

# The All-Around Vegetable

## The Many Uses of the Sweet Potato, and How to Make the Most of Them

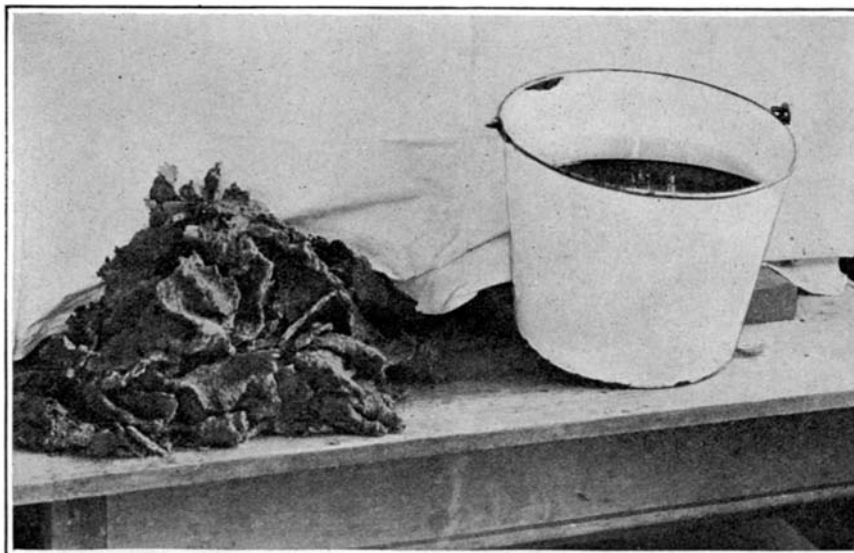
By S. R. Winters

THE 1921 sweet potato crop for the entire United States—accepting the July forecast of the Bureau of Crop Estimates—is sufficient to produce approximately 200,000,000 gallons of syrup—a volume suggesting a revision of the Biblical phrase, “a land flowing in milk and honey,” to that of a soil drenched in sweet potato syrup. The figure of speech is particularly applicable to the South, where nearly 90 per cent of the “juicy yams” are grown. Alabama, Georgia, North Carolina, Mississippi, Texas, and Louisiana—in the order named, are the principal sweet potato producing states—each harvest from 8,000,000 to 18,000,000 bushels annually.

Of course, the supposition that 112,023,000 bushels of potatoes will be converted into syrup is but a fantasy—a flight of imagination! The sweet potato lends itself to a variety of uses—in fact, an instructor in a negro college in Alabama recently testified before a Congressional committee that this southern vegetable food was being used in 100 ways. Without attaching credence or disputing this claim, there is no gainsaying of the flexibility of this underground root crop whose spreading vines literally dot the Southland. And, sweet potato syrup is the latest addition to its constantly expanding uses. A process developed by H. C. Gore, chemist-in-charge, fruit and vegetable utilization laboratory of Bureau of Chemistry, United States Department of Agriculture, makes possible the manufacture of sweet potato syrup both in the home and factory. A production unit, recently established by the Government at Fitzgerald, Ga., will determine the feasibility of the commercial application of the process. The initial experimental run of the factory machinery yielded 600 gallons of syrup and the costs of producing and marketing the product are being studied. Meanwhile, Southern homes can apply the process to effect in extracting table syrup from the humble tuber.

The recipe for preparing the liquid sweetening on farms has been successfully established by laboratory experiments. The original formula, however, as announced a few months ago, has been modified by subsequent determinations of the Bureau of Chemistry. The modification of the method of preparation is in the interest of a well-flavored product. The use of malt made from barley or wheat is somewhat restricted by the amended process inasmuch as the sweet potato has disclosed certain contents which enable it to digest its own starch. Yet, a limited quantity of malt can be employed to advantage. The potatoes are boiled until soft, stirred until they form a smooth pulp, water added, the proper temperature insured, and by incorporating a limited quantity of malt, which stands for a brief period, the starch in the potatoes is converted into maltose sugar and dextrin. On pressing the wort or the material in a state of fermentation these soluble solids, together with the reducing sugars originally present in the tubers, are readily divorced from the pomace.

