage, is to disabuse any one of the possible notions that chicory is an adulterant. Chicory used with coffee is no more of an adulterant than the sugar and cream most people add to each cup. Food labeling laws usually require that the presence of chicory, when part of the coffee blend should be made known. This requirement should prove advantageous to chicory as people learn to appreciate its influence in retaining the best part of the coffee flavors and aroma.

A beverage made of chicory alone is rather bitter and most Americans do not like it. The customary blend in this country is one containing 10 per cent or less of chicory, although a somewhat larger proportion is frequently used in the South.

Most of the chicory used in the United States is consumed in hotels and restaurants. Many of these buy their coffee with a specified percentage of chicory mixture. The chicory is particularly advantageous to the hotel or restaurant coffee maker because his coffee can not be consumed as fast as it is made, but must be brewed in advance and kept in condition throughout the entire meal serving period. The fact that chicory causes the caffeol, the aromatic oils that give coffee its pleasant flavor and aroma, to be held in the brew (demonstrated by Smith and Bartell) is the scientific explanation of the reason why good public eating places can keep their coffee in such excellent condition. Housewives, too, may take advantage of this property of chicory and serve a beverage with a small admixture of roasted chicory which will retain its qualities of excellence for a long period.

In the manufacture of chicory for use with coffee, the full grown

roots of special varieties, grown for this purpose, are washed, sliced, roasted, and ground. Many varieties of chicory are used solely as vegetables. These are distinguished by the form and color of their leaves. A comparatively few well-established sorts are used for roasting but the leaves of these roasting varieties, as well as those of the garden sorts, may be used for food.

Chicory a Possible Source of Levulose

The time may come when chicory will be of importance as a source of levulose, a kind of sugar. There are three common forms of sugar. Sucrose, is derived from sugar beets and cane; dextrose is found in a number of sweet fruits, in honey, and in the seeds, leaves, stems,

Fig. 2.—Harvesting a 20-acre field of Michigan chicory. The laborers are pulling and piling the roots which have been loosened with a beet lifter.

and blossoms of plants; and levulose is also found in many sweet fruits, in honey, and in certain plants. As dextrose is derived from the conversion of starch, the notable commercial product being corn sugar, so levulose comes from inulin, a starch-like substance found chiefly in the tubers of the Jerusalem artichoke and the roots of chicory, but present in some other plants as well. The Minnesota Experiment Station (7) reports that chicory is apparently as desirable as, or more desirable than, the Jerusalem artichoke as a source of levulose. The commercial possibilities of levulose production from either the Jerusalem artichoke or chicory have not yet been developed in any extensive way.

Chicory Drying Plants in Michigan

Chicory drying plants are located in Mt. Pleasant, Midland, Kawkawlin, Pinconning, Bay City, Bad Axe, and Port Huron. These plants are well distributed throughout the Saginaw Valley and Thumb District areas, which produce Michigan's crop. The usual extent of chicory production in Michigan is indicated by factory reports which show contracts calling for the production of 8,467 acres in 1929 and 9,522 acres in 1930. These contracts, at a given price per ton, were with

Fig. 3.—Weighing in the crop. Most of Michigan's chicory is now delivered to drying plants by motor truck.

1,564 growers in 1929 and 1,720 in 1930. This is an average production of about five and one-half acres per grower. The acreage is largely drawn from Sanilac, Huron, Bay, Tuscola, and Isabella counties.

Cultural Practices Comparable to Those of Sugar Beets

The labor requirements in chicory production are much the same as those for sugar beets and while the tonnage per acre is generally somewhat lower than is secured with the sugar beet crop the higher price per ton usually paid for the chicory roots has made the two crops comparable in net returns.

Climatic and Soil Requirements

The best yields of chicory are secured on fertile clay loams and loams similar to soils of the Brookston type. In demanding a soil of high fertility, chicory is not quite so exacting as sugar beets, nevertheless, if the crop is to be profitable, large acre yields must be secured and large acre yields require, first of all, a fertile soil.

Chicory roots rather deeply in a comparatively short time and is less likely to be injured by such dry weather as is normally encountered in Michigan's mid-summers than beans. A soil too wet for beans or small grains, however, is also too wet for chicory.

The climate of Michigan's Thumb District and Saginaw Valley with moderate summer temperature and well distributed rainfall is ideal for chicory. Its history in this and European countries indicates chicory to be strictly a cool weather crop unadapted to the southern warmer sections.

