

I.a.1 Wessel, Thomas “THE AGRICULTURAL FOUNDATIONS OF CIVILIZATION”

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J.H. Fabre once lamented, "History celebrates the battlefields wherein we meet our death, but scorns to speak of the proved fields whereby we thrive. It knows the names of the Ring 'a bastards but cannot tell us the origin of wheat. This is the way of Human folly." Jacob Molschott reduced all human understanding to the simple phrase, "Der Mensch ist was er isst," Mankind is what he eats.

Although both gentlemen were perhaps overstating the case, they were and remain surprisingly close to the mark. We still do not know the origins of wheat, but we might be able to say something about the impact of wheat on the development of western civilization. On the other hand, we do have from the work of Paul Mangelsdorf a pretty good idea of the origins of maize. The fact that wheat and barley became the staple crops of the Near East and corn and beans the staple crops of the New World had a profound effect on the development of civilization in those two areas of the world.

It is difficult to state from the archaeological evidence just when gathering of wild wheat leaped to settled cultivation of wheat fields, but probably no sooner than 4-5000 B.C. The earliest wheat and barley varieties were as primitive as the societies that cultivated them. Einkorn, a single seed wheat, and emmer, a two seed wheat, dominated the early cultivation. Soon some hybrids of 4-6 grains usually called bread-wheat made its appearance, but the principal difficulty of cultivation remained. With the cultivation of small grains, the former hunting-gathering societies made a significant step backward in nutrition.

The human body is an extremely efficient consumer of food stuffs, but is a poor manufacturer of the basic ingredients necessary to sustain life. Most of the vitamins, trace minerals, and particularly the amino acids necessary to build body protein must come already prepackaged in the food stuffs consumed. There are approximately 20 amino acids in nature, 10 of which are essential to human growth. None are manufactured in the process of digestion, but are indeed, broken out of the food stuffs in the digestion cycle. So long as societies depended on hunting and the consumption of red meat, most of the necessary amino acids were available in sufficient quantity. The move to small grain culture was another matter. Of the ten essential amino acids, wheat and/or barley provide sufficient quantities of only one or two, leucine and phenylalanine. Small grains are very low in lysine and wheat contains virtually no tryptophan. In order to gain the missing amino acids, early farmers had to continue to hunt or find an alternative means of providing red meat from "domesticated" animals. Herding, first goats, (milk also provides the missing amino acids) and then cattle, was paramount to basic survival in any meaningful manner. The problem was that domesticated animals also ate the small grains. Consequently, early society tended to divide its labor at nearly the same time between cultivation and herdsman. A biotic relationship developed between the two groups. The meeting grounds for the exchange of food stuffs were called cities. It is likely not simply a coincidence that Neolithic man is credited with the beginnings of settled agriculture and also the building of the first towns. Jericho, one of the oldest towns in the Middle East, was first sustained by hunting, then abandoned only to return as the center of agricultural development. Incidentally, only as an agricultural settlement did the residents of Jericho find it necessary to build the walls that Joshua was so contemptuous of.

While solving their problem of an appropriate amino acid balance by introducing animal husbandry into the agricultural mix, early Near Eastern societies had additional problems with small grain agriculture. Small grains are a timely crop. It must be planted more or less "on time" and more critically, it must be harvested "on time." If left in the field too long it's lost from the harvest. A society

successfully engaged in small grain agriculture has to develop a relatively accurate sense of time, and impose either upon itself, or accept the imposition from outside, the requisite discipline and order to make the system work. Also, small grain agriculture is particularly susceptible to brigandage. Unlike hunting, which can be done continuously and the product consumed immediately, small grains are harvested at a particular time and stored for future use. Protection of the settlement then, such as the walls of Jericho and the creation of an army for that purpose, is not an unlikely occurrence. The subsequent division of society into task-related parts, has all kinds of implications. Let me suggest only two. For one, the family organization that dominated early societal organization is likely to expand to include the whole of the community, with some kind of military leadership. Monarchs in the Middle East from the earliest dates known, are remembered as warriors above all else. Wise Joshua may have been, but he also carried a sword.

Once it was discovered that society could produce those who worked the fields and those who contemplated and acted as leaders, it was not likely to change. Indeed, leaders were more likely to find all kinds of ways to maintain their exalted position and retain the work discipline of the incipient farmers. One way to do so other than simply by the force of arms was to raise work in the field to virtue in itself. Priestly classes might aid in convincing the majority of the need to work to feed the nobility. In any event, such divisions of "labor" occur in Near Eastern society in rapid order once agriculture is firmly established.

Small grains, however, pose an additional problem for society. The return for seed sown is quite low. In the Neolithic period and centuries thereafter, the yield was probably no better than 4-6 to one. To increase population in any significant way, substantially more land had to be brought under cultivation, occasioning more difficulty in protecting it, and occasioning more military for protection and for use in stealing from those nearby.

One might question the causal relationships briefly outlined here, but the basic problems of small grain agriculture are simply given. I am not suggesting that early man was a molecular biologist. Of course they had no formal knowledge of nutrition but the manifestations of dietary deficiency are so gross that it would not take long for mankind to figure out who survived better and who worse. Those with access to both meat and bread were clearly the winners.