The numerous commercial varieties of sweet potatoes are adaptable to syrup-making, the color varying with the kind of potato. For instance, white varieties like Southern Queen yield a light-colored fluid while the Porto Rico and similar assortments produce syrups somewhat darker in color. Stored as well as freshly-dug tubers lend themselves to the production of the sweetening fluid—not as sweet, however, as maple or cane syrups. The intensity of the sugariness of the sweet potato product, may it be said here, is altogether satisfactory for many uses. The size of the underground root is irrelevant as far as the quality of the syrup is concerned. Herein, according to claims of the Department of Agriculture, lies the immense possibility of commercializing the newly-evolved process. Frequently forty per cent of the South's potato crop exceeds the prescribed standards of Northern markets in size, thereby render-



The syrup and the dried pomace from a bushel of sweets

ing them well-nigh valueless for shipment. These overgrown tubers, as well as ones dwarfed in growth, yield sweetening juice equal in quality to standard market grades. Soundness is the one absolute requisite for potatoes designed for syrup-making—decaying portions, diseased tubers and other inflicted faults must be discarded.

More about the method of preparing the syrup: The potatoes are washed and hand-trimmed by way of removing dirt, bruises, and decayed portions. The tubers are then blanched (parboiled) either in boiling water or steam. Blanching, preferable to peeling, serves the purpose of removing the ingredients in the peel which would impart a green or brown color to the syrup and an objectionable flavor. The potatoes are submerged in hot water in a suitable vessel and the water quickly heated to the boiling point. A few minutes having elapsed, the water is drained off and replaced with a fresh supply. The potatoes are then cooked until thoroughly mushy in boiling water or in steam. If the latter method is pursued, the water condensed should be rejected during the first half hour of the cooking period. One hour should be allowed for the cooking, a time limitation inviting the cells of the potato to crumble whereby the malt may invade and digest the starch. Steam under pressure is unnecessary as the higher temperature does not hasten the cooking of the potato.

Once cooked, the mushy tubers are scrambled into a paste. This is accomplished by stirring, adding water until the contents of the vessel constitutes a smooth thin pulp. About two parts of water to one of potatoes

is a correct proportion. The mixture is then brought to a temperature of 140 degrees Fahrenheit, a condition suggesting the introduction of the malt. One per cent of pale distillers' malt, made from barley or wheat, based on original weight of the potatoes, is added and thoroughly incorporated into the pulp and mixture, which now assumes the term “mash.” It is allowed to stand, with an occasional insertion of the stirring rod. While 140 degrees Fahrenheit is an expressed preference, the temperature range is liberal—varying from 129 to 145 degrees Fahrenheit, without deteriorating effects. At this juncture the starchy contents of the potatoes are devoured by the malt, the process requiring from twenty minutes to one hour. What scientists term as the iodine test will determine the completion of this reaction, namely: A small glass funnel is equipped with filter paper and a bit of the pulp placed on the filter. When the filtrate runs clear, the drops are permitted to fall into a test tube containing a dilute—pale yellow, cold solution of iodine in potassium iodide. Each drop as it enters the solution forms a deep blue color. As the reaction with malt progresses, succeeding tests yield purple, brown, and yellow-brown colors—and, ultimately are colorless. The starch-consuming process is complete, and thus the end of the mashing period is marked.

The mash drains without difficulty, and thus lends itself to a variety of separation methods. The simplest, however, is the rack-and-cloth system, well known on farms in the preparation of fruit juices. The pulp is laid up in the form of flat cakes between wooden racks, permitted to drain, and finally pressed. The equipment employed by the Bureau of Chemistry, and illustrated by the photographs which accompany this article, consisted of a screw press; a large pan of sheet tin, forming the floor of the press platform; a set of wooden racks; a wooden form for laying up the pulp; and press cloths of burlap or duck. The construction of a so-called “cheese” involves the laying of a rack on the drainage platform. The form is placed thereon and the cloth put diagonally across the form, the corners being opposite the sides. The mash is poured into this depressed “valley,” and the four corners of the cloth folded over so as completely to envelop the mash. The form is lifted and another rack placed on top. The form is again put in position and another cake of mash laid up. The operation is repeated until the pile is as high as desired. Meanwhile the wort or sweet portion of the malt flows off without applying pressure other than its own heaviness. Slight force will yield a big volume of wort, while heavy pressure is ultimately resorted to. The material while in a state of fermentation is subject to visitation from microorganisms which multiply rapidly in racks, cloths and pressure platforms. The pressing equipment should be dried or kept under water when not in use, otherwise objectionable flavors may be transmitted to the syrup.