Fig. 4.—Delivery of chicory into storage bins. In the foreground are the flumes through which the roots are floated into the washer and cutter. The cut roots are then elevated to the top of a high building to begin the drying process.

In view of the fact that chicory is rather slow in starting, much hand labor in keeping the crop clean will be saved if the crop sequence is such that chicory is preceded by another cultivated crop such as beans, corn, or potatoes. A fall plowed clover sod will make a satisfactory seed bed for chicory the next spring, but an old bluegrass or an alfalfa sod should be followed by such a crop as corn or beans before chicory is planted.

Well rotted barnyard manure results in good yield increases. If the manure is strawy, it should be applied in the fall, as undecomposed organic matter makes the preparation of a fine seed bed difficult.

Commercial fertilizer is generally applied by Michigan's more successful chicory growers. As a rule, they follow about the same prac-

tice as is followed with sugar beets. For sugar beets on heavy sandy loams, silt loams, and clay loams, the Soils Department of the Michigan State College (8) recommends 4-16-4 or 4-16-8 where no manure or leguminous green manure has been used within the last two years; 4-16-4 or 0-20-0 where the land has recently grown clover or alfalfa or has had an application of barnyard manure. The same recommendations should be satisfactory for chicory.

A Fine Firm Seed Bed Essential

The seed bed preparation for chicory must result in freedom of weeds and very fine tilth. Chicory seed is small and a little slow in germinating. It should be planted no deeper than is necessary to get coverage, a quarter of an inch or less if possible. This, of course, necessitates that the seed bed be firm as well as fine if tiny, shallow-planted seeds are to grow. There is no set method to get this fine firm seed bed. The preparation of a good seed bed is an art not a science, and ideal seed beds are dependent upon the experience, skill, and perseverance of the farmer who prepares them.

The general operations for the preparation of a good chicory seed bed may be outlined as follows:

1. Fall or early spring plowing to a depth of 7-10 inches. This gives room for well-shaped roots.
2. Discing and harrowing with the spring tooth as necessary.
3. Cultipacking.
4. More harrowing.
5. Floating the seed bed just before planting to give it smoothness.

At most of the drying plants, the chicory companies are in position to supply, on a rental basis, the special drills needed to sow chicory properly. In the earlier days of the industry in Michigan, most of the crop was put in with hand-pushed garden drills. A fairly wide range is permissible in time of planting, extending from early May into early June. It is not desirable to plant too early as early-planted chicory may produce a number of seed stalks thereby reducing root production and causing some weed difficulties in succeeding crops. Late planting shortens the growing season and cuts the yield. May 10-25 is about right.

It has been customary to plant chicory in 24 inch rows. Here, again, the chicory grower can probably take a lesson from the grower of sugar beets who has found that he can get a worthwhile increase in tonnage by cutting the width of his rows to 22 or even 20 inches if he has the kind of horses that can walk down the middle of 20 inch rows without tramping all over the plants on both sides.

Cultivate to Control Weeds

As soon as the plants are large enough so the rows may be followed, cultivation is started. As, with all row crops, the purpose of cultivating chicory is to control weeds. This may require frequent cultivation or it may not depending on how well the weeds have been checked by previous tillage. Cultivation beyond the needs of weed control is

unnecessary, it is a useless expense, and it may have a depressing rather than a stimulating influence on yield. Chicory has fine feeding roots as well as its fleshy tap root. These feeding roots should not be pruned by deep or excessive cultivation but the weeds must be controlled. Cultivation practices, therefore, should be governed accordingly.

Block and Thin Early

Also as soon as the plants are rowed through and have received one cultivation, usually at about the four-leaf stage, the job of blocking and thinning the plants is done. Blocking consists of carefully spacing