To illustrate this point let me make a substantial leap forward in time to an era where our knowledge of events is on firmer ground. We all tell our students of the black death of the 14th and 15th centuries, brought to Europe by black rats with devastating effect. When we look at the victims of the black death, the proportion of peasant deaths to deaths among the better off is clear. Most of Europe's pantry sustained themselves on a diet that consisted of little more than barley soup and beer. Beer, by the way, has more nutritional value than barley soup. The essential amino acids supplemented by red meat was largely absent from peasant diets, but not of those who rule. It may be that the plague was so devastating in part because Europe had a population that suffered from fundamental malnutrition. It might also be more than coincidental that the time of the black death corresponded with the change from barley-based to wheat-based agriculture, an increase in cattle levels, and a substantial increase in red meat available to the general population. Maybe when the king protected his deer and fish for his own use, he knew something. In any event, the Dutch Historian B.H. Slicher Van Bath has made a persuasive argument for malnutrition as a factor in the black death.

In summary it is possible to postulate a given set of cultural and political parameters for western civilization based on the fundamental considerations of small grain agriculture and the fact that wheat contains little or no lysine.

Settled agriculture, of course, did not occur just in the Near East. It began at roughly the same time in the New World - during the Neolithic period. Evidence of the existence of "single pod corn" has been found in strata dated 8000 B.C. Undoubtedly, however, true sedentary life based on field crops does not begin until sometime about 3-4000 B.C. Details about the agriculture of the central valley of Mexico in the Neolithic period is virtually unknown. Archaeological work in this region began only in the 1890's and only intermittently to the present day. Nevertheless, it is possible to say some things with reasonable certainty. Maize was clearly the principal crop raised by New World farmers. The first point to make about maize is that it cannot grow in its common form unless cultivated. Maize reverts to a simple grass if not cultivated. Botanists, archaeologists, and historians have debated for years about the origin of maize. Two common maize-related grasses, Teosinte and Tripsacum, seemed to be the best candidates as the precursor of modern corn. Biologists, however, have pointed out that both are perennials and possess what amounts to a genetic roadblock to the development of the modern maize annual. Paul Mangelsdorf in the last decade worked out a possible origin sequence. He postulated that a cross of two other primitive maize relatives, one common to the Central Valley of Mexico and the other common to the lower elevations of Peru, produced a primitive single pod corn that eliminated the genetic roadblock. If further crosses took place first with tripsacum and then teosinte, the product would be modern corn as it existed in the Neolithic period.

Probably, something like the scheme suggested by Mangelsdorf did take place. It suggests that communication between people in the Neolithic New World was at a higher level than once supposed. The importance of the production of maize was the return the crop provided for seed planted. While Neolithic farmers in the Near East could expect a return of about 4 to 1, New World farmers regularly could expect a return of 40 to 1. Maize however, has much the same nutritional deficiencies as wheat. It contains large quantities of only one of the essential amino acids and only moderate quantities of the rest. When consumed in combination with other and probably even older crops, lima beans and pumpkins, using those two in a generic sense, all of the essential amino acids are provided in sufficient quantities to sustain life at a healthy level. Beans and squash, pumpkins, etc. have a high level of return for seed planted. The need to introduce animal husbandry as a nutritional supplement is simply absent in the New World.

Corn, beans, and other similar crops have an additional characteristic worth noting. Where wheat is a very timely crop, New World crops are almost timeless. That is, if a farmer failed to harvest his corn and beans in the fall, it was quite safe to leave them for harvest at a later time. Corn and beans come as close to being indestructible as vegetable matter gets. Where Old World agriculture placed a premium on discipline, order and a sense of time, New World agriculture had few imperatives at all except the need to cultivate.

Old World agriculture virtually was without cultivation once the seed was planted. Wheat was scattered across the field and allowed to grow along with whatever else was in the field. Indeed, the need to expand Old World agriculture in the absence of a means to separate wheat from its competitors, weeds, may have led to improvements in seed bed preparation, the use of plows, and the consequent additional need for animals. Corn was planted in hills where only a crude hoe was necessary. Because of the enormous return for corn, increases in production could be made relatively easily with additional hills. Sustaining a fairly large population increase did not take anywhere near the additional land or labor that a similar increase would demand in the Near East. It has been estimated that in the Central Valley of Mexico some areas of cultivation could sustain the yearly needs of the population at the rate of 25 people to an acre. Corn, beans, and squash could be planted literally together rather than in separate fields. The lower growing squashes, in fact, acted as a ground cover that reduced weed populations once the plants were well up. It may be that agriculture of this sort rather than placing a premium on work, placed a premium on leisure. Certainly, it was not difficult to leave cultivation to women while men fought, dreamed, and built monuments to gods.

While it may be pushing too far to suggest that the agriculture of the Neolithic period established the direction of civilization for all time, it is clear that the development of cities, the breakdown of gene, and the rise of stratified societies with their priestly and ruling classes was not likely in the absence of agricultural development. The spread of agriculture in the Old World was rapid, while the techniques of agriculture changed very slowly indeed. The plow that allowed early man to harness animals for work appeared in the 3rd millennium B.C. and was largely unchanged until the appearance of the moldboard plow in the Middle ages A.D. Cultivation of small grains in 16th Century England was not significantly different from the methods used by Neolithic man. Not until the 18th century were substantial improvements made. In the New World agriculture spread as well to as far north as the St. Lawrence Valley, throughout the eastern part of the United States and, of course, throughout the southeast. Its southern migration stretched to the tip of South America. The crops domesticated by Neolithic man remained the staple of farming Indians in the New World through the time of the European invasions. European farmers brought with them to the New World some technology, but more importantly, a sense of time and of work and social organization grounded in the agriculture of small grains. When combined with the productive capacity of New World plants, the beginning of American agriculture was well established .