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Production Practices

for Irrigated Crops on the High Plains

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The TEXAS AGRICULTURAL AND MECHANICAL COLLEGE SYSTEM
GIBB GILCHRIST, Chancellor

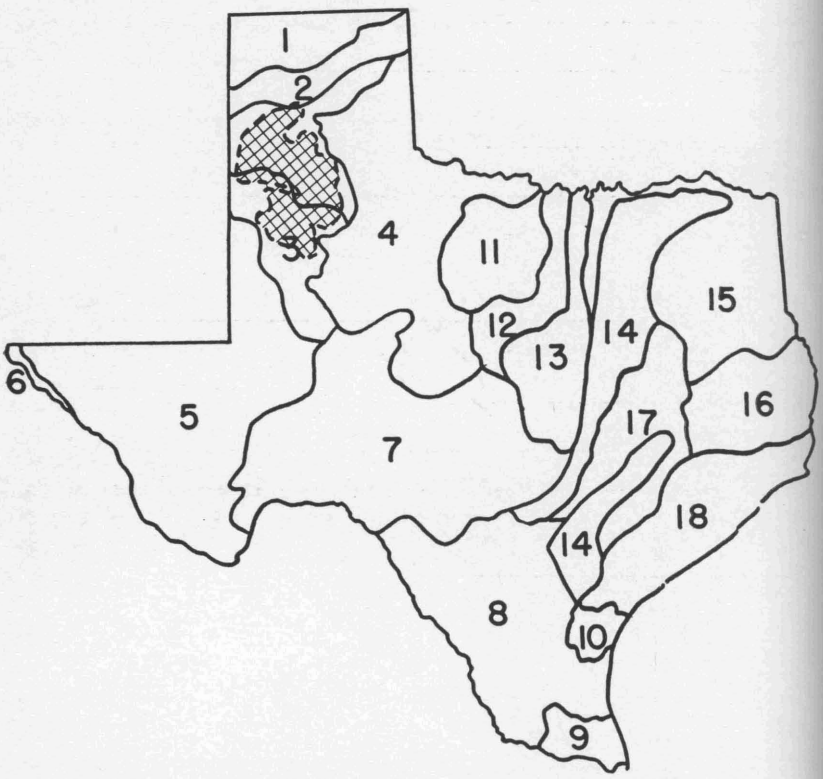

Figure 1. The shaded area shows the approximate boundary of the High Plains irrigated from wells. From Progress Report No. 7, Texas Board of Water Engineers, March 1949.

DIGEST

Under irrigation, the trend in farming on the High Plains has been to increase the emphasis on cash crop production. On sandy soils, almost 70 percent of the irrigated acreage in 1947-49 was planted to cotton and 21 percent to sorghum. No other crop occupied as much as 2 percent of the land. On the heavy soils, sorghum occupied 39 percent of the land irrigated, with cotton and wheat each accounting for about 22 percent. Alfalfa was another crop of major importance.

Irrigation from wells has greatly increased the stability of agriculture on the High Plains. Through irrigation, levels of yields are more than doubled and year-to-year variations in yields are greatly reduced. Irrigation makes possible the production of such crops as alfalfa, sugar beets and potatoes, which cannot be grown successfully without irrigation.

Data concerning production and production requirements for the crops commonly grown under irrigation on the High Plains are shown and discussed in this bulletin. Under production requirements are considered the use of items such as irrigation water, seed, fertilizer, insecticides and other materials, as well as seasonal labor, custom work and other hired services. Also included in the discussion are the usual field operations and the labor and power requirements for each crop. The requirements with both 2 and 4-row equipment are discussed for all row crops. Data for both sandy and heavy soils are shown.

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Production Practices for Irrigated Crops on the High Plains

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THIS BULLETIN REPORTS the results of a study of production requirements and practices for crops grown with irrigation on the High Plains of Texas. It is the third of a series of bulletins prepared from data obtained through a study of management problems on irrigated farms of the High Plains during 1947-49. The two previous publications, Bulletin 745, dealt with the cost of water for irrigation, and Bulletin 756 concerned the use of irrigation water.

Data were obtained from an average of 154 farms with 203 irrigation wells. Seventy of these farms were on sandy loam soils in Lubbock and Hockley counties and 84 were on clay or clay loam soils in Hale, Floyd and Swisher counties. In this bulletin, the term "sandy soils" refers to the sandy loam soils and "heavy soils" refers to clay or clay loam soils.

Only a few of the farmers interviewed grew sugar beets or potatoes. To obtain information concerning production practices for these crops, 35 farms in Deaf Smith county were included in the study during 1949. These farms were on heavy soils.

