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Dry-Land Farming

Jerry L. Williams
University of New Mexico

DRY-LAND FARMING

Dry-land farming is a system of land use, crop management, and timing of operations that are designed to cope with the conditions of climate and rainfall of a semiarid land. Experiments began on dry-land techniques as early as the 1860's and the methods became well-known in the Great Plains by the end of the 1880's.[1] A major component of dry farming, which is a term (along with dry-land farming) of western American origin, is the conservation of soil moisture during dry weather by special methods of tillage and plant adaptation. It is not farming without moisture, but farming where moisture is insufficient: often permitting agriculture to be practiced successfully in areas where rainfall is less than ten to twelve inches.[2] The methods used in a dry-land system were necessary to sustain the farming practice in areas where rainfall ranged from as low as ten to as high as thirty inches. As the annual rainfall in the region studied for this report varied from twelve to sixteen inches between 1951 and 1980[3], a period that climatologists believe to be similar to the period when homesteading occurred, the northeast was in a zone that required particular attention to proper application of and attention to dry farming methods. It appears that a requirement for settling in northeastern New Mexico and to sustain a livlihood in dry-land agriculture would have been to have a background in farming with some knowledge of dry farming methods. Many homesteaders who moved into the area from the other Great Plains states (Kansas, Oklahoma, and Texas) from 1905 to 1915 had been farmers or had worked on farms and were knowledgable of ways to conserve soil moisture. However, many others came from the Southeastern and Appalachian states, from the Great Lakes area, and from Eastern states such as Pennsylvania and New York. Others migrated in from mining camps of Colorado and New Mexico. It fell upon these non-farmers and people who had never lived in low rainfall areas to quickly learn about the scientific agricultural systems associated with dry farming in order to survive on the land.

The person credited with being the father of "scientific dryland farming" was Hardy W. Campbell, a Great Plains farmer who researched and wrote about moisture conserving techniques based on methods that had been studied and practiced in Europe over a century earlier.[4] Campbell moved from Vermont to South Dakota in 1879 and experienced a complete wheat crop failure in 1883 following an 1882 bumper harvest.[5] This failure drew his attention to the hazards of farming in a semiarid environment, and, following extensive

scientific research on the problems, he developed two manuscripts on the subject in the 1890's. His ideas became the accepted theory of the Department of Agriculture, which in turn supported continuing research at extension experimental stations throughout the semi-arid region of the West and expanded the farmers knowledge of how to respond to conditions of local climates.[6]

Campbell's ideas were based on the belief that moisture had to be stored in the soil. He did not view the problem as a lack of rainfall as much as an excessive loss of moisture through evaporation.[7] The evaporation is caused by the capillarity action of water in the soil. As the sun and wind dry out the surface layers of soil, water from the deeper soil areas rises toward the surface to replace it.[8] The dry-farmer had to design a technique that would draw deep soil moisture to root level, then hold it there and prevent it from evaporating.

Campbell wrote of ways to conserve moisture through proper cultivation using a dust-mulch plowing system followed by alternate fallowing. His early ideas were often erroneous and unsuited to the Great Plains environment. His mulch crust sometimes produced an impervious barrier to moisture penetration and to replacement of deep soil storage. The mulch crust did not prove to reduce evaporation and in times of drought and wind the mulch process exposed the fields to excessive dust erosion. The techniques were improved upon, with much of the corrective surgery being done by Campbell himself. By 1910 there was ample literature from a wide-range of research on methods of conserving soil moisture ~~with~~ the most notable study being by E.C.Chilcott on cultivation methods and crop rotations for the Plains.[9]

There are four major parts to the tillage and cropping methods of the soil-moisture conservation system. The first is that tillage practices no longer encouraged plowing. The method now focused on cultivation that encouraged moisture penetration by simply loosening the surface soil, which would allow rainfall to move through the lower layers immediately. Dragging to remove weeds was encouraged as weeds were viewed as an immediate transfer system of ground moisture to the air through evapotranspiration. Stubble from crops was no longer turned over, but was allowed to stand. Often, to encourage water absorption, a farmer would drag his field following the first Spring rains to break the surface crust into a lumpy surface that would absorb the later rains.[10] Of course when such a method was employed, the farmer would

hope the rains came instead of the wind. This whole method of shallow tillage and dragging brought about an entirely new line of farm equipment suited to the Great Plains. Plows with such brand names as the 'Noble Blade' and the'Graham Hoeme' were developed which did not have a moldboard and did not turn over the soil.[11]

The second major innovation for semi-arid climates was summer fallowing. The major purpose of this practice was to accumulate a year or two of moisture in the soil to recharge the deeper soil reservoirs. The fallow period was also designed to allow the farmer to conduct extensive weed and weed seed removal operations. To summer fallow would require the farmer to have sufficient land to enable him to practice a field rotation and to maintain a pasture space for his livestock, without causing a decline in his production. This concept frequently encouraged the farmer to plow more acreage than he expected to plant in a single year as the fallow land was also stirred on the surface to aid in the collection of rain water.[12] The result was an extensive area of exposed land, the fields to be planted and the fields to be fallow, that would be the most likely to erode if the anticipated precipitation failed to show up.

