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Chapter 6

AGRICULTURE IN LEHI'S WORLD: SOME TEXTUAL, HISTORICAL, ARCHAEOLOGICAL, AND BOTANICAL INSIGHTS

Terry B. Ball and Wilford M. Hess

Introduction

The title page of the Book of Mormon declares that the purpose of the text is “to show unto the remnant of the House of Israel what great things the Lord hath done for their fathers; and that they may know the covenants of the Lord, that they are not cast off forever—And also to the convincing of the Jew and Gentile that Jesus is the Christ.” As the authors of the book recorded the teachings, doctrines, and history that would accomplish this purpose, they also offered incidental insights into the everyday lives of Lehi and his descendants. Combining those textual insights with current historical, archaeological, and scientific information can help the reader better reconstruct, understand, and appreciate the world in which Lehi and his family lived. This approach can be especially helpful in understanding Book of Mormon agriculture.¹

Textual Overview

From the Book of Mormon text, we learn that agriculture played an important role in the lives of the Lehites.² At the command of the Lord, Lehiters and Jaredites alike brought crop and fruit seeds from the Old World (1 Nephi 8:1; 18:6; Ether 1:40–41; 2:1–3), which “did grow exceedingly” in the promised land (1 Nephi 18:23–24). Successful agriculture was often a hallmark of a righteous people (e.g., 2 Nephi 5:10–11; Enos 1:21), while the wicked frequently subsisted solely on wild beasts or on produce that they could rob, extort, or plunder from the righteous (e.g., Enos 1:20; Mosiah 7:22; 9:14; 21:21; 3 Nephi 4:2–6, 18–20). In times of war, agriculture often suffered—raising, protecting, and distributing crops became a matter of great concern and hardship (e.g., Mosiah 10:2–4, 19–21; 21:17–18; Alma 3:1–2; 4:2; 58:3–8; 60:3, 9; 3 Nephi 3:22; 4:2–6, 18–20). Often the Lord used crop failure and the resulting famine to chasten and humble his rebellious people (e.g., Mosiah 12:4–7; Helaman 11:4–17; Ether 9:28–35). Thus agriculture played a major role not only in the day-to-day subsistence of the people, but also in their relationship with God.

Plants of Lehi’s World

A number of food plants are mentioned by name in the Book of Mormon, either as cultivars the people were actually utilizing, or in allegories and imagery used to teach gospel principles and truths.³ The list includes wheat, barley, grapes, olives, corn or maize, neas, and sheum.⁴ Two plant species with industrial uses may also be implied: flax, which could be the source of the linen mentioned in the record, and perhaps mulberry, which is required to make the fabric we know as silk. Other plant names and a wide variety of botanical terms can be found sprinkled throughout the text. Tables 1 and 2

summarize these names and terms. Many of these species of plants and their botanical terms have Old World origins or cognates about which history, botany, and archaeology have revealed important insights.

All Manner of Grains

Grain was perhaps the most important food crop cultivated by the Book of Mormon people. The grain harvest became a measure of prosperity and favor with the Lord (e.g., Mosiah 21:16; Alma 1:29; Helaman 6:12; 11:13, 17; Ether 10:12). Grain crops were often a target or casualty of robbers and invading or occupying enemies (e.g., Mosiah 7:22; 11:3; 21:21; Alma 3:2; 4:2). Indeed, the availability of grain influenced the outcome of wars, and warring peoples labored to preserve this important commodity (e.g., Mosiah 21:18; 23:1; 24:18; 3 Nephi 3:22; 4:6; 6:2). When the grain crop failed, famine followed (e.g., Helaman 11:13; cf. Mosiah 12:6). The Lehites raised “all manner of grain” (Enos 1:21; cf. 1 Nephi 8:1; Mosiah 10:4; Alma 62:29; 3 Nephi 6:2; Ether 9:17), including wheat, barley, corn, and perhaps neas and sheum (Mosiah 9:9).

While corn is a New World crop that was probably unknown to Lehi and his contemporaries, Lehi and his family apparently brought wheat and barley with them on their journey from the Old World to the New World. The seeds certainly could have remained viable and survived the journey, which took several years. Viability is dictated by seed moisture content and storage temperature. J. Derek Bewley and Michael Black state that for each 1 percent decrease in seed moisture content, the storage life of a seed is doubled and that for each 10°F (5.6°C) decrease in seed storage temperature, the storage life of a seed is doubled.⁵ These authors also point out that at moisture contents of 18–20 percent seeds will respire and that with poor ventilation heat

will kill the seeds. Below 8–9 percent moisture content there is little or no insect activity in seeds, and below 4–5 percent moisture content seeds are immune from attack by insects and storage fungi, but the seeds may deteriorate faster than seeds maintained at a slightly higher moisture content. They point out that seeds in a natural history museum in Paris retained their viability for 55 to 158 years, as discussed by M. Paul Becquerel.⁶ Wheat and barley grains have sufficient longevity, even under less-than-ideal storage conditions, to survive for more than a decade. Moreover, it is possible that these grains were grown and harvested by Lehi and his family at one or more locations en route to the promised land, thus increasing their chance of viability, although this is not recorded in the Book of Mormon. According to a tradition among the native Jiballi of Dhofar (that region of Oman where Lehi and his family in all likelihood built their ship),⁷ wheat was grown there anciently, and one can see the rope marks in the cliffs above the Wadi Sayq where baskets of wheat were raised and lowered to coastal plains.⁸

By the time Columbus arrived in the New World, both wheat and barley apparently had disappeared and had to be reintroduced. Their disappearance is easily explained. The cultivated species of wheat and barley the Lehites would have had available to them were already highly domesticated by the seventh century B.C. Domesticated plants generally cannot survive without human intervention. As David Rindos clarifies, “the most highly developed cultivated plants are incapable of survival in the wild.”⁹ The very morphological changes that make a plant a good domesticate also inhibit its ability to compete in the wild and thus tie the survival of the plant to the activities of humans. For example, cultivated barley and the best cultivated wheats have nonbrittle ears that allow the spikes or seed heads to stay intact after ripening rather than shattering

and dispersing their seeds. Of course this trait is an advantage to the farmer since it allows him to gather and thresh the grain without losing it in the field. However, nonbrittle mutations can survive only under domestication, for without the ability to spontaneously and widely disperse seeds, the plants cannot adequately compete and reproduce in the wild.¹⁰ Thus, although these grains may have been imported by Lehi, if in subsequent years they were not planted, tended, harvested, and stored, they doubtless would not have survived, particularly in a humid climate. The Book of Mormon text suggests that such may have been the case. From about A.D. 322 to 400 the people were at constant war, perhaps to the point that farming was not possible. "It was one complete revolution throughout all the face of the land," Mormon records (Mormon 2:8). By about A.D. 401 Moroni was the only Nephite to survive the great wars and presumably did not grow crops while wandering and hiding (Mormon 8:3–5). The wicked Lamanites, who traditionally did not practice agriculture, continued to fight and were "exceedingly fierce among themselves" (Moroni 1:2). Moroni's observation suggests that the culture continued to be unstable even after the Nephites became extinct. Highly domesticated plants like wheat and barley would probably not have survived the neglect that may have accompanied so many years of war and political upheaval.¹¹

Some would suggest that the fact that wheat and barley were not being cultivated in the New World when Columbus arrived indicates that these crops were never in the New World before his arrival and therefore call into question the veracity of the Book of Mormon. However, archaeologists have actually recovered pre-Columbian barley in North America near downtown Phoenix, Arizona, where a Hohokam culture was present from about 300 B.C. to A.D. 1450;¹² at sites in Oklahoma

and Illinois dating to about two thousand years ago;¹³ and in areas populated during the Late Woodland cultural periods (A.D. 600–1050), as reported by Vorsila Bohrer.¹⁴ While physical evidence of pre-Columbian wheat has not been discovered by archaeologists, one should not conclude that wheat was not cultivated anciently in the New World. Generally, archaeologists understand that failure to find something mentioned in a text does not discredit the text. They recognize that the likelihood of an organic artifact being preserved is very small and that if an organic artifact is indeed preserved, the chance that it will be discovered and correctly identified is even more remote.¹⁵ Accordingly, within their discipline, archaeologists typically accept the axiom that the absence of evidence is not evidence of absence. Thus the Book of Mormon text itself—added to what we know about wheat cultivation in the world from which the Lehites came—may be the best sources for insights to help us understand the earliest cultivation of wheat and barley in the Americas.

Wheat

Wheat is mentioned twice in the Book of Mormon, once as one of the crops raised by Zeniff's colony in the land Lehi-Nephi (Mosiah 9:9) and again in a simile used by the resurrected Lord to warn his disciples of Satan's evil designs to "sift them as wheat" (3 Nephi 18:18).¹⁶ Bread, perhaps made from wheat, is mentioned over twenty times in the text, and the word *chaff* (the remaining by-product of threshing grains such as wheat) is present in six verses (see table 2).