On the High Plains, irrigation is entirely from wells. Although the first irrigation well was drilled in 1911, there was very little development previous to the middle thirties. The severe drouth of that period and rapidly rising farm prices during World War II, together with the development of more efficient pumps and power units, resulted in increased interest in irrigation. The number of wells increased from about 300 in 1934 to 4,300 in 1945. Since then the rate of development has greatly increased. Although there is no actual count of the number, available information indicates that more than 16,000 irrigation wells were in operation in

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1952 on the High Plains, from which more than 2,000,000 acres of cropland were irrigated. Figure 1 shows the area in which irrigation wells are concentrated.

The average annual rainfall at Lubbock is slightly above 18 inches. This is considered near the lower limits of successful dry-land farming. Even so, dry-land crop production was well developed before irrigation became important, due to the fact that 80 percent of the annual precipitation falls between April and October. Cash crop production is characteristic of the region, with cotton and grain sorghum the main dry-land crops on sandy soils. Much of the heavy land is devoted to wheat production. Although considerably less important than wheat, grain sorghum is the other major crop on the heavy land. Prior to irrigation, cotton occupied a relatively small percent of the dry-land crop acreage on most heavy soils.

IRRIGATED FARMING ON THE HIGH PLAINS

The rapid shift from dry-land to irrigated farming has been accompanied by numerous changes in farm organization and in farming practices. With irrigation, the trend has been more and more toward cash crops. On the farms studied, almost 70 percent of the irrigated cropland on sandy soils was in cotton, and cotton and grain sorghum together occupied more than 90 percent of the total. Most farmers irrigated a few acres of Sudan for grazing. Wheat was a minor crop on sandy soils, whether it was irrigated or not.

As irrigation developed on heavy soils, acreage shifted from wheat to grain sorghum, with the latter occupying 39 percent of the irrigated acreage on the farms studied, while cotton and wheat each accounted for about 22 percent. Here again, most farms had a few acres of irrigated Sudan for grazing.

Alfalfa became an important crop enterprise, particularly on heavy soils, with irrigation. Potatoes and sugar beets were not grown prior to the development of irrigation but subsequently have become important enterprises on heavy soils in several localities.

All crop production is highly mechanized. Most of the farms are equipped with row-crop tractors. Some farmers who grow wheat extensively on heavy soils also own wheatland type tractors. Of the row-crop tractors in use, approximately 55 percent were equipped for 4-row work and 45 percent for 2-row work.

Water is applied before planting to store a reserve of soil moisture and to provide moisture when rainfall is deficient at planting time. Irrigations after planting are to supplement rainfall during the growing season.

PRODUCTION PRACTICES FOR IRRIGATED CROPS

Cotton

Irrigated cotton was grown on 87 percent of the farms and on 70 percent of the irrigated acreage on sandy soils. Farms growing irrigated cotton reported an average of 141 acres, or 80 percent of the total acreage irrigated. More than 50 percent of the acreage was planted to Half and Half and this variety, together with Macha, accounted for about 80 percent of the irrigated cotton.

On heavy soils, cotton was irrigated by 50 percent of the farmers and occupied only 22 percent of the irrigated cropland. Farmers on heavy soils grew very little Half and Half cotton. Here, the Northern Star and Paymaster varieties each comprised about 40 percent of the irrigated crop, while Macha was grown on most of the remaining acreage.

Usual Field Operations and Materials Used

Stalks were cut as the first operation in seedbed preparation, regardless of soil type, when cotton followed either cotton or sorghum. On sandy soils, about one-third of the acreage was chiseled and another third was disked or one-wayed before listing. Stalks were cut on heavy soils as needed. Cotton land was then chiseled, was one-wayed or disked at least once and 80 percent was listed. About 20 percent of the acreage planted to cotton on heavy soils was leveled annually, but there was very little leveling on sandy soils.

On the sandy soils, cotton land was knifed before planting, but only 50 percent was so treated on heavy soils. Preplanting irrigation was usually done between these operations by running water down the lister furrow. Moisture conditions during the spring largely determined the need for preplanting irrigation. On the average, about 80 percent of the sandy soils and 50 percent of the heavy soils were irrigated before planting. Since 1949, the trend has been toward more preplanting irrigation. Ditches were made just prior to watering and were filled before knifing beds.