The sweetening fluid is now ready for table and culinary use, for manufacturing candy and as a mixing syrup. Its beautiful color is brought forth by filtering, which may be accomplished by allowing the product to stand for a day or a sufficient period of time for insoluble salts to form. Then mix about three per cent of the weight of the syrup of what is chemically known as kieselsol and cold water adequate to easy filtration. The mixture is filtered cold as heating has a tendency to cause the concentrated salts to dissolve and make their appearance in the syrup. A plate-and-frame filter press will accomplish the job. If the raw potatoes are of first-rate quality objectionable flavors will not be present, otherwise off-flavors may appear. These can be removed by adding to the syrup somewhat diluted with water three per



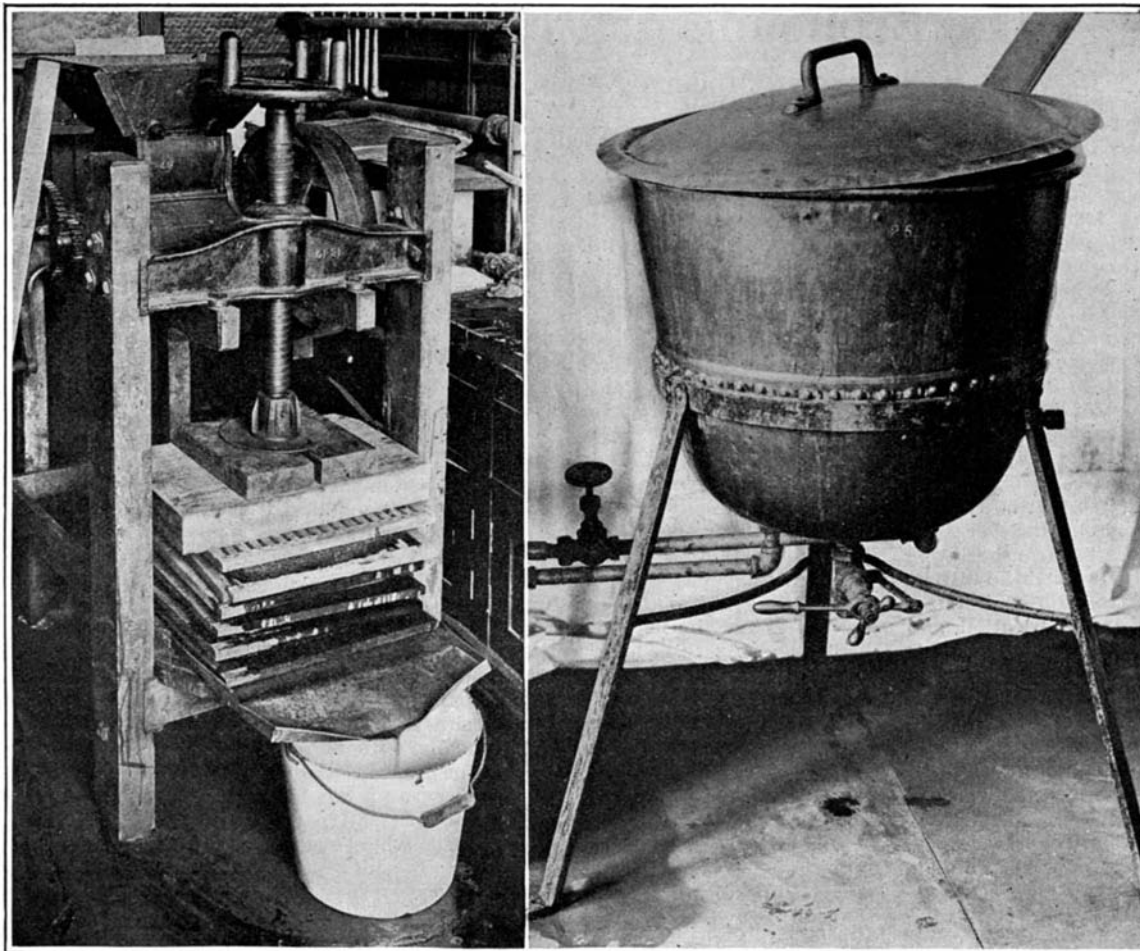
Sweet potatoes, ginger snaps and taffy are all improved by a dash of sweet potato syrup from the bottle

