WATERCRESS CULTURE IN FRANCE.*

A PICTURESQUE INDUSTRY.

BY JACQUES BOYER.

THE watercress (*Nasturtium officinale*) grows spontaneously on the banks of shallow running streams. In former times the markets were supplied entirely with wild watercress, which was sometimes gathered at great distance, but this cruciferous plant, which possesses stimulating and blood-purifying properties, is now cultivated on a very large scale in the suburbs of large cities. This rather picturesque variety of gardening is conducted in trenches flooded with water,

into the third trench, and so on. The water thus pursues a serpentine course through the field, its flow being regulated by gates at each end of the course. Experience has proved that a trench 150 feet long and ten feet wide requires twelve or thirteen gallons of water per minute.

The plantation having once been established, some cultivators confine their attention to renewing it occasionally by cuttings. They select young, vigorous

thrown across the trench and holds his hand as low as possible, in order to prevent the seed being blown away or distributed irregularly by the wind. Each year, as a rule, half the beds are re-seeded.

Two weeks after sowing, when the young plants are well out of the ground, a small stream of water is admitted and the flow gradually and cautiously increased. At this time the importance of proper grading becomes evident, for if the trenches are not correctly graded

CUTTING AND BUNCHING WATERCRESS.

WASHING AND PACKING BUNCHES OF WATERCRESS.

A SMALL WATERCRESS BED.

WATERCRESS CULTURE IN FRANCE.

by a system which originated in the environs of Dresden and Erfurt, and was introduced into France about the year 1811.

The most celebrated watercress farms in France are situated near Provins, at the sources of the rivers Voulzie and Durteint, and at St. Gratien and its neighboring villages, near Paris. In establishing a plantation, the first operation is the excavation, in well-watered meadow land, of parallel trenches 150 to 250 feet long, eight to thirteen feet wide, with an average depth of sixteen or twenty inches, and a very gentle slope (1 to 800 or 1,000). Each trench is separated from the next by a strip of grass about a yard in width. The first trench is supplied with water directly from a stream or artesian well. On reaching the end of the trench the water flows through an underground tile pipe to the second trench, from the other end of which it flows through a similar pipe

shoots bearing adventitious roots and plant them in little bunches, with the dibber, in the trenches at intervals of from two to four inches. The earth is then heaped up about the shoots, and the trenches are flooded to a depth of two inches. The water level is gradually raised as the plants increase in height, great care being taken to avoid submerging the plants entirely.

But if abundant crops are desired it is better to sow watercress seed every year. The old plants are raked off and the mud is removed with an implement which is called a rabot, or plane, and consists of a board fixed transversely on the end of a pole. The dry bottom of the trench is next strewn with well-rooted stable manure, or with superphosphate of lime, each acre receiving about three tons of manure or nine hundred pounds of superphosphate. The beds are now ready for sowing. As the seed of watercress is very fine, an ounce containing more than 120,000 seeds and a grain more than 250, the sower stands on a board

the seedlings will be washed away from some places and accumulated in others. If the plants are distributed unevenly for this or other reasons it is a good plan to space them uniformly by transplanting five weeks after sowing.

Harvesting begins a month later, or within ten weeks of sowing, and continues throughout the year, except in the very cold weather, when the trenches are covered with straw to protect the plants from freezing. The harvester, wearing knee-guards to one of which a bundle of split osiers is attached by a strap, kneels on a stout plank laid across the trench and cuts the stalks, one by one, with a knife, following the direction of the current of water. As he gathers the plants he removes all dead leaves and forms the cresses into bunches, tied with osier, which he throws on the bank beside him. In spring a good harvester can gather 120 bunches in an hour, but in summer, when it is necessary to remove the flowers, he cannot accomplish quite so much, and in winter he is able to gather only about

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sixty bunches per hour. Even in winter, if the weather permits, the harvesters work from sunrise until three o'clock in the afternoon. In spring each trench can be cut once a fortnight, but an interval of twenty-five days is necessary in winter.

The bunches of watercress are carried in wheelbarrows to the washing shed, where they are again examined for defective leaves, washed in a large tank, and packed in oval baskets four feet high, each of which holds twenty dozen bunches. Each layer of bunches forms a single ring in contact with the side of the basket, leaving an open space in the center. Owing to this arrangement the cresses are not deprived of light and air during transit, and they reach their destination in good condition.

Fertilizers are applied to the beds after each cutting, and the roller is frequently drawn along the trenches for the purpose of rooting the plants in the soft mud. For the same purpose, and also in order to incorporate the fertilizer with the mud, the beds are beaten, after cutting and fertilizing, with a plank twelve inches wide and more than four feet long, attached perpendicularly to the end of a pole six feet in length. One of the photographs shows two men walking at the sides of the trench and performing this operation, which is peculiar to the culture of watercress. In winter a beater, with a perforated blade parallel to the handle, is used.