The wheat Zeniff's people sowed (Mosiah 9:9) probably descended from seed stock originally imported from the Old World by Lehi and his family. Wheat is prehistoric in the Old World. Egyptian monuments indicate that it was already es-

established before the Hebrew scriptures came into existence, and when the Egyptians and Greeks speak of its origin they refer to mythology.¹⁷ The evidence indicates that wheat was first domesticated in the Old World, although the exact location of the event is a matter of debate. The earliest known grains of domesticated wheat have been found with barley and pulses in the Fertile Crescent, in Anatolia and the Balkans, and date to as early as 7500–6500 B.C.¹⁸ Simcha Lev-Yadun, Avi Gopher, and Shahal Abbo note that it is generally agreed that plant domestication first took place in the Jordan Valley and areas of the southern Levant (present-day Israel and Jordan).¹⁹ They suggest, however, that since the remains of wild forms of einkorn wheat, emmer wheat, barley, chickpea, lentil, bitter vetch, flax, and perhaps pea, have been found in a small cove area in the Fertile Crescent near the upper reaches of the Tigris and Euphrates Rivers, the northern Levant (present-day southeast Turkey and north Syria) is also a candidate for the location of domestication of these species. They conclude that agriculture in the region was first based upon three cereals (einkorn wheat, emmer wheat, and barley), four pulses (lentil, pea, chickpea, and bitter vetch), and a fiber crop (flax).

In contrast, Israeli researcher Eviatar Nevo observes that the wild progenitors of wheat and barley are especially rich in adaptive genetic diversity in the Fertile Crescent, most particularly in Israel, suggesting that Israel is the center of origin and diversity of these plants.²⁰

Molecular genetics provides another avenue to investigate the question of the location and process of wheat domestication. This research tool can be used to assign approximate dates to domestication events and identify wild progenitors of a domesticate. Using this kind of genetic analysis, researchers have identified a wild group of *Triticum monococcum boeoticum*

(wild einkorn wheat) from southeast Turkey as the probable progenitor of cultivated einkorn varieties, thus suggesting that the domestication of einkorn wheat began in that region.²¹ Other investigators in molecular genetics have concluded that einkorn, the most primitive of wheats, was domesticated only once, but that emmer, a slightly more advanced species, might have been domesticated more than once.²² Li Huang et al. studied Israeli populations of wild emmer wheat (*Triticum turgidum* var. *dicoccoides*).²³ They sampled twelve domesticated landraces (ancient varieties) and both primitive and modern cultivars of *T. turgidum*. They reported high levels of diversity and a large number of alleles (units of genetic material) that were not detected in wild emmer populations. Their observations led them to conclude that emmer wheat underwent a long-term domestication process in which wild, semidomesticated, and domesticated plant types grew sympatrically (side by side), resulting in continuing introgression (introduction of new genetic material through interbreeding) from the wild populations and possibly gene flow from transspecific sources (species other than wheat).

While we do not know for certain the exact location and means by which wheat was first domesticated, these findings argue strongly that the domestication process was in or near the Fertile Crescent. By the time Lehi and his family left the region, wheat and the bread made from it fed the world as he would have known it. It was the main field crop in both Judah and Egypt. In Judah fields of wheat were raised primarily without irrigation, depending instead on rainfall, which was sometimes scarce. Consequently, famine in years of poor rainfall was common. In contrast, Egypt was a land with abundant water for irrigation²⁴ and was the land to which Israelites looked in time of famine (e.g., Genesis 41–45).²⁵

Wheat was important in other areas of the ancient Near and Far East as well. The Chinese name for wheat was *mai*, the Sanskrit names were *sumama* and *gôdhûma*, the Hebrew name was *hittah*, Egyptians called it *br*, and the Basque name was *ogaia* or *okhayi*. The Chinese grew wheat, which was considered a gift from heaven, by at least 2700 B.C.²⁶ Wheat was also commonly mentioned in the Hellenistic records²⁷ and in ancient documents in Mycenaean Greek.²⁸ Thus, considering the importance and ubiquity of wheat in the diet of the Old World peoples, one can safely assume that as Lehi and his family gathered seeds to bring with them on their voyage to the New World (1 Nephi 8:1), they certainly would have included this most valuable of all grains.

Moshe Feldman points out that since its domestication, an incredible amount of variation has developed in wheat, some seventeen thousand different varieties having been produced.²⁹ Varieties now exist that will grow in nearly every region and climate of the world. The species of wheat that Lehi and his family may have brought with them on their journey to the promised land is not certain. Jane Renfrew recognized two wild and fourteen cultivated species of wheat.³⁰ These wheats have been divided into three groups on the basis of chromosome number, and they can be further divided into species whose seed heads (spikelets) remain intact after threshing (i.e., hulled grain) and those whose grains thresh free from their glumes (chaff) and are called naked grains. The wheats form a polyploid series (multiples of chromosome sets) with fourteen, twenty-eight, and forty-two chromosomes.³¹ These are referred to as diploid, tetraploid, and hexaploid wheats respectively. Hybrids can be attained from crosses between tetraploid and hexaploid wheats. Three different genomes (sets of genetic material), each composed of seven chromosomes, are found in the wheat genus

(*Triticum*), and are labeled as A, B, and D. The diploid wheats have only the A genome. The tetraploid wheats have both A and B genomes. The hexaploid wheats have all three genomes A, B, and D. The diploid form appears to be the most primitive and the tetraploids apparently originated from hybrids between the diploid wheat and another diploid species with the B genome. After hybridization a doubling in the chromosome number resulted in the tetraploid wheats, which subsequently hybridized with yet another diploid species to donate the D genome and form the hexaploid wheats.³² “The sources of the B and D genomes appear to be in the closely related genus *Aegilops*. The B genome is believed to have been donated by an ancestor of the present-day *Aegilops speltoides* whose genomes SS appear to be closely similar to the BB genomes of tetraploid wheat.”³³ Possibly *Aegilops squarrosa* is a donor of the D genome.³⁴

Daniel Zohary and Maria Hopf outlined the wheat types exceptionally well.³⁵ They pointed out that wheat falls into four cytogenetic groups. The groups include one diploid, two tetraploid, and one hexaploid. Forms within each group are interfertile. However, hybrids between groups are highly sterile. They outlined four principal species recognized today in the genus *Triticum*.

- Diploid *T. monococcum* L., or einkorn wheat (AA), is made up of both wild and cultivated forms. Cultivated einkorn, which contained hulled grains, was an important grain crop in the past, but it is not often cultivated in modern times.
- Tetraploid *T. turgidum* L. (AABB) includes wild emmer wheat, cultivated emmer wheat, durum wheat, and several other cultivated tetraploid forms. This wheat was important from the beginning of agriculture and gave rise to many of the present-day, free-threshing, tetraploid durum-type wheats that are favorites for pasta.

- Tetraploid *T. timopheevi* Zhuk (AAGG) includes both wild and cultivated hulled forms. This wheat is only grown in a small area in Georgia.
- Hexaploid *T. aestivum* L., or bread wheat (AABBDD), probably originated under cultivation by the addition of the DD chromosome complement from *Aegilops squarrosa* L. to the tetraploid AABB *turgidum* wheats. This group includes the most important wheats of today.³⁶

At the time Lehi and his family left the Old World, they may have had several species of wheat from which to choose and may in fact have brought more than one species with them. Einkorn wheat (*T. monococcum*) was still cultivated, though not widely, and bread wheat (*T. aestivum*) may have been present as well. Most likely, however, they would have brought one of the tetraploid wheats such as durum wheat (*Triticum turgidum* var. *durum*) or emmer wheat (*Triticum turgidum* var. *dicoccon*). These two species were the most abundantly cultivated varieties in Israel and adjacent countries, with durum being the favorite. Emmer wheat is significantly inferior to durum wheat, since it cannot be as easily and freely threshed as durum. Durum wheat is still, as it was in the time of the Bible, the dominant field crop commonly grown for bread in warm, temperate countries.³⁷

Growing wheat anciently was a labor-intensive undertaking. First the land had to be tilled (or plowed) and then leveled, after which seeds were sown in rows. When the seed heads ripened, the farmer used a sickle to cut the stalks, which were then tied into sheaves and taken to the threshing floor (a flat area of hard, compacted earth) for threshing. This was usually accomplished in Lehi's day by dragging a heavy threshing sled over the wheat, which would grind, cut, and crush the seed heads, thereby separating the naked kernels from the chaff (cf. Isaiah 28:24–28).



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Winnowing was done by hand, allowing the chaff (or husks) to be separated from the grain.

Winnowing followed. On a breezy day the farmer would use his winnowing fork to pick up the chaff and grain mixture from the threshing floor and throw it into the air. The wind would blow the light chaff away, while the heavier grain would fall back to the earth in a pile. The clean grain would then be collected and stored in barns or granaries. The stubble left in the field would be plowed back under or often burned in preparation for planting in the next growing season. That Book of Mormon peoples were familiar with these grain-growing practices is suggested by the use of terms throughout the text such as plowing, tilling, sowing, reaping, chaff, stubble, and sickles (see table 2).

Barley

It is probable that barley is included in the “grain of every kind” (1 Nephi 8:1) brought by Lehi and his family from the Old World to the promised land in the New World.³⁸ It is specifically mentioned by name as one of the cereals raised by Zeniff’s colony (Mosiah 7:22; 9:9) and apparently was a standard upon

which the Nephite monetary system was based: “A senum of silver was equal to a senine of gold, and either for a measure of barley, and also for a measure of every kind of grain” (Alma 11:7; cf. 11:15). Interestingly, barley also appears to have been a standard for biblical monetary systems as well: “Two barley grains made a finger’s breadth, 16 made a hand’s breadth, 24 a span, and 48 were the biblical cubit—about 41 cm”³⁹ (cf. Leviticus 27:16; 2 Kings 7:1, 16, 18).

