Spanish Irrigation Practices in New Mexico

Marc Simmons

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AN INTERESTING and seldom described aspect of colonial agriculture in New Mexico is the community acequia or irrigation system used by the Spanish settlers in the upper Rio Grande basin. Irrigation practices in this area derived largely from traditional methods employed in Spain and were regulated by royal ordinances. However, since the laws allowed a measure of latitude in interpretation and application to provide local authorities some flexibility in meeting unexpected problems, and since Pueblo Indian agricultural techniques influenced, albeit to a limited degree, water uses of the colonists, the practice of irrigation in New Mexico developed along its own distinctive lines.¹

The Spaniard’s fondness for gushing fountains, whether in his patio or the public plaza, is often attributed to the perennial scarcity of water in much of his native Iberia. According to at least one author, water has been the cause of more court cases and lawsuits than has the ownership of land, and in some parts of the peninsula it represents a commodity more precious than wine.²

Irrigation in Spain since Roman times has been employed most extensively in the arid regions of the south, particularly in Andalucía and the district surrounding Valencia. These areas were strongly influenced by seven centuries of Moorish occupation and this, together with the preponderance of words originating from Arabic that pertain to irrigation, for example, *acequia* (irrigation ditch), *noria* (irrigation well), *alfarda* (tax for irrigation of land), and *tahulla* (measurement of irrigated lands), have led most scholars to suggest that the practice was introduced and developed
by the Moors. This supposition is sometimes buttressed by reference to apparent Arabic customs associated with Spanish irrigation, such as the taking of water from acequias only after sundown.

It now seems clear, however, that the processes of agriculture and irrigation used by the hardy peasants of southern Spain were known long before the Moorish invasion, and after the establishment of alien rule these old practices continued. In time a veneer of Arabic custom easily became superimposed upon traditional patterns of land and water use. The Moors may have served as the vehicle by which some irrigation techniques were introduced from the East, but if that was the case, these influences must be regarded as minor accretions to the body of Spanish irrigation practice which had flourished from the days of the Romans. Thus the system of irrigation brought to New Mexico at the beginning of the seventeenth century was not primarily a contribution of the Moors as has been claimed.

The journals of Spanish explorers in the Southwest often called attention to the irrigation works observed among the sedentary Pueblo Indians. It remains uncertain how far back in prehistory these go, but probably at least as early as Pueblo III times when the Anasazi constructed terraces or check dams to retain rain and floodwaters in arroyos, and built stream diversion dams and irrigation canals.

A concrete-like ditch, apparently of great antiquity, has been reported in the Sierra Blanca mountains of southeastern New Mexico and was formed when lime-impregnated water flowing from a spring to Indian fields deposited successive layers of minerals. In 1883 archaeologist Adolph Bandelier discovered the same kind of irrigation ditch at a pueblo ruin near the Little Colorado River and recorded his puzzlement at viewing an acequia or concave trough that appeared to be “concrete or mexcla of some kind.” A similar acequia used by prehistoric farmers in the Verde Valley of central Arizona may be seen today at Montezuma Well National Monument. The most extensive irrigation system in the Southwest was that developed and used by the ancient Hohokam
and their successors, the Pima and Papago, in the Gila-Salt basin of southern Arizona. Less complex, but impressive nonetheless, were the irrigation ditches at Mesa Verde in southeastern Colorado, where one canal extended a distance of four miles.10

Although it is freely admitted by scholars that some irrigation was practiced by the Pueblo Indians of New Mexico at the time of Spanish occupation, disagreement exists as to its intensity and kind. Antonio de Espejo, who entered the area in 1583, reported finding “many irrigated corn fields with canals and dams, built as if by the Spaniards.” At Acoma he saw that “these people have their fields two leagues distant from the pueblo, near a mediumsized river, and irrigate their farms by little streams of water diverted from a marsh near the [San José] river.”11 Gaspar Castaño de Sosa, visiting San Ildefonso in 1591, noted that that pueblo had a very large area under irrigation.12 Bandelier, investigating the old Piro district at the end of the nineteenth century, declared that these Indians had “once irrigated the bottoms along the Rio Grande, and that the number and extent of [their] fields and of the irrigating ditches connected with them, attracted the attention of the Spanish explorers at an early day.”13