In large watercress farms it is customary to reserve the plants in one or more of the best trenches for seed, which is gathered in the latter part of June. Specialists in watercress distinguish two varieties, pale

and dark green. The pale cress is the favorite. It has larger leaves than the other variety, but is less robust and more easily killed by cold.

At Provins cutting is suspended from the middle of May to the middle of August. During the nine months of harvest a trench 230 feet long, seeded annually, yields about 12,000 bunches.

Watercress can be raised on a small scale, for family use, without this elaborate system of trenches and without having a brook or an artesian well. It is merely necessary to dig a shallow pit in a well-shaded spot or on the north side of a hill, and to fill it with water. It is advisable, but not absolutely necessary, to cover the water with osier mats or wood netting. Cuttings of watercress are then strewn over the surface of the water. They soon take root and grow, and in three weeks the cress is ready for use. It is not necessary to provide a continual supply of fresh water, but the pit must be kept full of water and fertilizers should be strewn over it every three weeks. In this way an ample supply of watercress for a family can be obtained almost without expense. In cutting it is advisable to select the tallest plants, or some of those that are most crowded, thus admitting light and air to those which are left.

Another simple method of culture is recommended by Vilmorin-Andriaux. A trench ten inches deep, three feet wide, and of any length is excavated, preferably on the northern slope of a hill. The bottom of the trench is hardened by treading, and covered with a layer of rich soil mixed with leaf mold or compost, which is gently pressed into a concave form.

The bed is watered copiously, allowed to dry, and sown, the seed being lightly covered with leaf mold applied with a sieve. The bed must be kept moist and a little leaf mold should be applied after each cutting. In this, as in all methods of culture, all weeds should be removed with the rake or by hand, and the plants should occasionally be entirely submerged for a few days, or sprinkled very copiously, in order to destroy insect enemies.

Watercress culture, in fact, save on a large scale, offers little difficulty and affords a crop readily grown and always available for table use. Its extensive cultivation calls for a somewhat considerable outlay, and some care must be taken to obtain the best results; but even in its most developed form it has few complications, and the crop yields are always ample.

In the towns mentioned it forms, as I have stated, a distinctive industry, a circumstance often observable in France, where the localization of industries, especially of farm or outdoor industries, are often highly developed and specialized in certain localities. The average visitor to Provins may well have an enjoyable time at this ancient town without so much as gaining any notion of the existence of the watercress industry or even so much as seeing it. Provins is, in truth, a place of the deepest interest. It is but ninety-five kilometers from Paris, and hence is within easy reach of the French capital. It consists of an old and new town, the former of which still retains the physiognomy of the Middle Ages, with most of its ancient walls and many old buildings of great historic importance.

FIRE-RESISTING BUILDING MATERIALS.

A STUDY OF THEIR QUALITIES.

A BULLETIN describing the fire-resistive qualities of building materials will be issued within a short time by the United States Geological Survey, through its Technologic Branch. Various materials used in building were subjected to the direct application of heat for two hours, in the laboratories of the National Board of Fire Underwriters, in Chicago, the temperature reaching that of a conflagration. After being exposed to the fire, the materials were withdrawn from the furnace and quenched with water, in order to get the conditions that would obtain after the firemen had begun their work on a burning building.

The investigations, which were conducted under the direction of Richard L. Humphrey, engineer in charge of the structural materials laboratory of the Survey, are the first of a comprehensive series undertaken with the object of determining the fire-resistive properties and rates of heat conductivity of various building materials and the comparative efficiency of the various methods of fireproofing. The investigations have the further object of greatly lessening the liability of loss by fire in government buildings, which are not insured, and greatly reducing their cost through more efficient methods of construction. While the tests are conducted primarily for the purpose of obtaining information of essential value to the government, it is believed that the results will prove of much importance to the public.

Mr. Humphrey in his bulletin gives the following caution: "Inasmuch as the tests herein recorded present many features of considerable importance, it has been deemed highly desirable to publish a detailed account of them, although the results are preliminary and inconclusive, and are presented solely for the purpose of making public the information acquired. They should not therefore be used as a basis for making conclusions, but merely as preliminary data regarding the relative fire-resistive qualities of the building material tested."

Regarding the tests themselves, Mr. Humphrey says: "The conditions under which these tests were made were unusually severe and none of the materials passed perfectly. The temperatures used would hardly be reached in an ordinary fire.

"Much of the damage done to the building materials in this series of tests was occasioned by internal stresses, the gas flame of the furnace heating one face of the test pieces much more rapidly than the other. All the materials tested, including the hydraulic-pressed brick, cracked more or less. The concrete cracked least, but the tests indicate the necessity for using metal reinforcement in concrete walls to distribute the effect of the expansion.