Barley was a founder crop (basic, staple crop) of Old World Neolithic food production and is still one of the main cereals cultivated in the Mediterranean agricultural belt. In the archaeological record, barley is commonly found with wheat.⁴⁰ It appears to have been “the most abundant grain of the ancient Near East and the cheapest. It was the standard fare of the poor, the ration of the soldier, serf and slave, and the staff of life for the Greek peasantry.”⁴¹ Michael Zohary reports that barley is mentioned more than thirty times in the Bible and no fewer than thirteen times in company with wheat. However, barley was considered inferior to wheat for human consumption and was less valued (e.g., Revelation 6:6). Consequently, it became the poor people’s bread. The advantage barley has over wheat is that it will grow in relatively poor, salty, and arid soils in which wheat may not grow. Moreover, since barley ripens a month or more before wheat, it provided the first new flour each year, and in fact was apparently taken for the omer offerings at the Passover feast. For these reasons, even though wheat is more palatable, barley was perhaps a more important crop in ancient Israel.⁴²

Jack Harlan observes that barley was apparently domesticated from wild races found today in southwestern Asia and was one of the earliest crops domesticated in the Near East. Wild forms with fragile ears (seed heads) have been found in Syria and

date to perhaps as early as 8000 B.C. Similar remains have been found in the southern Jordan highlands, dating to about 6800 B.C., and at Jarmo and the Zargos hills in Iraq around the same time. The first cultivated barley appears in Iran, Syria, Palestine, and Turkey at times ranging between 6000 and 7000 B.C. and is commonly found with remains of other important crops such as emmer wheat, einkorn grain, flax, peas, and lentils. Irrigated barley was present by 6000 B.C. and possibly earlier at Jericho.⁴³ Zohary likewise concludes that the cultivation of barley appears to have begun about 8000 B.C. in southwestern Asia, where the wild progenitor of the primitive two-rowed barley (*Hordeum spontaneum*) is widespread.⁴⁴ Later, the more advanced six-rowed types of cultivated barley were derived under domestication.⁴⁵

The species of barley Lehi and his family would have known are limited. Eighteen species of barley are recognized today, but only two, *Hordeum distichum* (two-rowed barley), and *H. hexastichum* (six-rowed barley) have been cultivated.⁴⁶

Barley ears have a unique structure. They contain triplets of spikelets arranged alternately on the rachis [axis of the barley ears containing spikelets]. According to the morphology of the spikelets, barley under domestication can be divided into two principal types:

1. Two-rowed forms, traditionally called *Hordeum distichum* L., in which only the median spikelet in each triplet is fertile and usually armed with a prominent awn [or beard—bristles that protrude upward from the spikelets]. The two lateral spikelets are reduced, they are born on longer stalks and are grainless and awnless. Each ear thus contains only two rows of fertile spikelets.

2. Six-rowed forms, traditionally referred to as *H. hexastichum* L., in which the three spikelets in each triplet bear seeds and usually all are armed. Ears in these varieties therefore have six rows of fertile spikelets.⁴⁷

Lehi and his family would probably have brought one or perhaps both of these barley species with them on their journey to the New World.

Corn/Maize

Although *corn* is a general term used to refer to grain or kernels of grain in the King James Version of the Bible (e.g., Genesis 41:5; Exodus 22:6; Isaiah 28:28),⁴⁸ when corn is referred to in the Book of Mormon (Mosiah 7:22; 9:9, 14), we assume that Joseph Smith was referring to maize (*Zea mays* L.), or corn as it is known in America today.⁴⁹ That the Prophet Joseph was not using the term in the generic biblical sense is perhaps evidenced in Mosiah 9:9: “And we began to till the ground, yea, even with all manner of seeds, with seeds of corn, and of wheat, and of barley, and with neas, and with sheum, and with seeds of all manner of fruits; and we did begin to multiply and prosper in the land.” As previously mentioned, the appearance in this passage of the Nephite terms *neas* and *sheum* suggests that Joseph Smith was not familiar with the plants to which they referred and so left the terms in their original language.⁵⁰ In contrast, he would have been amply familiar with wheat, barley, and maize, or “corn,” as he would have called it, and accordingly translated the Nephite terms for these grains into English.

Maize is a New World plant first domesticated in the Americas, possibly in more than one area. It is generally believed that maize originated in Mexico and was domesticated from wild maize (*teosinte*) in south central or southwestern Mexico⁵¹ in semiarid regions at elevations above 4,500 feet.⁵² DNA sequence data between two morphologically similar *teosinte* taxa indicate that the wild species of maize diverged about seven hundred thousand years ago from a common ancestor.

The domestication process was relatively recent and may have been based on a relatively small number of founding individuals that retained a substantial proportion of the genetic variation of their progenitors and diverged rapidly in morphology.⁵³ Maize similar to current types has been important in highland Mexico for millennia. Perhaps the earliest appearance of domesticated maize in the area can be found at Tehuacán (Mexico) at levels that may date to as early as 5000 B.C.,⁵⁴ though recent studies with maize starch suggest dates between 5000 and 3000 B.C.⁵⁵ Phytolith analysis⁵⁶ suggests that by 2450 B.C. maize cultivation had reached Ecuador.⁵⁷ By the time early explorers came to America maize was being cultivated from Canada to Chile.⁵⁸

Although maize cultivation was ancient and widespread in the New World, evidence to date indicates that it was not known in the Fertile Crescent at the time Lehi left.⁵⁹ It is not possible to know from the Book of Mormon text when the Lehites first learned of and began maize cultivation in the New World, but it is clear that approximately 450 years after their arrival, corn had become a valued part of their sustenance in the land of Lehi-Nephi (Mosiah 7:22; 9:9, 14). They would probably have learned of maize long before then from other peoples already living in the land when they arrived.⁶⁰

Neas and Sheum

Neas and sheum are included in the list of crops grown by Zeniff's colony in the land of Lehi-Nephi around 200 B.C. (Mosiah 9:9).⁶¹ As discussed above, these words are apparently Nephite terms used to refer to plants with which Joseph Smith was unfamiliar and which he therefore did not translate into English equivalents. John Tvedtnes suggests that because the terms appear in a list of cereal grains including corn, wheat,

barley, and other seeds, perhaps sheum and neas are grain food crops as well (Mosiah 9:9).⁶² He notes that in the ancient Akkadian language a term cognate to *sheum* was used to refer to cereal grains, often either wheat or barley. Hildegard Lewy identifies the term *sheum* with the ancient Assyrian term used to refer to barley,⁶³ and John Brinkman et al. view the term *še'u* as referring to barley, grains, and sometimes pine nuts.⁶⁴

Tvedtnes further suggests that neas may be compared with a Late Babylonian term for an unidentified plant and that the ending or last two letters may be related to a Sumerian word referring to either wheat or cereal grains. Moreover, he postulates that “the initial element may be from Sumerian *ni*, which is known in the word *ni-gig*, denoting something of grain.”⁶⁵

While neas and sheum were most certainly crop plants, it is also tenable that they were not grains. The list of crops in which the terms appear reads: “And we began to till the ground, yea, even with all manner of seeds, with seeds of corn, and of wheat, and of barley, and with neas, and with sheum, and with seeds of all manner of fruits” (Mosiah 9:9). The wording suggests that while corn, wheat, barley, and fruits were clearly propagated from seeds, perhaps neas and sheum were not. While cereals are always propagated from seeds, some plants are propagated from tubers and others from slips or cuttings. Anciently, there were many nongrain food crops being utilized by the indigenous people in the Americas that would have been unknown to Joseph Smith. For example, at Guitarrero Cave in Peru, researchers found the remains of the oldest cultivated plants in the New World dating to approximately ten thousand years ago. These plants were used for bedding, food, and apparel. They found tubers and rhizomes including *oca* and *ulluco* and a number of fruits and tubers including *lacuma*, *pacae*, and *Solanum hispidum* (potato). The fruits and tubers could have

been gathered wild since they are native to the area. However, they also found common bean (*Phaseolus vulgaris*), lima bean (*P. lunatus*), and chili pepper (*Capsicum* sp.), which must have been cultivated because they are not native to the region. Since Native Americans were cultivating these plants, they may have cultivated the local plant types as well.⁶⁶ We know that Native Americans domesticated and cultivated a wide variety of plants that produce starch-rich roots and tubers. Harlan lists sweet potato, manioc, arrowroot, and jícama as root crops that originated in Mesoamerica.⁶⁷ Dolores Piperno and others have identified manioc, yams, and arrowroot starch grains on milling stones from Panama that date between 5000 and 3000 B.C.⁶⁸ Perhaps neas and sheum were Nephite terms for some of these food plants used from antiquity in the New World.

All Manner of Fruits

In addition to cereal crops, the text clearly indicates that “all manner of fruits” were raised by the Nephites. The diet of New World peoples during Nephite times included a wide variety of fruits. Two Old World fruits, olives and grapes, are also mentioned in the text in metaphorical contexts by Old World prophets or by Christ.