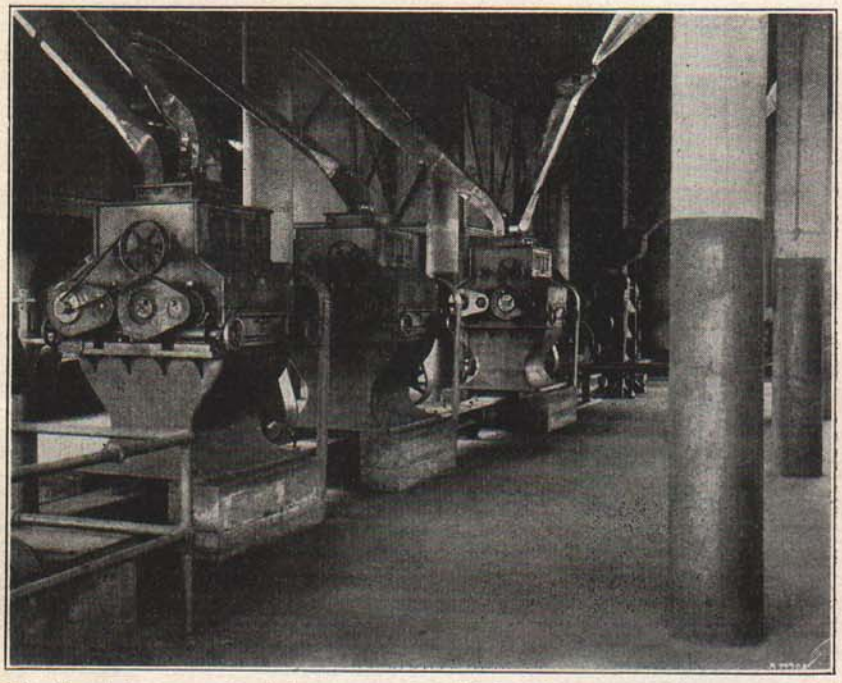

Fig. 5.—A battery of grinders preparing dried and roasted chicory roots for the market.

little bunches of plants by cutting out the intervening ones with a sharp hoe. Thinning, that is, good thinning is the singling out of the one best plant in these bunches. These single plants should be spaced about eight inches apart in the row thus leaving, in a perfect stand, 125 to 150 chicory plants to 100 feet.

If the thinning job is delayed until the chicory plants get too large, the operation tends to injure the plant which is left, slow up its recovery, and cut the final tonnage per acre.

Chicory possesses that rare advantage of being almost free from disease and insect pests. The sugar beet has been considered good in this respect, but chicory is better. Cut worms and wire worms may

injure chicory somewhat when it is grown following an old sod, but almost never does such injury occur on a well-prepared seed bed following another cultivated crop.

Harvest Late Enough to Use Full Growing Season

Chicory roots develop most during the cool weather at the end of the season and if harvest is timed to take advantage of the full growing season maximum yields will be secured. However, harvest ought to be completed before serious ground freezing occurs or harvest difficulties will increase and roots will be injured.

Fig. 6.—A Michigan factory for the final processing and preparation of chicory products.

Lifting, to loosen the roots, is done with a beet lifter and should be carefully done to loosen each root in its entirety. Pieces of chicory root left in the soil may grow and develop chicory as a weed in following crops.

The roots, loosened with a lifter, are next pulled by hand, the workman strikes the roots together to knock off loose dirt and throws them into piles. Twelve to 16 rows of chicory are used to make a row of piles. The leaves are then topped off with a sharp knife.

If the topped roots cannot be hauled to the dryer immediately, the piles of roots should be covered with leaves to prevent frost injury and needless evaporation.

Chicory tops are apparently less valuable as feed for livestock than

sugar beet tops. The yield is smaller in the first place and sugar beets are cut so the tops contain more of the root than is the case with chicory. Most growers scatter the chicory tops back on the land for their manurial value though frequently they turn cattle or sheep in the field to pick up what they choose. Cows giving milk should be kept off chicory tops to avoid the danger of off-flavored milk.

With hard surfaced roads throughout the chicory growing territory, the motor truck is the common means of conveying roots to the drying plants. Here, the roots are washed and sliced into cubes about an inch square, then elevated to the top of the dryer from which floor by floor they are brought down over a coke fire which drives off the water and greatly reduces the bulk of the product which is shipped to central processing plants. The dried chicory may be held in storage since, in this condition, it retains its quality indefinitely.

Michigan chicory is gotten into final condition for the market in central plants located at Port Huron, Michigan and at Flushing, New York. The final processing consists of roasting the dried chicory and grinding it to a fineness suitable for blending with ground coffee. Most of the ground chicory is handled in bulk in waterproof barrels or sacks but some of it is packaged in form for convenient distribution to housewives who find it advantageous as a coffee improver in the home.

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