The Real Dry-Farmer

BY J. RUSSELL SMITH

Professor of Industry, University of Pennsylvania

Harper's Magazine
May 1914, page 841

One of the greatest and most triumphant agricultural booms in the world is to be found in Africa—the dry-land farming of central Tunis, where the rainfall is less than ten inches. This success is astonishing in the face of the uncertainty, dread, and failure that harass our own as yet unadjusted dry-land agriculture. As an evidence of local failure I would cite the observations of an agricultural scientist on a recent ninety-mile journey in the southern part of the Great Plains, where the rainfall averages twenty inches. In the ninety miles traversed there was but one surviving settler and not even a cattle-ranch. The dry farmers had pushed out the cattlemen, and the recent droughts had pushed out the dry farmers—all but one—in a strip as long as from New York to Philadelphia. Our uncertainties arise under a rainfall of ten to twenty inches. The African's complacency is assured by less than ten inches. Subscriptions have recently been taken up for people living in an average rainfall of sixteen to eighteen inches. Where Simpson failed the average is seventeen inches. Yet the complacent success of Tunis is in the vicinity of Sfax, where in seven consecutive years the total rainfall amounted to forty-one inches—five and eight-tenths per year.

The Tunisian rain is a winter rain, which is the best kind for dry farming, but beyond that there are not many extenuating circumstances in the climate. It is so near the Sahara that it is a thorny camel-pasture, and the frequent siroccos of the summer season are fearful driers. There are no permanent streams. The Tunisian success depends upon the fact that the Arabs long ago worked out to a finish the dust-mulch practice (which we recently "discovered" with such a hurrah), and, further, they and their French copyists have applied it to a crop that suits the environment: olives—*a tree crop*.

The Sfax dry-farming boom is an olive boom.

I rode out of Sfax in three directions,—twelve miles, seventeen miles, and eighteen miles, respectively, and always in olive-orchards. They lined the road on both sides. Near the town they were from forty to eighty years old. Farther out the trees were younger, and the new plantations are still spreading. I rode one hundred miles to the south, and at the end of the journey the gray-green of the olive-trees was still to be seen. Although most of the intervening distance was bare of them, there were enough plantations *en route* to show that it was all olive ground. I passed groups of tenting Arabs on their camels, saw their camps set back a safe distance from the good French road, and their invaluable "ships of the desert" browsing on the scattering thorn-bushes. Here was the life that had for ages prevailed on the edge of the Old World deserts. The nomad in his tents of camel's hair pauses awhile where the browsing is good, then, packing his chattels, his children, and his wives on the camels, he follows his flock where fancy (and browsing) dictate. Passing these ancient scenes, it was almost uncanny to come suddenly upon a two-thousand-acre plantation of healthy young olive-trees stretching away across the well-tilled plain as far as the eye could see.

In one direction, I was told, the

plantings extend almost solidly for one hundred miles. The seven years with the combined rainfall of forty-one inches seem to have had no bad effect on the boom or on the trees. The plantings would be much more extensive than they are if it were not for the fact that the government fears that plantings will exceed labor supplies, and will not, at present, release any more of the camel-range for olive-planting. The government is actually going out and destroying young olive-plantations of the Arabs. This happens because the lands in question were set apart by treaty for the tribal use of the tenting Arab. His use consists in tenting where he pleases, pasturing where he pleases, and planting a patch of barley where he pleases. If he can plant barley, he reasons that he can also plant olives, even if the trees will live a thousand years with care. But the government thinks differently, tears up his trees, and restores the land to the primeval uses prescribed by treaty. This desire of the tenting Arab to settle down where he can be secure (the French give security) is interesting, and the willingness of this hundred-generation nomad to plant trees and wait fifteen years for profits is surprising.

It is the universal practice in this region to water the young tree three times a summer for three summers, and to plant barley in the young orchard for about six winters. Then comes clean culture—the dry-farming dust mulch. The tree begins to bear at six and seven years, but the income is not expected to meet expenses until the trees are fifteen or twenty years old. "The man who plants the olive does not get the profit," they say in Tunis; but it is astonishing how widely they plant them, nevertheless. Here, as elsewhere, the olive has a habit of bearing a big crop one year and a light crop the next, in which it greatly resembles the fallow-year-wheat-year combination of American dry-farming.