Grapes

In a passage of Isaiah quoted by Nephi, the prophet likened the good works he hoped the covenant people would bring forth to grapes and bemoaned the fact that they brought forth “wild grapes” instead (2 Nephi 15:2, 4). Later, the resurrected Savior also used grapes in a metaphor for the works of men (3 Nephi 14:16). These references constitute the only direct mention of grapes in the Book of Mormon text, and although they give no direct evidence that grapes were actually

cultivated by the Lehites, their metaphorical usage suggests that the descendants of Lehi were familiar with the fruit.

While grapes cannot be directly confirmed as a crop among the Lehites, they certainly had wine. Wine is mentioned in thirty-two verses in the Book of Mormon. Typically, wine is produced from the juice of grapes, although sometimes the word refers to beverages made from other fruits. While there are alcohol-free wines today, it is unlikely that “wine” would have referred to nonalcoholic juices either during biblical (Luke 1:15; 5:38–39)⁶⁹ or Book of Mormon times. Several references to wine in the Book of Mormon indicate that its use could cause one to be inebriated. For example, on one occasion the captive people of Limhi paid a tribute of wine to their Lamanite guards, who became so “drunken and asleep” that Limhi and all his people were able to escape from the land (Mosiah 22:7, 10). Later, Moroni used a similar ploy to incapacitate Lamanite guards (Alma 55:4–24; cf. Alma 55:31).

Lehi and his family would certainly have known of grapes in the Old World. As Zohary explained: “From the dawn of man’s history the vine and its fruit were widely cultivated in the Old Testament world: ‘Noah was the first tiller of the soil. He planted a vineyard’ (Genesis 8:20). . . . The identification of the Hebrew *gefen* with ‘vine’ is as unquestionable as *kerem* with ‘vineyard’ and *anavim* with ‘grapes.’ Innumerable words in the Bible are associated with planting, pruning, vintage and wine production, and various terms designate the parts of the plant and its fruit varieties.”⁷⁰ The vine grows wild in temperate regions of western Asia, southern Europe, Algeria, and Morocco. It also appears in Armenia, to the south of the Caucasus and the Caspian Sea. Anciently it was mentioned in Bactriana, Kabul, Kashmir, and in Badakkhan to the north of the Hindu Kush. Seeds of the grape have been found in lake

dwellings near Parma and Switzerland. It was assumed that both Semitic and Aryan nations knew the use of wine and may have introduced it into all of the countries into which they migrated, which would include India, Egypt, and Europe. Winemaking in Egypt goes back five or six thousand years. And of course the Phoenicians, Greeks, and Romans used it extensively. The Chinese did not cultivate the vine in their provinces before about 122 B.C., but the existence of several wild vines has been documented in northern China.⁷¹

H. P. Olmo reports that an estimated ten thousand cultivars of the Old World grape are thought to derive from a single species, *Vitis vinifera* L.⁷² The wild species is thought to have originated in Middle Asia and is still found from northern Afghanistan to the southern borders of the Black and Caspian Seas. The cultivated grape is closely related to wild vine forms distributed throughout Europe and western Asia. Botanists thought these wild grapes were an independent species, *V. sylvesteres*, but since the wild forms are so closely related to the domestic forms, most botanists now regard the wild *sylvesteres* as a race of the cultivated crop.⁷³ Olmo further suggests that domestication began when migratory nomads marked forest trees that supported fruitful vines—such as poplar, pear, willow, plum, or fig—in order to be able to return to them. Vineyards developed later when they could be protected from domesticated sheep and goats by high, mud walls. In the Near East, cultivation of the grape is thought to have occurred as early as the fourth millennium B.C. Domesticated varieties from Asia Minor and Greece were dispersed westward by Phoenician sea routes. The spread of the Christian faith during the Roman period also helped to disseminate domesticated varieties. The spread of grapes followed the main river valleys—the Danube, Rhone, Rhine, Tiber, and Douro. Olmo also

suggests that grapes were introduced to the New World when it was discovered. Spanish and Portuguese voyages helped the spread of grapes.⁷⁴

Wild New World grapes were apparently harvested by Native Americans, but there is no evidence that they ever tried to cultivate them. Early Europeans in the New World used some wild and weedy species such as the fox grape (*V. labrusca*), which grows well in forest margin habitats along the edges of woods and fence rows. After early settlers converted forests to farms, this forest margin habitat was increased significantly and provided conditions appropriate for hybridization of various species of grape. Some of the better known American grapes were selected from such hybrid populations. Early attempts were made to introduce the European grape (*V. vinifera*) germ plasm by crossing it with American species. Most of the early attempts were not successful.⁷⁵ However, in modern times, a number of wild species native to America have been successfully used for breeding new varieties of grape or as hardy stock for grafting.⁷⁶

The Lehites probably did not bring Old World grapes with them to the New World. Anciently, domesticated grapes were cloned from cuttings, as is the practice today. Some grape clones date back hundreds of years, perhaps more than a thousand years in some instances.⁷⁷ Grape seeds are considered too genetically variable to reliably reproduce domesticated plants, often growing into plants that produce “wild,” nondesirable fruit.⁷⁸ If the Nephites wanted to grow grapes at their new location, they would have taken cuttings, but cuttings would in all probability not have survived the journey. Accordingly, it is our opinion that any grapes that may have been cultivated by the Lehites came from native stock or that the wine to which the text refers was produced from some other fruit.

Olives

Olives are mentioned frequently in the books of 1 Nephi and Jacob (see table 1), but, as with grapes, they are used in the context of metaphors rather than referred to as an agricultural crop cultivated by the Lehites, leaving us with no direct confirmation that they actually grew olives in the New World. However, coming from the Old World, the Lehites certainly would have been familiar with olive culture. From antiquity, the olive was important in the diet of the inhabitants of the Mediterranean basin, and its oil was used for holy anointing of kings and priests, anointing the sick, and lighting, as well as for a solvent for spices, incense, and aromatics used as perfumes and in cosmetics.⁷⁹ Indeed, the olive was perhaps the most important plant, having both culinary and religious significance in ancient Israel.⁸⁰ Wilford Hess et al. offer an extensive discussion of olive culture, particularly as related to Jacob 5, making it evident that olives have been an important crop throughout the Mediterranean since about 3000 B.C.⁸¹ Daniel Zohary and Pinhas Spiegel-Roy report that olive stones and wood charcoal were found in Chalcolithic Horizons (3200 B.C.) in Tel Masos near Beersheva in early Bronze Age deposits, which date approximately from 2900 to 2700 B.C.⁸² Likewise, J. Boardman observes that olives were cultivated in Palestine by at least the early part of the third millennium B.C. and possibly as early as the fourth millennium.⁸³

It is commonly held that olive cultivation began in the region that includes northern Palestine and southern Syria. There are three Chalcolithic sites in the Jordan valley that have plant microremains indicating early olive tree cultivation and an economy based largely on the olive tree.⁸⁴ Some writers conclude that the olive was not first cultivated in Palestine. For example, Colin Renfrew suggests that the olive was domesticated



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Stone olive press used for extracting oil from olives.

in the Aegean region rather than in the Levant.⁸⁵ However, W. B. Turrill notes that mythological legends in Greece suggest that the cultivated olive came into Greece from an external source.⁸⁶ Archaeological evidence confirms the importance of olives in Greece from early Minoan times, about 1300 B.C. Regardless of the exact location of domestication, certainly olives were important very early on throughout the Mediterranean region and would have played a significant role in Lehi's Old World life.

Because of the olive's importance in the Old World, it would not be unreasonable to postulate that the Lehites attempted to bring the fruit with them to the New World, but it is our opinion that they would not have succeeded. During Old and New Testament times,⁸⁷ and even today,⁸⁸ the propagation of olive trees has involved taking cuttings from desirable trees rather than attempting to propagate trees by seeds. Seeds are too genetically variable to reliably produce quality plants that provide good fruit and oil. Domesticated plants with desirable characteristics have been propagated by cuttings since before

recorded history.⁸⁹ Accordingly, we can assume that Lehi and his family were amply familiar with the olive culture practices of the day and, had his family attempted to bring olives with them, they would have brought cuttings rather than seeds. Unfortunately, as with grape cuttings, it is improbable that olive cuttings would have survived the journey to the New World. Moreover, even if the cuttings remained viable, they likely would not have survived in the new climate. Olives are adapted to the Mediterranean climate with warm, wet winters and hot, dry summers. The plants require winter chilling but will not tolerate an average temperature below 34°F (1.3°C) for the coldest winter month. They will grow at elevations up to about 550 meters above sea level and even up to 600 meters for some varieties. The plants thrive on calcareous schistose sandy or even rocky soils with good drainage.⁹⁰ The only places olives thrive in the Americas are areas with Mediterranean climates, including regions of California, Chile, and Argentina.⁹¹ It is interesting to note that the olive is not mentioned in the Book of Mormon after Jacob 6, perhaps a further indication that olive culture was not actually practiced by the Lehites.