From these and other references that could be cited, it is evident that the Rio Grande Pueblos knew and practiced extensive canal irrigation at the opening of the Spanish period. At the same time, where practical, they resorted to dry farming, i.e., dependence on rainfall alone, and arroyo flood farming or utilization of land naturally flooded by arroyos, but without canals for distributing the water.14 Owing mainly to a devastating drought that beset the Southwest at the end of the sixteenth century, dry farming and arroyo flood farming diminished in importance and canal irrigation, because of its greater dependability, came to outweigh these other methods in the Pueblo area.15 The construction of elaborate dams and ditches and the solution of complicated problems involving the allocation of water rights were facilitated by the presence among the Rio Grande villagers of “a social organization which could mobilize and control a fairly large adult force and satisfy the irrigational needs of the society.”16 In other words,
Pueblo ditches were built and managed as communal affairs, this work and the regulation of waters representing an important public task. No doubt also, the arrival of the Spaniards with their own techniques of acequia farming helped intensify the use of canal irrigation among the Pueblo Indians.

At San Juan Pueblo, where Juan de Oñate established the first settlement of Spaniards in 1598, the Indians depended largely upon rainfall for their crops, although some ditches were seen nearby. According to the chronicler Gaspar Pérez de Villagrán, drought had withered the native fields so that the people came beseeching the Spanish priest to offer prayers for rain. When this was done and the sky "suddenly darkened and poured forth a regular torrent of rain, the barbarians stood spell bound in awe. . . ." It was well enough to trust to providence for an occasional miracle, but the colonists were wise enough to exert efforts of their own, and soon after their arrival, with the aid of the San Juan people, they began construction of acequias in order to have them ready the following spring.

The Ordinances of 1573, a set of codified instructions for the founding of new settlements, served as Oñate's guide when he laid out the villa of San Gabriel on the west bank of the Rio Grande opposite San Juan. One article of those Ordinances enjoined colonizers to select town sites where abundant water was available for drinking and irrigation. This requirement was certainly fulfilled, but the proximity of the villa to Indian lands in violation of other laws may have been one of the reasons for the removal of the settlers to a new town at Santa Fe in 1610. According to instructions delivered to Oñate's successor, Governor Pedro de Peralta, the cabildo or municipal council of Santa Fe was empowered not only to distribute lands but to apportion water for irrigation. This was in line with long established custom and law which accorded town councils the responsibility of regulating and distributing water both for domestic and agricultural use.

The first citizens of Santa Fe, probably with the aid of Mexican Indian servants and conscripted Pueblo laborers, dug two acequias madres (main ditches) to water fields on either side of the small
river that passed through their villa. From the canal on the north, known after the Reconquest as the Acequia de la Muralla, a lateral ditch brought water to the vicinity of the plaza and Governor’s Palace, although at times, it seems, a smaller acequia leading from a marsh or ciénaga near the parish church served this area. Often the flow of the diminutive Santa Fe River was insufficient to meet the needs of all fields, and only in wet years did farmers below the town receive adequate water for their crops.