The third main practice was the maintenance of stubble from the previous crop. The stubble, which was called "trashy fallow", was an aid in snow stabilization, moisture penetration, and as a soil binder against wind erosion. The practice of stripping the land, which was introduced to the farmers, involved alternating narrow strips of fallow stubble and crop land at right angles to prevailing winds.[13] This would hold much of the soil in place under the most severe wind conditions. The last wind erosion practice to be introduced to dry-land farmers was the intermittent contour ridging of the soil (counter to the wind direction) with a lister, which was a machine adapted for ridging. The ridges would create an artificial wind break as well as a surface runoff collector system.

The fourth practice was the utilization of drought resistant crops. Among them were winter wheats and special sorghums: crops which did extremelly well in northeastern New Mexico. The proper crop was as important as the tillage and fallow techniques. The Mennonites who migrated to the Plains from Russia brought their homeland seed varieties of wheat and grains...varieties which produced a much higher yield than the seeds brought from the humid areas of the United States. Niels Hanson, who served as head of the horticultural

department at South Dakota State University from 1905 to 1937, was the first to recognize the value of these imported seeds. He made eight trips (the first in 1897) to Russia, Siberia, China, Turkestan, and North Africa collecting and researching drought-resistant crops and seeds.[14] He had introduced an entire series of wheats and clovers, as well as species of fruit trees (cherry, pear, apricot), to the Plains farmers by the end of the first decade fo the twentieth century. His work also led to the later introduction of winter wheat varieties and early sorghums which would mature before the possibility of a summer drought. According to Webb in The Great Plains, the most famous varieties introduced were the Red Fife hard spring wheat from Russia, winter wheats from the Crimea, and special series of oats, ryes, barley, and corn from North Africa and China.[15]

It appeared that the basic planting considerations for semiarid cropping included early maturation and plants that would adjust to fluctuations in the precipitation and in the growing season. The plants would require strong stems for wind and hail resistance, flexible root structure which would draw from both shallow and deep soils, and the ability to sustain life through prolonged periods of dormancy.[15] These crops did include most of the wheats and millets raised by the homesteaders as well as the fodder crops such as broom corn, kaffir corn, and milo maize. The recommendations did not include pinto beans, which were introduced from the Rio Grande basin by the immigrants from the west who settled along the alluvial floodplains on the canyon bottoms.

The beans on the plains became the major cash crop during the years of abundant rainfall, replacing many of the lower valued (but greater suited) crops and altering many of the methods of cultivation. As most interviewed farmers admitted, the change to beans was one of the greatest errors of the dry-land farmers in the northeast. However, as the farmer was attempting to provide the best living for his family, he saw little alternative but to maximize his cash return on the land. We shall see later that this maximum return contributed to the termination of production and the eventual decline of dry-land farming in northeastern New Mexico.

[1]Kraenzel, The Great Plains in Transition, p. 309

[2]Webb, The Great Plains, p.367

[3]From a report by Iven Bennett for the 2nd Edition of New Mexico in Maps (edited by J L Williams) on precipation in New Mexico. University of New Mexico Press, 1986.

[4]In 1731 Jethro Tull had published a book in England on horse-hoeing tillage which described how tillage practices can be a method of manuring a field. (See Webb, The Great Plains, p. 367).

[5]Kraenzel, The Great Plains, p.309

[6]His best known work was the Soil Culture Manual, published by his own company in Lincoln ,Nebraska, in 1909.

[7]Paul Bonnifield, The Dust Bowl: Men, Dirt, and Depression, pp. 40-41.

[8]Webb, The Great Plains, pp.370-371.

[9]Kraenzel, The Great Plains, p.310.

[10]According to Bonnifield in The Dust Bowl, p.41, "breaking the crust would also destroy the soil pores through which the ground moisture was evaporating.

[11]Kraenzel, The Great Plains, p.310.

[12]Ibid.

[13]Bonnifield, The Dust Bowl, p. 42.

[14]Kraenzel, The Great Plains, pp. 312-313.

[15]Kraenzel, The Great Plains, p. 314.