All Manner of Cloth

Both the Lehites and Jaredites developed a textile industry, with the production of “precious clothing” sometimes being viewed as a sign of industry and favor with God (e.g., Alma 1:29; Ether 9:17; 10:24), but more often as a mark of pride and worldliness (e.g., 1 Nephi 13:7, 8; Alma 4:6). While all the types of cloth produced by the Lehites are not clearly identified in the text, two of the most prized fabrics, linen and silk, are specified. If the linen and silk of Lehi’s world are the same fabrics we recognize today, then linen would have been produced from plants and silk from

silkworms raised on plants that may have been cultivated by the Lehites.

Linen

“Fine-twined linen” or “fine linen” is mentioned throughout the Book of Mormon text (see table 2).⁹² The Lehites would have been well-acquainted with linen, the fabric made from the fibers of the flax plant, in the Old World. Flax was probably the oldest cultivated plant used for weaving clothing and, until recently, was extensively grown from the Atlantic coast of Europe in the west, to Russia and India in the east, and to Ethiopia in the south.⁹³ Flax fibers are stronger than cotton or wool and anciently were the principal vegetable fiber used for weaving textiles in Europe and western Asia. In modern times, flax has gradually been replaced by cotton as the fiber plant of choice.⁹⁴

Researchers have concluded that cultivated flax (*Linum usitatissimum* L.) was derived anciently from a single species composed of several slightly different forms.⁹⁵ Archaeological evidence indicates that flax belongs to a group of plants that were present during the start of agriculture in the Near East, where it is thought to have first been domesticated. No definitive evidence indicates the precise start of domestication of flax in the Near East, but the gradual increase in seed size and use of linen indicate that flax cultivation in the region was apparently practiced before 6000 B.C.⁹⁶ In the traditional capital of Crete, flax was well known.⁹⁷

Linen's popularity spread throughout the ancient Near East because the flax plant is easily disseminated by seeds. Flax was possibly associated with the earliest records of civilization in deposits of the Swiss Lake Dwellers. Cultivated flax appeared by at least 1000 B.C. in Egypt and the Middle East. The Egyptians

wore linen and used linen to wrap their mummies, and linseed oil was used for embalming. The early Greeks and Romans cultivated flax for both fiber and seed, and the plant, or its products, is also mentioned by Virgil, Ovid, Cicero, and Pliny.⁹⁸

Flax is commonly mentioned in the Bible. According to M. Zohary, during biblical times it was exclusively a fiber plant, and its cultivation dates back to 5000 B.C. in the Middle East, including the land of Israel, where he assumes domesticated flax originated.⁹⁹ The fibers for spinning, the linen produced, and the flax plant itself are all expressed by the Hebrew word *pishtah*. Flax was a principal oil and fiber source in the Old World and probably the earliest cultivated plant used for weaving clothes.¹⁰⁰ The famous Shroud of Turin, thought to have an image of the Savior, is linen.¹⁰¹

Flax found its way to the New World as well. Liberty Bailey observes that cultivated flax was “widely distributed, probably originally from Asia; escaped in waste places in N. Amer.”¹⁰² Thus, when translating the Book of Mormon, the Prophet Joseph certainly would have been familiar with linen, and we can assume that he translated the term accurately. We can also assume that the Lehiters would have included flax among the “seed of every kind” which they brought with them to the New World. The Jaredites had linen as well, and in all probability they brought flax seeds with them on their trek to the promised land. Since the plant grows well in the wild, flax was possibly already established by the time the Lehiters arrived.

Silk

A textile that Joseph Smith identified as silk or silks was produced by both the Lehiters and Jaredites in times of prosperity (see table 2).¹⁰³ While Joseph Smith was most likely familiar with silk, it was not a fabric produced at that time in

the Americas nor was it the most common cloth encountered in his backwoods upbringing. Accordingly, it is our opinion that while the fabric he identified as silk from the Book of Mormon text may have indeed been the silk we know today, it is also tenable that the fabric was something silklike. True silk is a fabric produced from fibers made by silkworms feeding on mulberry leaves. The mulberry tree (*Morus* L.) is not mentioned in the Book of Mormon text, but in parts of the Old World, the trees have been cultivated since antiquity for edible fruit and leaves for silkworm forage. There are only twelve species of mulberry, but because of morphological variability within some species, approximately ten times that many have been described.¹⁰⁴ The two most common species are white mulberry (*Morus alba* L.) and black mulberry (*M. nigra* L.). White mulberry is preferred for silk production. Silk has long been produced in China and Japan where the number of different varieties of white mulberry grown suggests that cultivation dates from ancient times. The white mulberry probably reached western Asia and southern Europe after monks brought the silkworm to Constantinople under Justinian in the sixth century A.D. If the white mulberry did not originally exist in Persia and the regions of the Caspian Sea, it must have penetrated there a very long time ago as well. The names *tutti* and *tuta*—which are Persian, Arabic, Turkish, and Tartar—have a similarity to the Sanskrit name *tula*. The white mulberry has been commonly used in Europe for raising silkworms. A variety of this plant is also commonly cultivated in India, and some varieties grow wild in northern India. However, no biblical Hebrew name is known for the plant.¹⁰⁵

Black mulberry is more valued for its fruit than for its leaves and is distinguished from the white by several characteristics besides the color of the fruit. It also has a greater number of varieties than white mulberry.¹⁰⁶ P. M. Smith notes that the

black mulberry is native to Iran and Asia Minor but has been cultivated in the Mediterranean area for many centuries.¹⁰⁷ He observes that not only is it referred to in the Bible, but also by Greek and Roman writers. Zohary notes that although silk is mentioned several times in the Bible, neither biblical nor post-biblical literature refers to its production.¹⁰⁸ He suggests that the rendition of *tut* in Maccabees as “mulberry tree” is tenable, though the words *sycamine* in Luke 17:6 and *mesukan* in Isaiah 40:20 may or may not be mulberry. He points out that *mesukan* is clearly related to the Sumerian *messikanu* or *sakannu*, which are thought to refer to mulberry. Zohary also notes that “The black mulberry, possibly a derivative of the white, grows wild in northern Persia, on the shores of the Caspian Sea and in ancient Colchis, whence it was introduced long ago into the lands of the Bible. Such early introduction from Persia and its neighbors was true of the apple, the pomegranate, the fig and the pistachio.”¹⁰⁹ John Sorenson and Carl Johannessen suggest that some species of mulberry were in the New World before Columbus and that the bark from the trees may have been used for making paper and cloth.¹¹⁰

Although mulberries were obviously present in Israel during Lehi’s time, there is no evidence of silk production in the area. In light of the fact that the Lehites were probably not familiar with silk production and because mulberry is not directly referred to in the Book of Mormon, we cannot confidently conclude whether the silk of the Lehites was true silk produced from silkworms or was from a plant fiber.

Other Textiles of Lehi’s World

In the Old World, both plant and animal fibers were used for textiles, though Mosaic law prohibited the mixing of plant and animal fibers like linen and wool (e.g., Leviticus 19:19).

Since the Lehites “did cause that the women should spin, and toil, and work, and work all manner of fine linen, yea, and cloth of every kind” (Mosiah 10:5), we may assume that they used animal fibers as well.

Cotton was probably an important source of plant fiber. There are both Old World and New World cotton varieties. The diploid species of *Gossypium herbaceum* and *G. arboreum* were cultivated in the Old World at least five thousand years ago. *G. arboreum* became the dominant species throughout Asia and Africa.¹¹¹ Early evidence of cotton in the New World has been found at Tehuacán dating to the same time period as maize, 5000 to 3000 B.C. In Peru, naturally colored types of cotton are still grown today.¹¹² Interestingly, world cotton production in modern times is based primarily on the species *G. hirsutum*, which is actually a cross between an Old World species (*G. herbaceum*) and a Peruvian species (*G. raimondii*). Researchers postulate that the first cross of these two species may have initially taken place as far back as the start of the Pleistocene. It apparently took place long enough ago for at least four known species to have evolved from it and for one of those evolved species to have reached the Hawaiian Islands.¹¹³ Considering the importance of cotton in the Old World, it is possible that the Jaredites or Lehites brought cotton with them to the New World and that they encountered, recognized, and used New World varieties when they arrived.

Conclusion

Agriculture played an important role in Lehi's world. Raising, harvesting, and securing crops were major concerns of the Lehites. They cultivated “all manner” of grains, fruits, and textile crops. Many of the crops identified by name were important in the Old World—which Lehi left behind on his

journey to the promised land in the Americas—and were likely brought with his family on their pilgrimage. Once here, some of those crops, such as wheat and barley, were successfully propagated and cultivated, at least for a time, and continued to provide sustenance for the Lehighites. As one would expect, the Lehighites also adopted New World crops into their diets, most specifically corn (maize), and perhaps neas and sheum. For the Lehighites, successful agricultural endeavors became a mark not only of prosperity, but of favor with God as well. Future research applying genomics to trace plant ancestry¹¹⁴ may yet help us identify any remnants of crop plants that the Lehighites brought from the Old World and further elucidate Old and New World affinities for the plants we have discussed.