"The fact brought out most clearly by these tests is the low rate of heat transmission of Portland cement concretes and mortars. This is one of the desirable qualities in buildings intended for fireproofing purposes. For marking the cement blocks, linen tags were fastened by wire nails to the interior walls at the time of molding. Most of these tags remained

in place during the test, and when the walls were demolished, the tags in every case were found entirely undamaged.

"An average of all the tests shows that about 90 per cent of the maximum temperature attained by the faces of the panels was reached in one hour, while in the case of the mortar blocks the increase in temperature of the backs of the panels in one hour was only about 20 per cent of the total increase in the two hours. Of the solid concrete panels, the cinder concrete showed the smallest increase in the temperature of the backs of the walls, and the granite concrete the largest. The total increase in the temperatures of the mortar panels was about the same as the total increase in the temperatures of the backs of the concrete, but the increase in one hour was somewhat greater in the case of concrete.

"The damage done to the faces of the mortar and concrete panels would probably be caused at a temperature about half that of the maximum temperatures reached, owing to the water of crystallization being driven from the mortar. This thin layer of dehydrated mortar may have formed a protective coating and prevented dehydration.

"The backs of the brick panels also showed a small increase in temperature, but the natural building stones and tiles proved poorer non-conductors of heat.

"It is apparent that the strength of the webs of ordinary hollow blocks is insufficient to resist the stresses set up in these tests, as in many tests the rapid rise in temperature and the subsequent quenching of one of the faces of the blocks caused the webs to split. It was noticeable that the richer the mortars used in these blocks the better they withstood the tests. The amount of water used in mixing the mortars had a similar effect on the fire-resistive qualities; the mortars mixed with the greatest percentage of water gave the best results.

"When the blocks were cracked or spalled before the application of water the damage appeared to be greater in the dry mixtures containing the greatest percentage of sand, and it was further observed during the fire test that the richer mixtures warmed up more slowly than the others. It is apparent that one of the causes of weakness in the cement hollow building blocks under these fire tests was the weakness of the concrete, a too dry and lean mixture, which, coupled with the thinness of the webs, provided insufficient strength to resist the stress due to the rapid expansion of the face. It is quite possible, as was shown in some of the block tests, to make blocks which will pass the conditions perfectly; the web must be thick enough to give the necessary strength.

"The brick panels probably withstood the tests better than the other materials. The common brick tested comprised unused new Chicago brick, and used St. Louis brick. Fifty per cent of the new bricks were split, while sixty to seventy per cent of the old bricks were not damaged. Lime knots seemed to be

responsible for most of the damage to the new bricks, as they were found at the bottom of nearly all the cracks. The bricks at the back of the panels were entirely unaffected. While the strength tests are not conclusive there is apparently little difference in the strength of the bricks before and after firing.

"The hydraulic-pressed brick withstood the test very well. No damage was apparent after the firing and before the water was applied, and although a number of the bricks cracked, seventy per cent of them were found to be sound after quenching.

"The sand-lime brick did not withstand the test as well as expected, but the sample tested, which was purchased at random, appeared to be somewhat below average quality.

"The concrete behaved remarkably well and it was difficult to determine whether the limestone, granite, gravel, or cinder concrete sustained the least damage. The faces of all the panels were more or less pitted by the fire and washed away by the stream of water. The test was unfair to the cinder concrete as the cinder was very poor, containing a large percentage of unburned coal; however, the sample selected was the best of six or eight investigated in St. Louis. During the fire test the coal ignited and left the surface of the concrete very rough and badly pitted. The limestone aggregate in the face calcined, and the granite aggregate split and broke away from the surface mortar. The granite concrete probably behaved better than any of the above-mentioned concretes. Damage in no case extended deeply, probably not more than 1½ inches. The evidence shows that even at this depth the temperature was comparatively low. The high stresses produced in the panels by the rapid rise of the temperatures of the faces, while the backs remained cool, caused cracks. On taking down the panels the blocks of concrete were found to be cracked vertically for some distance from the face. The serious damage done the various natural building stones precludes any comparison among them.

"The tile tested was bought in the open market and in one panel was taken from a lot of material about to be erected in a building. A large percentage of the faces of the tiles were washed away by the water, and the material composing the faces became soft and could easily be crumbled in the fingers. There was a comparatively rapid rise in the temperature of the backs of the panels. The plaster on the partition panel tile fell off a few minutes after the test was started."

Metallic calcium dissolves in absolute alcohol, producing calcium ethoxide, $(C_2H_5O)_2Ca$, which forms crystals containing 2 molecules of alcohol of crystallization. Calcium hydride acts upon alcohol in an analogous manner. Calcium may also be substituted for sodium in the synthesis of acetic acid esters and similar compounds. With other alcohols than ethyl alcohol the results obtained are less satisfactory.

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PRESSING DOWN THE ROOTS WHICH HAVE BEEN LOOSENED IN HARVESTING.

A WATERCRESS PLANTATION.

WATERCRESS CULTURE IN FRANCE.—[SEE PAGE 377.]