cent of its weight of powdered bone char or other decoloring carbon. The mixture is heated to boiling point, permitted to stand for several minutes and the char removed by filtration. The sweetened liquid is then evaporated to the necessary density.

The yield of syrup is equal to one-third of the weight of the potatoes entering into its composition. The cost of manufacture is relatively low, and the method of preparation in home and factory is comparatively simple. The final product is an amber-colored syrup possessing a distinctive flavor — not as sweet as maple or cane syrups, to be sure. The intensity of its sweetness, however, is sufficient for a multitude of uses. Then, too, the conversion of sweet potatoes into syrup offers a big possibility in the tuber-producing South, where markets are frequently far removed and storage facilities inadequate. All thanks to a chemical process of such transforming powers—an uncouth underground root becomes a table delicacy and contributes to the relish of gingersnaps and taffy! The various pieces of apparatus employed in extracting syrup from sweet potatoes are shown in the accompanying illustration, and one is immediately struck with the simplicity of this process. Indeed, it should come into pretty general use, not only in large sized commercial plants but on the small farm and in the home.

#### Effect of Gasoline Removal on Heat Value of Natural Gas

THE Bureau of Mines, in Technical Paper No. 253, presents details of an investigation to determine to what extent the general public and various official bodies have been justified in supposing that the removal of gasoline from natural gas greatly decreases the heating value of the latter. It has been found that in general this decrease in heating value has been overestimated. In the type of gas ordinarily supplied to the domestic consumer loss in heating power was found to be about 2 per cent after the removal of the gasoline vapor. As a rule gasoline vapor is usually accompanied by proportionate amounts of other constituents of high heating value, so that a gas high in gasoline is usually one of high heating value, even after the gasoline has been removed. Where casing head gas is involved the percentage of loss is larger, but only in rare instances does such gas reach the domestic consumer.



Left: Extracting the "wort" at high pressure. Right: Steam-jacketed copper kettle that serves for cooking the potatoes, as a mash tun, and as an evaporator