AGRICULTURE IN NORTHERN ALGERIA

The five-foot wild olive-bush behind the blanket has an eight-foot exposure of a root nearly an inch thick

This land has almost no value as pasture, and when the government releases it it is virtually given away; but at twenty-five years of age the seven or ten olive-trees that are on an acre increase its value to $100 or $150. If well cared for, the average yield is from 800 to 1,100 pounds of olives, worth, at the present price, from fourteen to twenty dollars to the grower. The gathering of the crop requires from four to six days—Arab days' work—per acre. The oil yield is thirty or thirty-three per cent. of the weight of the olives.

AN ARAB AND HIS DRY-FARMING APPARATUS

The plow cuts the roots of all plants just below the surface

Among intelligent Tunisians there is no discussion as to which is more certain, a tree crop or a grain crop. They *know* that they cannot depend on grain. It is authoritatively stated that in one locality even more arid than Sfax the barley gives in ten years two good crops, three mediocre crops, and five failures, while the olive gives in three years one good crop, one mediocre crop, and one failure — a sixty-per-cent. crop advantage in favor of the olive, with less work. This is on the very edge of the Sahara, where the natives have been growing olives for unknown centuries—probably for two thousand years, and it may be longer than that.

Why does the tree crop beat the grain crop in the great fight for scanty water? There are many reasons, and good ones. If, as Napoleon said, victory goes to the army with the heaviest artillery, the water will certainly go to the plant with the longest roots.

The sensation of a dry-farming congress at Colorado Springs was a wheat plant with a root system six feet long, carefully washed out of the earth in which it had grown. Mr. E. C. Chilcott, in charge of dry-land farming investigations for the United States Department of Agriculture, affirms, in a rather venturesome way, that this is the average length of wheat roots. Dr. Warren shows that the soils of Nebraska are mostly clear of rocks as far down as the water-level, which is commonly from one to two hundred feet, occasionally more on the high plains. Here is a vast open soil mass with precious water at the bottom of it, and we are trifling around the top six feet with wheat roots. Monsieur Trabut, Government Botanist of Algeria, in speaking of the deep-rooting habits of trees, has told me that in a newly dug well he had seen the roots of a carob-tree sixty feet below the surface. The carob fed John the Baptist, the Prodigal Son, and the Scriptural swine. Its nutritive value is undiminished. From that day to this the carob bean has been a regular crop in the drier Mediterranean lands, because it is an avid searcher after water, and one of the best crops for arid, unirrigable lands. In Portugal, Spain, North Africa, and many other Mediterranean lands it is still feeding the pig, the donkey, the horse, the man, and it is surprising to find how many Americans have eaten St. John's bread in our Eastern cities, where it is often to be had on fruit-stands.

It is the general opinion in Sfax that

the olive there is a shallow rooter. Studies of the olive-trees of the Colorado Desert, California, conclusively show that this is the case there. It would be a foolish tree that would send its roots into a bone-dry subsoil such as exists beneath many deserts. The desert tree, particularly the olive-tree, adjusts itself to this environment by developing surface roots that spread over a great area with a network of feeding rootlets ready to seize and hold the slightest shower that moistens the dust. Twenty-year-old olive-trees in the Colorado Desert showed root areas seven to nine times as great as the areas covered by the spread of the branches.

Along with this the olive, like other desert plants, has developed an almost marvelous power of water storage, so that last year's rain is really the important thing for this year's crop.

A plantation of crop-yielding trees is like a standing army. Call this army to duty, and it can come. Give the trees the duty call of a shower of rain to catch and use, and they are ready for it with outspreading and deep-reaching roots to suck it up and store it. The grains are like a volunteer force. Call the volunteers. They are brave enough, but they must spend some months in drilling before they are of any value, and then the need may be over. Call the grain crops to duty and they spend some months making straw. Then if there is enough water left they will make grain. But the dry farmer often finds that there is no water left, and crop failure follows.

The grains, short-lived and fast-growing, must rear their structure and then make fruit, but the tree once reared is in a position to use its resources for crop production. This is a great advantage. The passing whims of the weather have far less influence on trees than on grain. The making of a corn crop resembles a toboggan slide. The plant gets itself ready, and then at a critical moment in July it shoots upward so fast that you can at times literally hear it grow. If there happens to be no good moisture supply on hand when this rush is due, there isn't any rush, and is there any harvest? It is the July rain that makes the corn crop, for the plant has a quick, short, crisis when it requires water. Other grains resemble it in their dependence upon the conditions of a short critical period, and a rainfall whose figures total up very respectably may make crop failures by six-week droughts. These short spasms of drought are far less destructive to the tree crop than to the grain

A CAROB ORCHARD IN VALENCIA, SPAIN

crop. The tree breaks into flower with the bud formed last year, sends up from its roots the energy stored last year, and when a six weeks' drought comes it is searching for water far down in the subsoil twenty or thirty feet below the wheat roots, or it is drawing nutriment from the storehouse of its roots, which often have several times the volume of the top.