TABLE 1

Summary of Plants Mentioned in the Book of Mormon

Plant	Reference
Barley	Mosiah 7:22; 9:9; Alma 11:7, 15
*Briers	2 Nephi 15:6; 17:23–25; 19:18; 20:17
*Cedars	2 Nephi 12:13; 19:10; 24:8
Corn	Mosiah 7:22; 9:9, 14
*Figs	3 Nephi 14:16
*Fir	2 Nephi 24:8
*Grapes	2 Nephi 15:2, 4; 3 Nephi 14:16
*Lilies	3 Nephi 13:28
Neas	Mosiah 9:9
*Olive	1 Nephi 10:12, 14; 15:7, 12, 16; Jacob 5:3–46; 6:1
Sheum	Mosiah 9:9
*Sycamores	2 Nephi 19:10
Thistles	Mosiah 12:12; 3 Nephi 14:16
Wheat	Mosiah 9:9; 3 Nephi 18:18

Entries marked with an asterisk are plants and terms that are used metaphorically by Old World prophets or by Christ. See note 3.

TABLE 2

**Summary of Agricultural or Botanical Terms
Found in the Book of Mormon**

Term	Reference
*Barns	3 Nephi 13:26
Blossoms	2 Nephi 15:24; Mosiah 12:12
Bread	2 Nephi 8:14; 13:1, 7; 14:1; Alma 5:34; 8:21, 22; 3 Nephi 14:9; 18:1–6; 20:3–8; 26:13; Moroni 4:3
Chaff	2 Nephi 15:24; 26:18; Mosiah 7:30; Alma 37: 15; Mormon 5:16, 18
Crops	Alma 34:24
*Digging	2 Nephi 15:6; 17:25; Jacob 5:5–76
*Dunging	Jacob 5:47, 64, 76
Famine	1 Nephi 5:14; 2 Nephi 1:18; 6:15; 8:19; 10:6; 24: 30; Mosiah 1:17; 9:3; 12:4; Alma 9:22; 10:22, 23; 45:11; 53:7; 62:35, 39; Helaman 10:6; 11:4– 15; 12:3; 13:9; Ether 9:28, 35; 10:1; 11:7
Forests	1 Nephi 18:25; 2 Nephi 19:18; 20:18, 19, 34; 27: 28; Enos 1:3; Mosiah 8:21; 18:30; 20:8; 3 Nephi 20:16; 21:12; Ether 10:19
Fruit ¹¹⁵	1 Nephi 8:1, 10–35; 11:7; 15:36; 17:5, 6; 18:6; 2 Nephi 2:15, 18, 19; 14:2; 15:1; 20:18; 27:28; Jacob 5:8–77; 6:7; Enos 1:21; Mosiah 3:26; 9:9; 10:4; Alma 5:34, 52, 62; 12:21–23; 32:37–43; 33:1; 42:3; Helaman 6:26; 11:13, 17; 3 Nephi 14:16– 20; 24:11; Ether 9:17, 35
Garners	Alma 26:5
Grafting	1 Nephi 10:14; 15:13, 16; Jacob 5:8–68; Alma 16:17

Grain	1 Nephi 8:1; Enos 1:21; Mosiah 7:22; 10:4; 11:3; 12:6; 21:16, 18, 21; 23:1; 24:18; Alma 1:29; 3:2; 4:2; 11:7; 62:29; Helaman 6:12; 11:6, 13, 17; 3 Nephi 3:22; 4:6; 6:2; Ether 9:17; 10:12
Grass	2 Nephi 8:12; 13:30
Groves	3 Nephi 21:18
Harrow	2 Nephi 9:47; Alma 14:6; 15:3; 26:6; 29:4; 36:12, 17, 19; 39:7; Mormon 5:8
Hoe	Ether 10:25
Linen	1 Nephi 13:7, 8; 2 Nephi 13:23; Mosiah 10:5; Alma 1:29; 4:6; Helaman 6:13; Ether 9:17; 10:24
Plowing	2 Nephi 12:4; Ether 10:25
*Pruning	2 Nephi 12:4; 15:6; Jacob 5:4–76; 6:2
Reaping	2 Nephi 5:11; 26:10; Mosiah 7:30, 31; Alma 3:26; 9:28; 26:5; 32:43; 3 Nephi 13:26; Ether 10:25
Ripening ¹¹⁶	Jacob 5:37, 58; Mosiah 12:12; Alma 26:5
Roots	2 Nephi 15:24; 21:1, 10; 24:29, 30; Jacob 5:8–73; 6:4; Mosiah 14:2; Alma 5:52; 32:37–42; 46:40; 3 Nephi 25:1
Seeds ¹¹⁷	1 Nephi 8:1; 16:11; 18:6, 24; 2 Nephi 5:11; 15:10; 16:13; Mosiah 9:9; Alma 32:28–39; 33:1; Ether 1:41, 43; 2:3
Sheaves	Alma 26:5; 3 Nephi 20:18
Sickles	Alma 26:5
Silk	1 Nephi 13:7, 8; Alma 1:29; 4:6; Ether 9:17; 10:24
Sowing	2 Nephi 5:11; Mosiah 7:30, 31; 3 Nephi 7:8; 13:26; Ether 10:25
Stalks	Mosiah 12:11
Straw	2 Nephi 21:7; 30:13

Stubble	1 Nephi 22:15, 23; 2 Nephi 15:24; 26:4, 6; 3 Nephi 25:1
Thickets	2 Nephi 19:18; 20:34; Mosiah 18:5
Threshing	Ether 10:25
Threshing Floor	3 Nephi 20:18
Tilling	1 Nephi 18:24; 2 Nephi 2:19; Enos 1:21; Jarom 1:8; Mosiah 6:7; 9:9, 14; 10:4, 21; 23:5, 25, 31; Alma 42:2; 62:29; Ether 6:13, 18; 10:25
Timber	Helaman 3:5–10
Trees	1 Nephi 8:10–30; 10:12–14; 11:4–25; 15:7–36; 2 Nephi 2:15; 16:13; 17:2; 20:19; 24:8; Jacob 4:6; 5:3–74; 6:1; Mosiah 18:5; Alma 5:34, 52, 62; 12:21, 23, 26; 26:36; 32:37–43; 33:23; 42:2–6; Helaman 3:9; 3 Nephi 4:28; 14:17–19; Ether 2:17
Vines	1 Nephi 15:15; 2 Nephi 15:2; 17:23; Alma 16:17; 3 Nephi 24:11
Vineyards	2 Nephi 13:14; 15:1–10; Jacob 5:3–77; 6:2–3; Mosiah 11:15; Alma 13:23; 28:14
Wood	1 Nephi 16:23; 2 Nephi 5:15; 17:2; 20:15; Jarom 1:8; Mosiah 11:8–10; Helaman 3:11; 3 Nephi 8:21

NOTES

1. Agriculture is typically thought to include animal husbandry, but this report will focus only on farming and botany.

2. We will use the term *Lehites* to refer to the descendants of Lehi, both Nephite and Lamanite.

3. Old World prophets quoted in the Book of Mormon—such as Isaiah, Zenos, and even Christ—often used botanical imagery in their teachings and prophecies. In some instances, there is little

current evidence to indicate that the agricultural practices were actually followed or that the plants they mention were in fact found in the New World, but their very mention suggests that the audience was somehow familiar with the terms.

4. The appearance of the two foreign words *neas* and *sheum* in the text warrants a note about the translation process. In addition to its internal complexity and doctrinal consistency, one of the remarkable aspects of the Book of Mormon is that it was translated in only eighty-five days, often under extreme difficulties. See Larry C. Porter, "The Book of Mormon: Historical Setting for Its Translation and Publication," in *Joseph Smith: The Prophet, the Man*, ed. Susan Easton Black and Charles D. Tate Jr. (Provo, Utah: BYU Religious Studies Center, 1993), 49–64. In discussing the astonishing process by which the Book of Mormon was translated, B. H. Roberts, "Translation of the Book of Mormon," *Improvement Era*, April 1906, 427, raised a question concerning the role of the Urim and Thummim in the process. He states: "We have no statement at first hand from Martin Harris at all, only the statement of another, Edward Stevenson, as to what he heard Martin Harris say was the manner of translation. This was as follows: 'By aid of the seer stone, sentences would appear, and were read by the prophet, and written by Martin, and when finished he would say, "Written," and if correctly written that sentence would disappear, and another appear in its place; but if not written correctly, it remained until corrected so that the translation was just as it was engraven on the plates precisely in the language then used' [Edward Stevenson, 'One of the Three Witnesses,' *Millennial Star* 44 (6 February 1882): 86–87]." Elder Roberts observes that if this account were accurate then it would lead one to assume that the "Urim and Thummim did the translating, not Joseph the Seer." Such a conclusion would imply that the translation would be a "word for word bringing over from the Nephite language into the English language, a literal interpretation of the record. Therefore the language of translation would not be Joseph's, "but the divine instrument's." This would further imply that New England localisms, modern phrases from the English translation of

Hebrew scripture, and words from other sources would be present in the original Nephite record. Elder Roberts concludes that there are difficulties involved in such a theory of translation. It would be impossible to have a word-for-word translation from one language to another, for doing so would produce unintelligible jargon. Since the language of the English translation of the Book of Mormon is in the English idiom, and since errors in grammar can be found in the translation, it seems obvious that the translator is responsible for the language and grammar of the text, and any errors in the record are the faults of man, not of God. Elder Roberts further observes that this assumption should not cast any doubt upon Joseph's role as a seer. Any human imperfections certainly do not detract from the message of the book. Roberts, "Translation of the Book of Mormon," 428. As Joseph worked with the text, he translated Lehte terms and phrases into the terms and idioms of his day. Apparently not having an English equivalent for *neas* and *sheum*, he left them in their original language.