#### Apparatus for getting the biggest value out of the sweet potato

#### Puncture Plant Protection

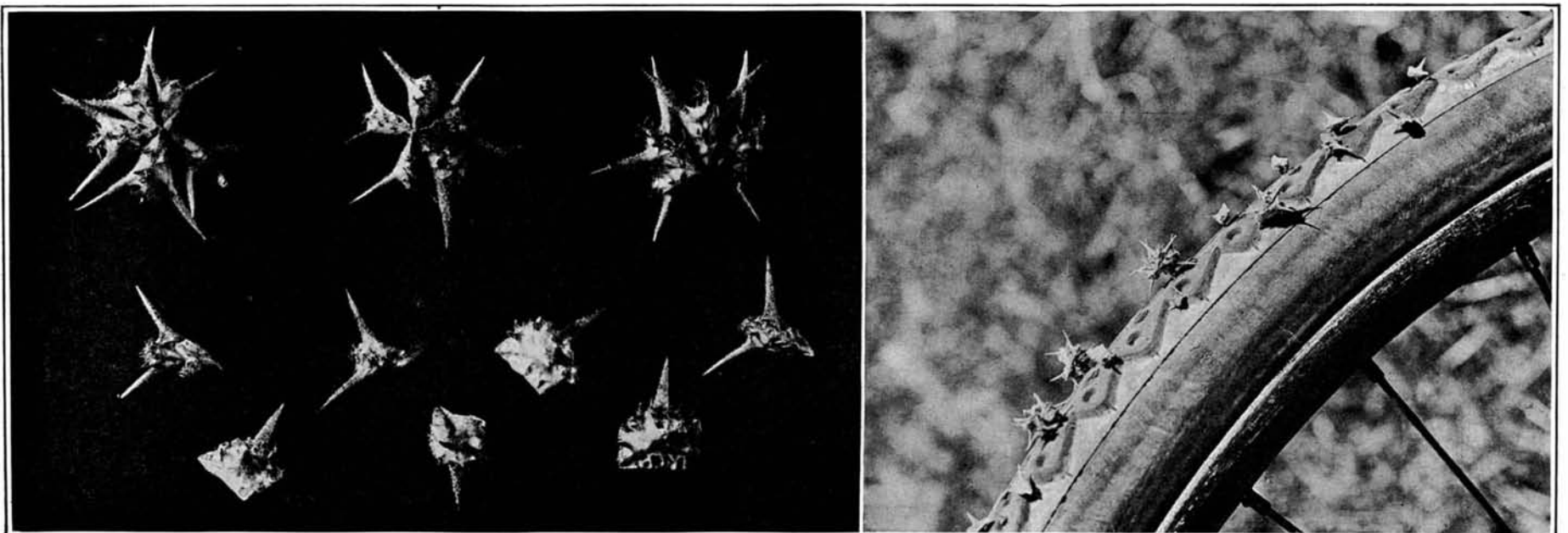
IF you can imagine a roadside sprinkled liberally with tacks and needles, all lying point-side upward, ready to spread discomfort and disaster among the touring motorists and bicyclists which pass that way, you will frame a good mental picture of actual conditions existent in sections of Arizona and California where the puncture plant has been introduced and acclimated. Scientifically this weed is known as *Tribulus Terrestris* probably because it spreads tribulation and terror among all owners of inflated-tire vehicles. It is a native of southern Europe and was introduced to this country in burs imbedded in the fleeces of imported sheep. When mature, the fruits, or burs, of the puncture plants split into 5 sections, each of which is equipped with a pair of sharp spines. These sections are scattered about over the ground in such a way that some of the points are always directed upward ready to penetrate and puncture any rubber tires which pass over them.

When the spiny needles of the puncture plant are embedded in automobile tires it is very difficult to locate and remove these destructive bayonets which repeatedly prick holes through different inner tubes

as they are inflated in the contaminated casing. The spiny seeds effect a double dose of damage inasmuch as they spread the infection to new sections which previously may have been unacquainted with the obnoxious plant. The seeds may be carried in automobile tires long distances and finally deposited by the roadside where they germinate and produce new plants. In addition, the seeds are disseminated widely by wind, rain, flood, spring freshet and snow. They often work their ways into the coats of market live stock or else the puncture weeds are harvested with market hay. Recently, in one way or another, seeds of the puncture plant have been introduced into Kansas, Arkansas, Texas, Nebraska, Iowa, Indiana, and Illinois, and at present the objectionable burs and spiny seeds are causing much havoc among the motorists of those regions. The possibilities for damage from this plant are well illustrated by the experiences of a California motorist who reported 70 punctures in one tire, all due to the puncture vine. In some sections where the puncture plant has become established, one-half of the bicycle tire and approximately one-quarter of the automobile tire punctures result from the spiny burs of this plant which are distributed along the waysides.

Fortunately, the puncture plant is an annual and on tillable ground, it can be controlled by repeated cultivation which prevents the formation of seed. Along the roadsides, where the weeds are most dangerous from the standpoint of the motorists, mowing has been resorted to unsuccessfully as an eradication expedient. The vines grow so low and spread so close to the ground that it is impossible to cut them off satisfactorily with the mower before they form seed. Furthermore, many of the plants which are clipped will subsequently produce burs and seed the same season. The national agricultural authorities are now testing out the effectiveness of iron sulfate and crude oil sprays for destroying the puncture plant. Potentially, they expect to perfect control measures which will minimize the motoring dangers due to the puncture plant, the unwelcome emigrant which reached our shores by stowaway methods.

The illustrations below give an excellent idea of the general appearance of the puncture plant's opening seeds and how they imbed themselves in the soft rubber surface of automobile and bicycle tires.



The puncture plant of Arizona and California, *tribulus terrestris*, and the way it works destruction upon the unsuspecting motorist