With the organization of other villas in New Mexico in the eighteenth century, ample provision was made for the irrigation needs of the settlers, although specific information on this point is scarce. During a visit to New Mexico in 1760, Bishop Pedro Tamarón mentioned a large irrigation ditch at El Paso of size sufficient to receive half the waters of the Rio Grande. Subsidiary canals leading from the principal acequia ran through broad plains to irrigate vineyards and fields of grain. The certificate for the founding of Albuquerque in 1706 reveals that among the first tasks completed was that of the construction of acequias “properly ditched and running.” Viewing these in 1776, Fray Francisco Atanasio Domínguez described them as being fed by the Rio Grande and so wide and deep that “there are little beam bridges to cross them.” The situation with regard to irrigation at the founding of another villa, that of Santa Cruz de la Cañada in the lower Chimayó valley, was unique among New Mexican towns. Here in 1694 Governor Diego de Vargas forced Tano Indians to vacate villages and lands that they had settled after the Pueblo Revolt in 1680, so that these could be occupied by Spanish colonists coming from Mexico. Thus when the latter arrived, they were pleased to find that the Governor had granted them “the dwelling houses, cleared agricultural lands, drains, irrigation ditches, and . . . dams which they said native Indians had and did have for irrigation and the security of raising their crops.”

Spanish colonial law established the general principles relating to irrigation development and its public regulation, based upon traditional legal codes and practice in Spain. Thus the Recopilación provided that all waters in the New World should be common
to all inhabitants; that viceroys and other officials should supervise irrigable lands and protect them from livestock; that distribution of waters to colonists be made on the advice of municipal councils; and that whatever local provisions might be established regarding water distribution, these should be conceived so as to promote the public welfare. The duties of the individual were also spelled out—water users were required to maintain and care for their acequias, to cooperate with other owners on communal ditches, and to refrain from constructing new ditches above those persons who had prior rights to the water.

These laws provided a foundation upon which an irrigation system arose in colonial New Mexico, but since local demands of the environment and Indian practices helped shape this institution, attention must be given to those details that convey a picture of the distinctive situation which developed in the upper Rio Grande basin. In the first place, the community acequias were organizations composed of all landowners holding property on a ditch. They contributed labor or support in proportion to the amount of land fronting on a main acequia, whether it was cultivated or not. The association of water users that had charge of an irrigation system was often one of the most highly integrated and efficient organizations in the community. This was necessary since the economic welfare, and hence the very survival of most settlers, was closely tied to the cultivation of the soil. Many of the practices directed by local associations for water distribution derived from those used in the area surrounding Valencia, Spain, where a Tribunal de las Aguas, managing irrigation affairs, functioned in a manner similar to the community acequias that developed in New Mexico.

It should be noted that in the upper Rio Grande valley two kinds of irrigation associations appeared—the public organization and the private. The first was an adjunct of a legally formed municipality, such as the villas, or of an Indian pueblo. In these the acequia madre was regarded as public property and its management was the responsibility of the municipal government. The private organization was one formed in a community that had
limited or no legal status and lacked a town government. By far the largest number of New Mexican colonists lived in small rural hamlets of this kind. Here the community ditches were voluntary undertakings on the part of interested water users. Although there was no intervention or direction by a municipal council, strict regulation was provided by an elected mayordomo or ditch boss.80

So little information is available that the manner in which the four colonial villas in New Mexico superintended their irrigation systems is not clear. There exists a single reference to an alcalde de aguas in the villa of El Paso in 1802,81 who may have been analogous to a juez de aguas or water inspector found in other parts of Spanish America.82 If such an officer existed in the remaining New Mexican villas, he perhaps functioned in place of a mayordomo.83 In rural districts it is certain that the alcaldes mayores exercised some jurisdiction over irrigation matters, especially with regard to formal complaints or suits involving damage to ditches by livestock or theft of waters.84