One great factor of especial interest to the believers in dry farming yet remains to be considered; that is the absolute perfection with which the tree crop fits into the theory and practice of dry farming. The heart of the system is the moisture-saving earth mulch, made by keeping the ground cultivated. This is impossible when wheat or other scattered grain covers the ground, but very easy with tree crops, because the cultivator can go right up to the tree trunks at any and all times. The Tunisian Arabs and their pupils, the Tunisian French, practise this to perfection, and it is doubtless one of the main reasons why the tree crop is more certain than the grain crop and has survived a seven-year period of six-inch rainfall with almost tropic heat.

When the earth mulch keeps the water in the ground, the tree crop can be adjusted to the amount that is there. Thus the Sfax Arabs long ago found that seven to ten olive-trees per acre could use all the water there was and make as many olives as fifty trees or one hundred trees.

Those are some of the reasons why the dry farmers of Sfax are contentedly extending their plantings in a region of such aridity that we would omit it from our calculations of usable land. In this country dry farming has failed with disheartening frequency on large areas with greater rainfall than that of Sfax, and yet vaster areas with similar rainfall still remain an unchallenged scanty pasturage as the wastes of Sfax were for a thousand years preceding the recent awakening.

The lesson for the American lands of scanty rainfall seems plain. Develop at once a set of crop-yielding trees, so that every dry farmer can increase his chances by trying at least two of them. I do not venture to say what these tree crops should be. That is a question for the experiment stations to determine in the light of the ever-varying local conditions. I do, however, feel qualified to indicate a few probabilities.

On the western and southwestern edges of our arid belt we have rainfall distribution and temperature conditions resembling those of Sfax. The olive-tree thrives in considerable areas of the Southwest. Thrifty groves are to be found in western Texas, Arizona, and California as far up as San Francisco. It is quite possible that our plant-breeders can improve upon the variety of dry-land olive that the Arabs of Tunis inherited from the Romans, and which the Department of Agriculture has introduced into the United States. Mr. Frank Meyer, plant-explorer of the department, has recently sent cuttings of an olive-tree in Crimea that survived 2° F. when all its companions froze. This suggests the possibility of northward extension of the olive territory. The recent tripling of the price of olive-oil, and the rising price of meat and butter, indicate a field for the development of an olive-oil industry here. The labor of picking and handling the crop would certainly be reduced if we could get a hardy olive as large as one recently reported from South Africa, two or three times as large as those commonly grown. There is good reason to believe that agricultural scientists can develop satisfactory olives that will thrive on now virtually unused land, and that would enable us easily to duplicate the olive crop of the rest of the world—if we set out to do it.

Some astonishing evidence has recently come from our own arid Southwest. About twenty years ago there were some olive-plantations made on irrigated lands in districts that may properly be called desert. After the orchards were established, a failure of the irrigation supply led to abandonment. The cottonwood shade trees and the other fruit trees perished, but the olive has lived and thrived for a number of years on the natural rainfall of 8.11 inches per year at Phœnix and 6.88 inches at Casa Grande, Arizona.

These trees have lived in a veritable flood in comparison with a grove that

was abandoned at Palm Springs, California, in 1900. This place lies in the Colorado Desert to the east of the San Jacinto Mountains. The annual precipitation "is a scant 3½ inches, with a total of only 0.70 inches for 1905, and a maximum of 9.36 inches for 1905." The 0.70-inch rainfall of 1903 fell in March. It was followed by twelve rainless months and preceded by ten months with a total of 1.40 in November and December, making twenty-three months, including two desert summers with a total rainfall of 2.10 inches. "Scant as this rainfall is, nearly all of it occurs in the six months from October to March, inclusive. During the six summer months, when a temperature of 100° F. is reached almost daily, there is scarcely a trace of rain. That any vegetation should be able to pass through this terrible ordeal of heat and drought seems beyond belief to one accustomed to the plant growths of regions having abundant rainfall; yet many species of shrubs and three species of trees are native in these hot sands."