Cotton was planted as soon as temperature and moisture were favorable. This seldom occurred before the early part of May. An average of 24 pounds of seed was planted per acre,

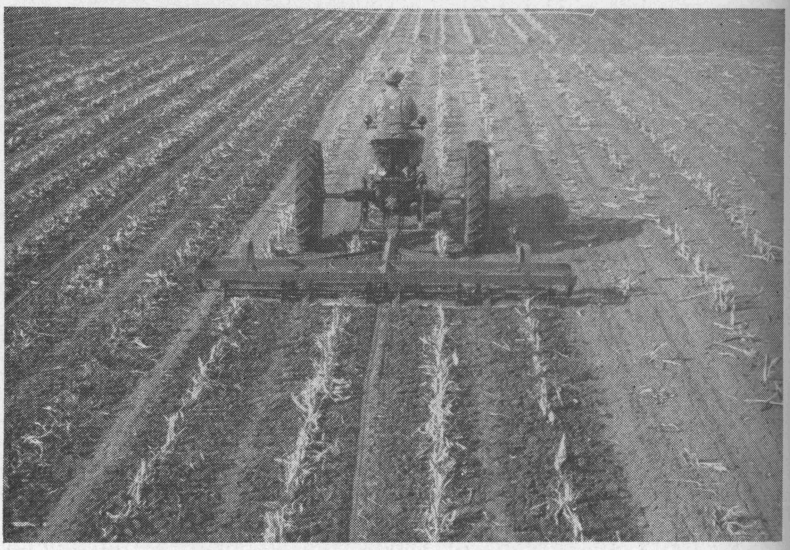

Figure 2. Stalks left from the previous crop were cut as the first operation in preparing a seedbed for row crops.

one time over (Table 1). During the study, 50 percent of the cotton on sandy soils was replanted, whereas replanting averaged only 20 percent on heavy soils. Torrential rains shortly after planting, hail and failure to control damage to young plants from wind-blown soil contributed to the necessity for replanting. Sometimes, weedy cotton was replanted to save hoe labor.

Sandy-land cotton was knifed once and cultivated three or four times. Some cotton on heavy soils was harrowed soon after planting and all was knifed shortly after coming up. Three or more cultivations followed, with many farmers using rotary hoe attachments for the first cultivation.

All cotton was hoed late in June or early in July and on sandy soils was hoed again late in July or during August. Only about one-third of the crop on heavy soils received the second hoeing. Seasonal labor was employed, usually at an hourly rate, for hoeing (Table 2).

Cotton was usually irrigated in July after one or two cultivations. On the average, 80 percent of the crop was irrigated twice. Including preplanting irrigation, an average of 10.8 inches of water was used per acre of cotton on sandy soils and 9.5 inches per acre on heavy soils (Table 1). Ditches were built prior to each irrigation.

Only a few cooperating farmers poisoned to control insects. More recently, the occurrence of thrips, flea hoppers, bollworms and leafworms has increased and more attention is given to problems of insect control. Some farmers hired privately-operated services that contracted to make periodic insect counts and give advice as to controls needed. Some farmers applied insecticides with 4 or 6-row equipment, while others hired commercial airplane dusting or spraying.

Cotton was usually gone over twice in harvesting. The first time over, the crop was snapped. Seasonal labor, usually transient, was used almost entirely for hand harvesting (Table 2). During the second time over, 50 to 60 percent of the acreage was hand snapped and the remainder was machine stripped. The recent trend is toward more machine harvesting. Farmers without strippers hired this work on a custom basis. The usual price paid for machine stripping averaged about 50 percent of the price paid per hundredweight for hand snapping (Table 2).

Prior to 1949, none of the cotton on cooperating farms was defoliated. Eleven percent of the acreage was defoliated during 1949 in preparation for machine stripping.

Labor and Power Requirements

Cotton was produced entirely with row-crop tractors. Labor and power used with both 2 and 4-row equipment are shown in Figure 3. Requirements also are shown for the two major soil groups because of variations in the types of field operations involved. For farms on the same soil type, there was no significant difference in field practices whether 2 or 4-row equipment was used.

The use of multi-row equipment and mechanization has increased operating efficiency by reducing the time required for machine operation. However, operations such as spreading water, hoeing to keep irrigated cotton clean and much of the harvesting of high lint yields were done by hand and required relatively large amounts of labor.

On sandy soils, a total of 39.8 hours of labor was the normal requirement per acre of irrigated cotton with 2-row equipment. Of this, only 12 percent (4.8 hours) was used for tractor operation, and the remaining 88 percent was for hand work. With 4-row equipment, there was a saving of 1.5 hours in tractor work but no saving in hand operations. A similar saving was made by using 4-row equipment on heavy soils.