Concerning the duties and activities of the mayordomo who oversaw management of ditches in New Mexican villages and in the Indian pueblos, a good deal is known, particularly since the office continues today and many time-honored practices dating from the Spanish period have been preserved. Originally, under call and direction of the district alcalde, male members of a community acequia gathered annually to elect a mayordomo, or in some instances two or three, and to determine the amount of his salary. Once selected, the ditch boss enjoyed a large measure of authority and prestige. He inspected and superintended repair of acequias, regulated the number of days labor required of each proprietor, distributed and apportioned water, adjudicated disputes, and searched for infractions of regulations.85 From the mid-nineteenth century there remains at least one formal list, probably prepared by the mayordomo, of proprietors along the new ditch of Chamisal near Belen, which carefully tabulates acequia frontage and days of labor owed by each man.86 Because of widespread illiteracy and scarcity of paper during the colonial years, it is doubtful if such written records were common under the Spanish regime.
The amount of irrigable land cultivated by a single farmer averaged only ten acres in the 1850's, and this had probably long been the case. Larger farms were concentrated in the Río Abajo below Santa Fe where the floodplain of the Río Grande widened, but above the capital valleys were narrow and discontinuous along the main river and its tributaries, limiting the amount of cropland available to each family. The pattern known for the Chama valley in the late eighteenth century was perhaps typical of remote areas in the northern district. Here agriculture was practiced little above the subsistence level because the men and older boys devoted the bulk of their time to the care of livestock, hunting, trading, and militia service. After clearing a section of bottomland and digging acequias for irrigation, they left the raising of crops to women, children, and the elderly, who used a digging stick rather than the plow.

The construction of a new irrigation system required the expenditure of a considerable amount of labor on the part of the settlers. Diversion dams and acequias were modeled to some degree after those used in Mexico and Spain, but owing to the lack of surveying instruments, heavy tools, and engineering skills, the works here were simpler and less efficient. For example, in testing the fall of an acequia under construction, water had to be turned into it frequently to observe the amount of grade since no surveyor was available. Furthermore, ditches were seldom straight, their builders zig-zagging around trees, boulders, small hills, and other obstructions.

The first problem to be considered was that of obtaining a head of water copious enough to supply a new ditch. Usually a river or stream was tapped two to four miles above farmlands, so that by gravity flow the water could be carried through the acequia madre to smaller canals leading directly to the fields. On the Rio Grande, with its abundant volume and low banks, a diversion wing of stones was often sufficient to turn the current into a canal. Elsewhere, on small or intermittent streams where a ready source of water at the right level was lacking, recourse was had to dams
(presas) to impound the flow and form a reservoir that might be conveniently tapped. By all accounts the New Mexican dams were crude affairs of logs, brush, and stones easily destroyed by spring freshets or summer flash floods. The one at El Paso in 1773 was described by a local citizen as “made of wattles, as the terrain of the river does not permit any other kind of fabrication, to say nothing of the trouble caused by its excessive floods and freshets, for it not seldom happened that after a dam had been built of stones, fagots, and stakes, it was necessary to tear it down in order to prevent inundation of the town.” A traditional-style dam seen by James W. Abert near the village of Manzano in 1846 was “very large, constructed of crib-work, 12 feet wide, and 8 feet high, and 100 feet long, formed of rough logs, and the interior filled up with stones and earth.” On dams of this nature little or no provision was made for diversion, so that the structure had to carry the weight and pressure of whatever quantity of water descended from above. If the pressure was too great and the dam was lost, crops might perish from lack of water before it could be replaced and normal flow restored to the acequias.

The construction of ditches below the point of diversion from the main stream was undertaken by the collective manpower of the community. Primitive hoes and shovels of wood served in the absence of iron tools during colonial days, and earth was removed on rawhides pulled by oxen. Main acequias averaged from three to five yards wide and from two to six feet deep. Earth thrown out of the ditch each spring as it was cleaned soon formed a mound several feet high and helped stabilize the bank. The acequia madre was always kept above the land to be irrigated so that waters could be released into the lateral or secondary channels and carried to the fields below. These secondary ditches, called brazales in Spain, were known in New Mexico as contra acequias, or more commonly during the colonial period as sangrías. Headgates of wood admitted water from the acequia madre into the lateral channels, and as soon as the flow reached his field the farmer with a hoe made
small dams “so as to overflow a section at a time . . . depressing eminences and filling sinks, and causing the water to spread regularly over the surface.” Working in this slow and tedious way, a cultivator could irrigate five to six acres in a day.