5. J. Derek Bewley and Michael Black, *Seeds: Physiology of Development and Germination*, 2nd ed. (New York: Plenum, 1994), 93.

6. M. Paul Becquerel, "Biologie Végétale: La longévité des graines macrobiotiques," *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences* 199 (1934): 1662. Certainly, barley and wheat seeds are not viable after storage for thousands of years in ancient tombs, as is commonly reported. Bewley and Black, *Seeds*, 89.

7. See Terry B. Ball, S. Kent Brown, Arnold H. Green, David J. Johnson, and W. Revell Phillips, "Planning Research on Oman: The End of Lehi's Trail," *Journal of Book of Mormon Studies* 7/1 (1998): 12–21.

8. This information was provided by Mr. Ali Saaïd Akaak, a Jiballi from Dhofar, in a personal conversation with Terry Ball.

9. David Rindos, *The Origins of Agriculture: An Evolutionary Perspective* (Orlando, Fla.: Academic, 1984), 140.

10. Daniel Zohary and Maria Hopf, *Domestication of Plants in the Old World: The Origin and Spread of Cultivated Plants in West Asia, Europe, and the Nile Valley*, 2nd ed. (Oxford: Clarendon, 1993), 25, 28.

11. John L. Sorenson and Carl L. Johannessen, "Biological Evidence for Pre-Columbian Transoceanic Voyages" (unpublished, expanded manuscript of a paper presented at the conference "Contact and Exchange in the Ancient World," Philadelphia, Pa., 5 May 2001) note that millet apparently likewise disappeared from regions where it had first been introduced and cultivated in the New World.

12. Daniel B. Adams, "Last Ditch Archaeology," *Science* 83 (December 1983): 32, 37.

13. Nancy B. Asch and David L. Asch, "Archeobotany," in *Deer Track: A Late Woodland Village in the Mississippi Valley*, ed. Charles R. McGimsey and Michael D. Conner (Kampsville, Ill.: Center for American Archaeology, 1985), 79–82.

14. Vorsila L. Bohrer, "Domesticated and Wild Crops in the CAEP Study Area," in *Prehistoric Cultural Development in Central Arizona: Archaeology of the Upper New River Region*, ed. Patricia M. Spoerl and George J. Gumerman, Center for Archaeological Investigations, Occasional Paper 5 (Carbondale, Ill.: Southern Illinois University, 1984), 249, 252.

15. While organic artifacts of wheat have not been and may not ever be found in the New World, analysis of inorganic opaline plant microfossils, called phytoliths, may yet reveal evidence of pre-Columbian wheat cultivation. Researchers are currently developing phytolith classification paradigms for Old World cereals in an effort to produce research tools to explore the possibility. Terry B. Ball, John S. Gardner, and Nicole Anderson, "Identifying Inflorescence Phytoliths from Selected Species of Wheat (*Triticum monococcum*, *T. dicoccon*, *T. dicoccoides*, and *T. aestivum*) and Barley (*Hordeum vulgare* and *H. spontaneum*)," *American Journal of Botany* 86/11 (1999): 1615–23.

16. See John L. Sorenson, *An Ancient American Setting for the Book of Mormon* (Salt Lake City: Deseret Book and FARMS, 1996), 184–85.

17. Alphonse de Candolle, *Origin of Cultivated Plants* (1886; reprint, New York: Hafner, 1967), 354–55.

18. Moshe Feldman, "Wheats," in *Evolution of Crop Plants*, ed. Norman W. Simmonds (London: Longman, 1976), 124.

19. Simcha Lev-Yadun, Avi Gopher, and Shahal Abbo, "The Cradle of Agriculture," *Science* 288 (2 June 2000): 1602.
20. Eviatar Nevo, "Genetic Diversity in Wild Cereals: Regional and Local Studies and Their Bearing on Conservation ex Situ and in Situ," *Genetic Resources and Crop Evolution* 45/4 (1998): 355.
21. Manfred Heun et al., "Site of Einkorn Wheat Domestication Identified by DNA Fingerprinting," *Science* 278 (14 November 1997): 1312.
22. T. A. Brown, "How Ancient DNA May Help in Understanding the Origin and Spread of Agriculture," in *Philosophical Transactions of the Royal Society of London, Series B, Biological Sciences* 354 (29 January 1999): 89.
23. Li Huang et al., "Restriction Fragment Length Polymorphism in Wild and Cultivated Tetraploid Wheat," *Israel Journal of Plant Sciences* 47/4 (1999): 213–24.
24. Michael Zohary, *Plants of the Bible: A Complete Handbook to All the Plants* (Cambridge: Cambridge University Press, 1982), 74.
25. In this biblical text the term *corn* is used to refer to cereal grains and likely means wheat. When the King James Version was translated, corn was the common name in England for wheat or grain. Wheat or grain is still commonly referred to as corn today in the UK and in India, which was influenced by colonizers from the UK. However, the Book of Mormon references to corn appear to refer to maize, which Americans call corn.
26. De Candolle, *Origin of Cultivated Plants*, 355.
27. Michael I. Rostovtzeff, *The Social and Economic History of the Hellenistic World* (Oxford: Clarendon, 1959), 240, 335, 359, 1164, 1168, 1187, 1450.
28. Michael Ventris and John Chadwick, *Documents in Mycenaean Greek* (London: Cambridge University Press, 1973), 213–15.
29. Feldman, "Wheats," 120.
30. Jane M. Renfrew, *Paleoethnobotany: The Prehistoric Food Plants of the Near East and Europe* (New York: Columbia University Press, 1973), 40.
31. Tetsu Sakamura, "Kurze Mitteilung über die Chromosomen-

zahlen und die Verwandtschaftsverhältnisse der *Triticum*-Arten,” *Botanical Magazine (Tokyo)* 32 (1918): 151–52.

32. Renfrew, *Paleoethnobotany*, 41.

33. Ibid.

34. Ibid.

35. Zohary and Hopf, *Domestication of Plants*, 24.

36. There are many other classification paradigms for wheat, but for the sake of simplicity and consistency we will use this cytogenetic classification in this paper.

37. Zohary, *Plants of the Bible*, 74; Zohary and Hopf, *Domestication of Plants*, 39.

38. See “Barley in Ancient America,” in *Reexploring the Book of Mormon*, ed. John W. Welch (Salt Lake City: Deseret Book and FARMS, 1992), 130–32; and Sorenson, *Ancient American Setting*, 184–86.

39. Richard M. Klein, *The Green World: An Introduction to Plants and People*, 2nd ed. (New York: Harper and Row, 1987), 298.

40. Zohary and Hopf, *Domestication of Plants*, 54.

41. Jack R. Harlan, “Barley,” in *Evolution of Crop Plants*, 95.

42. Zohary, *Plants of the Bible*, 76.

43. Harlan, “Barley,” 93–94.

44. Zohary, *Plants of the Bible*, 76.

45. Daniel Zohary, “The Progenitors of Wheat and Barley in Relation to Domestication and Agriculture Dispersal in the Old World,” in *The Domestication and Exploitation of Plants and Animals*, ed. Peter J. Ucko and G. W. Dimbleby (Chicago: Aldine, 1969), 55.

46. There are hundreds of modern varieties of these two cultivated barleys and thousands of landraces. Zohary and Hopf, *Domestication of Plants*, 55. They are currently cultivated from the polar regions to the tropics. Zohary, *Plants of the Bible*, 76.

47. Zohary and Hopf, *Domestication of Plants*, 55.

48. See note 25 above.

49. See John L. Sorenson, *Images of Ancient America: Visualizing Book of Mormon Life* (Provo, Utah: Research Press, 1998), 35, 37; and Sorenson, *Ancient American Setting*, 28, 98–99, 139–40, 184.

50. See note 4 above.

51. Major M. Goodman, "The History and Evolution of Maize," *Critical Reviews in Plant Sciences* 7 (1988): 197. Richard S. MacNeish, "The Archaeological Record on the Problem of the Domestication of Maize," *Maydica* 30 (1985): 171–78; Richard S. MacNeish, *The Origins of Agriculture and Settled Life* (Norman: University of Oklahoma Press, 1992), 76–78.

52. H. Garrison Wilkes, "Maize and Its Wild Relatives," *Science* 177 (22 September 1972): 1072.

53. Holly Hilton and Brandon S. Gaut, "Speciation and Domestication in Maize and Its Wild Relatives: Evidence from the *Globulin-1* Gene," *Genetics* 150/2 (1998): 863.