Preharvesting operations accounted for about 30 percent of the total labor required. With the same size equipment, labor for machine work was similar, regardless of soil type. Labor for hoeing was also the same (5.20 hours per acre) in each case. However, an average of 1.45 hours of labor was used per acre of cotton for one irrigation on sandy soils but only .85 hour per acre on heavy soils. This saving was possible because the runs were longer and it was not necessary to re-set siphon tubes so often on heavy soils. Also, farmers on sandy soils had more trouble from washing and from ditches breaking than was experienced on heavy soils.

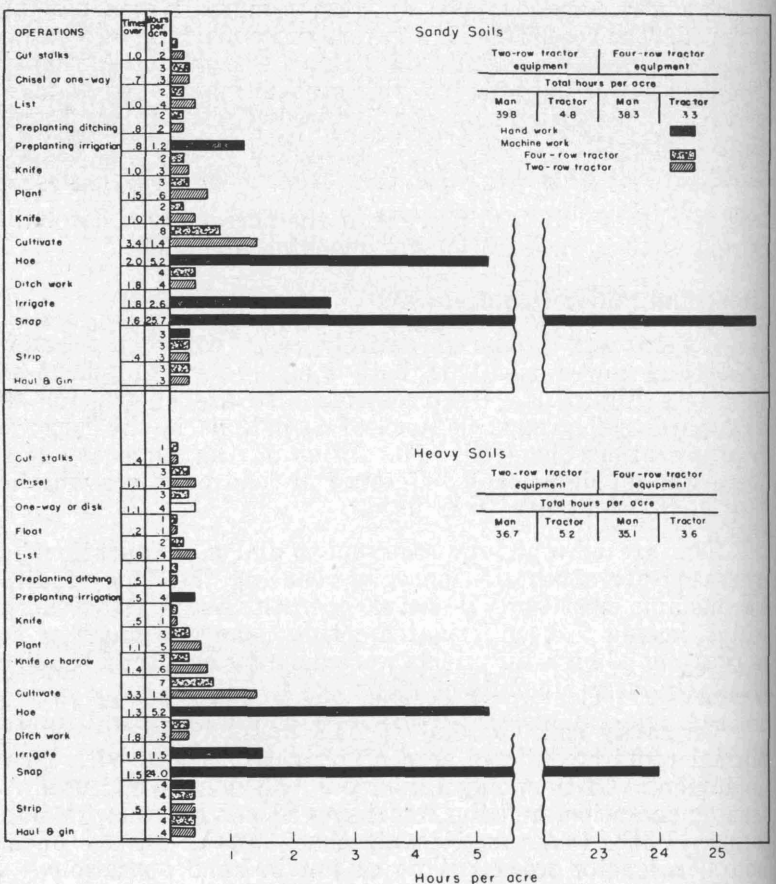

Figure 3. Labor and power required for irrigated cotton production per acre and by operations, 1947-49.

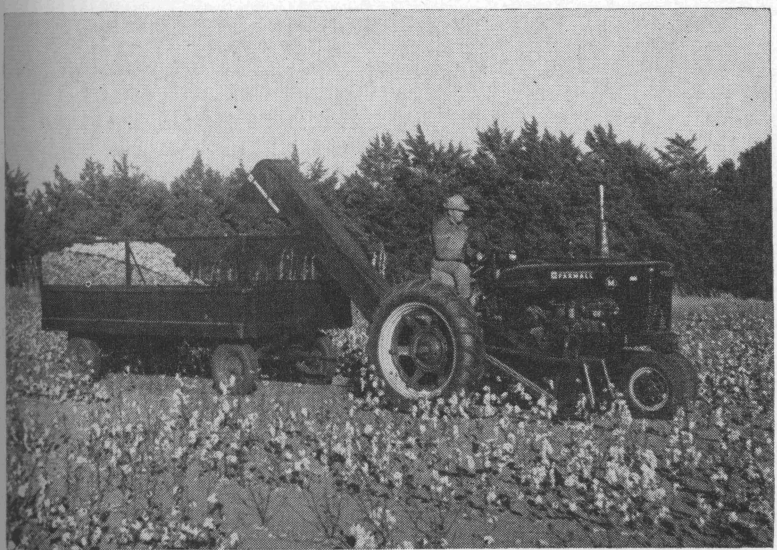

Figure 4. Irrigated cotton was usually gone over twice in harvesting. The first time over, the crop was hand-snapped, but for the second time over, 50 to 60 percent was snapped and the remainder was machine-stripped.

With lint yields averaging nearly a bale per acre (Table 3), 25.7 and 24.0 hours, respectively, of off-farm labor were used for cotton snapping on sandy and on heavy soils. From .6 to .7 hour of labor was used to cover approximately half the total acreage with a stripper.