When water was plentiful, users might draw whatever quantity they wished from the ditches. In times of scarcity, however, the supply was strictly rationed by the mayordomo who supplied permits to take water for a limited time. In such cases a farmer frequently kept his entire family working all night irrigating his patches of ground. Especially during a drought, quarrels and serious conflicts over water allotment were common. Some of these ended in court and others with bloodshed. A related problem is illustrated by the text of an alcalde’s decree in 1813:

Those who must irrigate by bringing water from up above another ditch, should construct a flume (canoa) wherever the waters cross, so that owners of the other ditches will not be harmed and to avoid theft of waters which might otherwise be made under the pretext of emptying water from one irrigation ditch to another. In such an event, other parties would be denied the benefit of their own work and would lack water they need, so that their crops would be held back and damaged. And he who does not build a flume when he should, must pay the consequences, suffering four days of imprisonment in the public jail.

An important aspect of the development of Spanish irrigation in New Mexico concerns the influence it exerted over traditional systems of the Indians. Apparently many of the community irrigation customs of the Pueblos were entirely compatible with Spanish institutions and were allowed to continue. This was in conformity with laws set forth in the Recopilación which provided that ancient customs of the Indians should be retained and respected so far as practicable. Nevertheless, it is apparent that Spanish practices, such as organization of labor under a mayordomo and techniques of dam and acequia construction were gradually adopted by the Pueblos. They continued to retain, however, ancient ceremonial practices surrounding irrigation, such as the planting of prayer
Acequia madre, Santa Fe, ca. 1915
Courtesy Museum of New Mexico

Irrigation ditch and floodgate
Courtesy Museum of New Mexico
sticks in the ditches and ritual dances following cleaning of the acequias in spring.

With Indians and Spaniards often living side by side, there were numerous instances of joint use of acequias. Serious controversies over the method of administering such ditches arose not infrequently, with the district alcalde acting as arbiter to settle matters in dispute. Along the Rio Grande near El Paso in the 1770’s, the mission Indians and colonists were living commingled, “the former having their farms and a branch irrigating ditch, while the latter have the main ditch, containing two flood gates from which the Indians’ water comes. The upkeep of the dam is obligatory upon all.”

Another source of friction was unattended livestock that wandered into Indian land, not only stripping fields but damaging irrigation ditches. Soft, sandy banks along canals easily collapsed under the hooves of grazing stock, filling the ditches or causing breaks that permitted escape of precious waters. From the first introduction of horses and cattle into New Spain, the royal government repeatedly passed legislation designed to safeguard Indian farm plots, but the laws were generally ignored.

One of the earliest of these in New Mexico was a decree of 1620 which ordered that large stock of the Spaniards be kept at least three leagues distant from the pueblos and Indian fields. Again in 1687, the governor of New Mexico issued a proclamation requiring stockmen to keep their animals out of growing crops and away from irrigation ditches. When the Indians of San Juan Pueblo complained in 1718 that their fields and acequias were suffering grave damage from cattle owned by residents of the villa of Santa Cruz, the lieutenant governor in Santa Fe prohibited the latter from leaving their livestock untended. A century later the alcalde of the Jemez jurisdiction announced:

In vain have the superior authorities demanded compliance with orders which prohibit grazing-stock from being pastured alongside cultivated fields or along the banks of irrigation ditches. . . . If the
Indians should suffer serious damage, severe penalties will be imposed on transgressors. . . . Whenever loose animals are found in fields, the owner must suffer the fine of one-half a real of silver for each head.\textsuperscript{67}

Even such strict measures as this seemingly had little effect, mainly because fencing of cropland and ditches was not practiced and stockmen continued to be careless about providing a herder for their animals. Withal, it is plain that for Indian as well as Spaniard, maintaining and protecting an irrigation system on the New Mexico frontier was a vexatious but necessary task.