54. Major M. Goodman, "Maize," in *Evolution of Crop Plants*, 130.

55. Dolores P. Piperno et al., "Starch Grains Reveal Early Root Crop Horticulture in Panamanian Tropical Forest," *Nature* 407 (19 October 2000): 895. MacNeish, *Origins of Agriculture*, 117; and Emily M. De Tapia, "The Origins of Agriculture in Mesoamerica and Central America," in *The Origins of Agriculture: An International Perspective*, ed. C. Wesley Cowan and Patty Jo Watson (Washington, D.C.: Smithsonian Institution Press, 1992), 143–71, concur with the early dates, while Austin Long et al., "First Direct AMS Dates on Early Maize from Tehuacán, Mexico," *Radiocarbon* 31/3 (1989): 1039, and especially Karen Hardy, "Preceramic Lithics in Central Mexico: An Examination of the Tehuacán and Oaxaca Chronological Sequences" (Ph.D. diss., University College, London, England, 1993), want a more recent date. Hardy's study pointing to more recent dates for Tehuacán culture has been questioned by Kent V. Flannery, "In Defense of the Tehuacán Project," *Current Anthropology* 38/4 (1997): 660–62; and Richard S. MacNeish, "In Defense of the Tehuacán Project," *Current Anthropology* 38/4 (1997): 663–72, but she later defended her position. Karen Hardy, "On the Tehuacán Project: Reply to Flannery and MacNeish," *Current Anthropology* 40/1 (1999): 63–69.

56. See note 15 above.

57. Deborah M. Pearsall, "Phytolith Analysis of Archeological

Soils: Evidence for Maize Cultivation in Formative Ecuador,” *Science* 199 (13 January 1978): 177–78.

58. Hudson T. Hartmann et al., *Plant Science: Growth, Development, and Utilization of Cultivated Plants*, 2nd ed. (Englewood Cliffs, N.J.: Prentice Hall, 1988), 490.

59. Sorenson and Johannessen, “Biological Evidence,” review the literature arguing the possibility of pre-Columbian *Zea mays* (corn) appearance in Eurasia and Africa, but no one suggests its appearance in the Levant before 600 B.C. See also Carl L. Johannessen and Anne Z. Parker, “Maize Ears Sculptured in 12th and 13th Century A.D. India as Indicators of Pre-Columbian Diffusion,” *Economic Botany* 43/2 (1989): 164–80; Walton C. Galinat, “Evolution of Corn,” *Advances in Agronomy* 47 (1992): 203–31; Jonathan D. Sauer, *Historical Geography of Crop Plants: A Select Roster* (Boca Raton, Fla.: CRC, 1993).

60. The text suggests that the Book of Mormon people, for the most part, lived and fought in a relatively small area, perhaps two hundred square miles. The archaeological record indicates that there were other peoples preceding and contemporary with the Lehites throughout the Americas. Sorenson, *Ancient American Setting*, 9–23, 146.

61. See *ibid.*, 185.

62. See John A. Tvedtnes, *The Most Correct Book: Insights from a Book of Mormon Scholar* (Salt Lake City: Cornerstone, 1999), 346, who attributes some of his etymological suggestions to Robert F. Smith.

63. Hildegard Lewy, “On Some Old Assyrian Cereal Names,” *Journal of the American Oriental Society* 76/4 (1956): 202.

64. John A. Brinkman et al., eds., *The Assyrian Dictionary of the Oriental Institute of the University of Chicago* (Chicago: Oriental Institute, 1992), 17:2:345–55.

65. Tvedtnes, *Most Correct Book*, 346.

66. Michael E. Moseley, *The Incas and Their Ancestors: The Archaeology of Peru* (London: Thames and Hudson, 1992), 96–97.

67. Jack R. Harlan, *Crops and Man*, 2nd ed. (Madison, Wis.: American Society of Agronomy and Crop Science Society of America, 1992), 77.

68. Piperno et al., "Starch Grains," 895.
69. Klein, *Green World*, 300–301.
70. Zohary, *Plants of the Bible*, 54.
71. De Candolle, *Origin of Cultivated Plants*, 191–94.
72. H. P. Olmo, "Grapes," in *Evolution of Crop Plants*, 295.
73. Cf. Zohary and Hopf, *Domestication of Plants*, 144.
74. Olmo, "Grapes," 295.
75. Harlan, *Crops and Man*, 132.
76. Zohary and Hopf, *Domestication of Plants*, 148.
77. Researchers using DNA testing in studies of Neolithic pottery have determined the genetic past of grapes. Patrick E. McGovern, "Searching for the Beginnings of Winemaking," *Expedition* 41/1 (1999): 4–5. One such study determined that one of the world's most successful clones, the Cabernet Sauvignon grape, is a hybrid. "Secrets of the Cabernet," *Economist* 343 (3 May 1997): 72.
78. Grape seeds were likely disseminated by birds long ago, even before fruit was cultivated. De Candolle, *Origin of Cultivated Plants*, 191–92.
79. Zohary and Hopf, *Domestication of Plants*, 137.
80. David Eitam and Michael Heltzer, eds., *Olive Oil in Antiquity: Israel and Neighboring Countries from the Neolithic to the Early Arab Period* (Padova: Sargon, 1996); Rafael Frankel, *Wine and Oil Production in Antiquity in Israel and Other Mediterranean Countries* (Sheffield: Sheffield Academic Press, 1999), 38.
81. Wilford M. Hess, Daniel J. Fairbanks, John W. Welch, and Jonathan K. Driggs, "Botanical Aspects of Olive Culture Relevant to Jacob 5," in *The Allegory of the Olive Tree: The Olive, the Bible, and Jacob 5*, ed. Stephen D. Ricks and John W. Welch (Salt Lake City: Deseret Book and FARMS, 1994), 484–562.
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83. J. Boardman, "The Olive in the Mediterranean: Its Culture and Use," in *Philosophical Transactions of the Royal Society of London Series B* 275 (1976): 194.
84. Reinder Neef, "Introduction, Development and Environmen-

tal Implications of Olive Culture: The Evidence from Jordan,” in *Man's Role in the Shaping of the Eastern Mediterranean Landscape*, ed. S. Bottema, G. Entjes-Nieborg, and W. Van Zeist (Rotterdam: Balkema, 1990), 295.

85. Colin Renfrew, *The Emergence of Civilisation: The Cyclades and the Aegean in the Third Millennium B.C.* (London: Methuen, 1972), 304; Ventrìs and Chadwick, *Documents in Mycenaean Greek*, 50, 217.

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87. Hess et al., “Botanical Aspects of Olive Culture,” 484–562; Wilford M. Hess, “Botanical Comparisons in the Allegory of the Olive Tree,” in *The Book of Mormon: Jacob through Words of Mormon, To Learn with Joy* (Salt Lake City: Bookcraft, 1990), 87–102.

88. N. Jacobini, M. Battaglini, and P. Preziosi, “Propagation of the Olive Tree,” in *Modern Olive-Growing*, ed. J. Humanes Guillén and J. M. Philippe (Rome: United Nations Development Programme [UNDP] Food and Agriculture Organization of the United Nations [FAO], 1977), 27.

89. Hess et al., “Botanical Aspects of Olive Culture,” 495–96, 498–99, 541.

90. Renfrew, *Paleoethnobotany*, 133–34.

91. Hess et al., “Botanical Aspects of Olive Culture,” 553–54; see Sorenson, *Ancient American Setting*, 232.

92. “Possible ‘Silk’ and ‘Linen’ in the Book of Mormon,” in *Reexploring the Book of Mormon*, 162–64.

93. A. Durrant, “Flax and Linseed,” in *Evolution of Crop Plants*, 191–92; Zohary and Hopf, *Domestication of Plants*, 119.

94. Zohary and Hopf, *Domestication of Plants*, 119.

95. De Candolle, *Origin of Cultivated Plants*, 120.

96. Zohary and Hopf, *Domestication of Plants*, 126.

97. Ventrìs and Chadwick, *Documents in Mycenaean Greek*, 295.

98. Durrant, “Flax and Linseed,” 191.

99. Zohary, *Plants of the Bible*, 78.

100. Zohary and Hopf, *Domestication of Plants*, 119.

101. Thaddeus J. Trenn, "The Shroud of Turin: A Parable for Modern Times?" *Journal of Interdisciplinary Studies* 9/1–2 (1997): 121.
102. Liberty H. Bailey, *Manual of Cultivated Plants: Most Commonly Grown in the Continental United States and Canada* (New York: Macmillan, 1949), 604.
103. "Possible 'Silk' and 'Linen' in the Book of Mormon," 162–64; and Sorenson, *Ancient American Setting*, 232.
104. Bailey, *Manual of Cultivated Plants*, 336.
105. De Candolle, *Origin of Cultivated Plants*, 149–51.
106. *Ibid.*, 152.
107. P. M. Smith, "Minor Crops," in *Evolution of Crop Plants*, 316.
108. Zohary, *Plants of the Bible*, 71.
109. *Ibid.*
110. Sorenson and Johannessen, "Biological Evidence."
111. L. L. Phillips, "Cotton," in *Evolution of Crop Plants*, 197–98.
112. James M. Vreeland, "Coloured Cotton," *International Development Research Centre Reports* 10/2 (1987): 4–5.
113. Phillips, "Cotton," 198–99. Sorenson and Johannessen, "Biological Evidence," provide a nice review of pre-Columbian transoceanic crossing of cotton theories.
114. Jeffrey Bennetzen, "Opening the Door to Comparative Plant Biology," *Science* 296 (5 April 2002): 60–63; Steven H. Strauss, "Genomics, Genetic Engineering, and Domestication of Crops," *Science* 300 (4 April 2003): 61–62.
115. References using fruit in regard to one's posterity (e.g., "fruit of his loins") or the product of something (e.g., "fruit of one's labors") have not been included in this list.
116. References to "ripening in iniquity" have not been included in this list.
117. References to seed meaning one's posterity have not been included in this list.