The twenty acres of olives abandoned there have lived and grown somewhat in competition with desert shrubs on their own ground—sandy ground at that. For four consecutive years—from 1901 to 1904—the rainfall was 2.09 inches, 3.50 inches, 2.90 inches, 0.70 inches. Nor could the trees depend on subsoil waters, for the digging of an eighty-foot well found only dry cobblestone and gravel. While these trees had survived and bloomed, they had not fruited, but a very little irrigation produced a crop on others near by. The desert temperature of 120–122° F. seemed not to interfere at all. As all this was done by varieties of olives from regions of twenty-inch rainfall in Europe, there is hope of the results that may be obtained with care from the African varieties.

But the dry farmer, especially in the Great Plains region, should be essentially a live-stock farmer, and crops that fit into this scheme are particularly welcome. The mulberry is one of the most fruitful trees man has yet found, and the delight with which pigs and poultry devour the sugary and nutritious fruit would gladden the heart of any agriculturist. In Carolina the farmers say that a mulberry-tree will feed a pig for two months and make him fat. Then there is the honey locust. That hardy and thoroughly acclimatized tree belongs botanically and economically with the mesquite, and both of them belong with the carob. The carob bean, as has been pointed out, is an important crop in the Mediterranean countries, and the American and British farmers pay several cents a pound for it in various patent stock-foods. The carob, mesquite, and honey locust are alike in being legumes, bearing crops of large beans in which nitrogenous seeds are packed in sugary pulp. The name "honey locust" did not come by chance. The analyses of these three beans are strikingly alike, and show surprising values in comparison with standard stock-foods. They compare as follows:

	Protein	*Nitrogen free extract*	*Crude fiber*	*Fat*
Carob	6.6	59.5	8.7	0.5
Mesquite	10.3	54.7	28.9	0.7
Honey locust	4.5	69.9	14.5	2.2
Corn meal	9.2	68.7	1.9	3.8
Wheat bran	15.4	53.9	9.0	4.0

These high analyses make it clear why the Algerian farmers have recently got more than a cent a pound for their carob beans, and why the mesquite meal of Hawaii brings twenty-five dollars per ton as food for dairy cows and cavalry horses.

The mesquite has been an important source of animal food for ages. As a Texas farmer puts it: "I have mesquite in my pastures, and value a crop of beans very highly. A good bean crop means fat stock." Every cattleman of the Southwest recognizes the value of mesquite; but none of them ever planted it, because it grows wild and none of them knows what an acre of it yields because he never took the pains to find out. He probably has no solid acre of the trees, anyway, and to determine just what an acre yields is a scientific task at best—an experiment-station task, in fact, particularly when the product is gathered and eaten by browsing animals. Years ago a New Mexico station botanist of vision pointed out the virtues of mesquite and the need of developing it, but the money for the work has not been forthcoming.

There is no more reason why the American farmers should raise wild scrub mesquite than that they should raise wild scrub apples, and it is probably a great mistake for many of them to be bothering with grain when they have at their disposal such a water-hunting, nitrogenous food-factory, already adjusted by nature for the work.

The mesquite is at home in half a million square miles in the Southwest, and the honey locust will grow on a few hundred thousand square miles to the north of the present mesquite limits, and a million square miles eastward to the Great Lakes and the Atlantic. Accurate information about the fruiting habits of the tree is scarce. No one seems to have considered it worthy of attention. I know that cattle eat the beans greedily, and that farmers in many Eastern localities aver that it bears regularly. I have been specifically and reliably informed that a door-yard tree in Maryland has borne six consecutive heavy crops estimated at twenty bushels each. I had eleven two-bushel sacks filled under a tree that I saw in Virginia in 1912. They weighed three hundred pounds, being very bulky. A farmer in Kansas tells me that he has secured four hundred pounds from one tree. If that is the best tree in America, it is a marvelous chance. A wild tree—one of the best of timber trees—that will throw down three or four dollars' worth of cow feed is worthy of the most respectful consideration from agriculturists. Thus far it has been neglected, while attention has been bestowed upon its inferiors.

The Arab has worked out his system and won industrial contentment through his tree crop on the edge of the Desert with a rainfall of less than ten inches. May we not, by taking thought, win a similar agricultural stability in our vast areas of low rainfall where we still pray for rain and take up subscriptions for the industrially unadjusted?

I have mentioned three crop trees for the American dry-farm scientists. I mention them to prove a point, not to make a list. The botanic resources of this and other countries, as reported by plant-explorers and plant-breeders, indicate that there are many, possibly dozens, of trees that should at once become the subject of experiment. I submit that the development of tree crops is an urgent matter to which practically every agricultural experiment station in America should devote a part of its energies. This requires appropriations and the labors of patient men.