NOTES

1. On the looseness of Spanish law regarding the matter of irrigation, Marcelino C. Peñuelas says, "En las \textit{Leyes de Indias} se establecen normas concretas sobre trabajos de irrigación pública. Sin embargo, estas normas eran lo suficientemente amplias para permitir adaptaciones a las especiales condiciones de cada región." \textit{Lo Español en el Suroeste de los Estados Unidos} (Madrid, 1964), pp. 272-75.

2. Elena de la Souchère, \textit{An Explanation of Spain} (New York, 1965), p. 16.


17. George P. Hammond and Agapito Rey, eds. & trans., Don Juan de Oñate, Colonizer of New Mexico, 1595-1628 (Albuquerque, 1953), pt. 2, pp. 610, 626.


21. Reference to an acequia madre on the north side of the river is found in a document cited by Ralph E. Twitchell, Old Santa Fe (Chicago,
1963), pp. 78-79. This canal became known as the Acequia de la Muralla because of its proximity to a wall defending the northern limits of the town. Ibid., p. 56.


25. Ralph E. Twitchell, Spanish Colonization in New Mexico in the Oñate and De Vargas Periods (Santa Fe, 1922), p. 20.


29. Peñuelas, pp. 272-74; and Foster, p. 64.


31. Fernando Chacón to Jacobo Ugarte, Santa Fe, June 14, 1802, Spanish Archives of New Mexico, State of New Mexico Records Center, Santa Fe (SANM), no. 1607.


33. That Santa Fe now has a majordomo (as of 1971, Ignacio Moya) over its acequia madre, is no evidence that this official existed under Spanish rule, although such may have been the case.


37. Davis, pp. 70-71.
40. Another device, the ancient water lift or noria which supplied acequias from a well, was used in some of the north Mexican provinces but apparently never reached the Southwest.
44. Hutchins, p. 274.
45. Davis, p. 67.
46. Twitchell, *Old Santa Fe*, p. 79n; and Adams and Chávez, p. 71n.
47. Gregg, p. 108.
48. Farmers, following traditional practices today, are often observed over-watering their fields on the theory that if some moisture is good for the crops, more must be better. The result is a rapid leaching of minerals from the soil and a significant reduction of food value in the crops produced. This may have been a problem also in the colonial period during years when water was abundant. Interview with David Carter, Soil Conservation Officer, Pecos, N.M., Feb. 20, 1971.
49. See Governor Real Alencaster to Commandant General Salcedo, Santa Fe, Sept. 1, 1806, SANM, no. 2012(3), in which the governor refers to the misery and famine caused by a general lack of water for planting.
50. Simmons, p. 9. In the context of this document the term *canoa* clearly means flume. More often in New Mexico it meant a hollowed out log that served as a water trough or salt box for livestock. During the Mexican period, alcaldes in Santa Fe were obliged to see that irrigation ditches crossing roads were provided with bridges and that all acequias were so placed as to avoid flooding of the streets. Marc Simmons, trans., "Antonio Barreiro's 1833 Proclamation on Santa Fe City Government," *El Palacio*, vol. 76 (1970), p. 29.
51. Lib. ii, tit. i, ley 4; and Hutchins, p. 266.
52. In an interesting case from the early Mexican period, the alcalde
of Bernalillo, upon complaint of Santa Ana Indians, required a local settler to contribute his share of labor to a common acequia. Testimony taken by Jesús Miera, Bernalillo, July 18, 1829, Julius Seligman Collection, University of New Mexico Library, Albuquerque.

55. Bando of Pedro Reneros de Posada, El Paso del Norte, March 3, 1687, SANM, no. 43.
56. Bando of Pedro de Villasur, Santa Fe, Aug. 11, 1718, SANM, no. 290.
57. Simmons, Alcalde, p. 8. The problem of errant livestock continued well into the twentieth century. An act of the Fourth New Mexico State Legislature, Leyes de Nuevo México, 1919, pp. 191-97, concerning damage to irrigation ditches by stray stock was, in tone, strongly reminiscent of the Jemez alcalde’s proclamation on the same matter.