Although machine operations on dry-land and on irrigated cotton are similar for seedbed preparation, planting and cultivating, nearly twice as much labor was needed for production of the irrigated crop as for the dry-land crop. A large part of this additional labor was for hand work. Spreading water and building ditches were added operations with the irrigated crop. Weed growth was greatly stimulated by irrigation and resulted in a large increase (often double) in the amount of hoeing. The number of cultivations was also materially increased. Irrigation also improved the environment for insects and increased insect control problems.

Irrigated cotton yields averaged more than double dry-land yields (Table 3). Hand-harvesting and ginning costs were in proportion to yields. Machine stripping was slower with irrigated than with dry-land cotton. As a rule, from 25 to 30 percent more labor was required. This was owing to the high yields and rank growth of irrigated cotton.

Grain Sorghum

Grain sorghum, the basic feed grain of the area, was grown primarily as a cash crop and was irrigated by more farmers than any other crop. On heavy soils, sorghum for grain occupied 36 percent of the irrigated acreage and was reported on 90 percent of the farms, while on sandy soils this crop was grown on 19 percent of the irrigated acreage and on 70 percent of the farms. Only combine-type sorghums were grown for grain.

Forage sorghums were planted on 2 to 3 percent of the irrigated cropland. Hegari was the most important of these but is not treated separately in the following discussion.

Usual Field Operations and Materials Used

Seedbed preparation for grain sorghum was similar to that for cotton. On sandy soils, stalks were cut, about 80 percent of the acreage was chiseled or one-wayed, and the entire acreage listed. Some listing was done in February but most of it was done in March. Farmers on heavy soils usually chiseled grain sorghum land and followed with a one-way. About half the acreage was either one-wayed a second time or was disked. About one-third of all sorghum land on heavy soils was leveled or floated at this time.

Preplanting irrigation was usually done in April and on sandy soils varied from 50 percent of the crop in 1947 and 1949 to 70 percent in 1948. Grain sorghum was given less preplanting irrigation than cotton, particularly on heavy soils. On farms where both cotton and grain sorghum were grown, usually cotton beds were watered first, regradless of the soil type. The relatively long planting period for sorghum, in contrast with a short planting period for cotton, and the resulting urgency for getting cotton established, encouraged this practice.

Some growers made two plantings of grain sorghum, one in late April or May and another in June, to facilitate timeliness of cultivation and irrigation throughout the season. About 20 percent of the crop was replanted. Farmers planted 5 or 6 pounds of grain sorghum seed per acre on sandy soils and an average of 7 pounds on heavy soils. Nearly all of the seed were purchased and most of them were certified (Table 1).

Once established, the crop was usually knifed. Some grain sorghum on heavy soils was harrowed instead of knifed, and

Figure 5. Irrigating grain sorghum. By using siphon tubes, water is distributed more uniformly but sets are moved more often and labor requirements are increased.

some was both knifed and harrowed. Two cultivations were common on sandy soils, but on heavy soils only about 20 percent of the crop was cultivated twice.

The first seasonal irrigation commonly followed cultivation. The crop usually was too large to cultivate after being irrigated. As in the case of cotton, most of the water was applied during July and August and was run between the rows. On sandy soils, about 70 percent of the crop received a second seasonal irrigation to bring the total water used, on the average, to 9.8 inches per acre (Table 1). On the heavy soils, where preplanting use of water for sorghum was light, all of the crop was irrigated twice and about a third of the acreage was watered three times. An average of 10.5 inches of water was used per acre on heavy soils.

Because sorghum is seldom cultivated after being irrigated, much of the ditching for the first seasonal watering serves for subsequent irrigations. Irrigation ditches were filled before harvest. Most of the harvesting was done during October and November, between the time of the first and second harvesting of cotton.

Labor and Power Requirements

Grain sorghum production on the High Plains is entirely mechanized except for irrigation. Consequently, very little seasonal labor is needed. In some cases, an extra hand was hired to help with combining. Most farmers own a combine but the others depend on custom combining. Some farmers hired trucks for hauling grain either to market or to farm storage. On the whole, sorghum growers had a very high degree of control of all phases of production.

Labor and power requirements for both 2 and 4-row equipment on both sandy and heavy soils are shown in Figure 6. As in the case of cotton, the size of equipment used had no effect on the kind of field operations or on the number of times these operations were performed.

Average labor requirements for grain sorghum were low, ranging from 7.7 hours per acre with 2-row equipment on sandy soils to 5.2 hours with 4-row machinery on heavy soils. The use of 4 rather than 2-row equipment resulted in a saving of about an hour of tractor work, regardless of soil type.

On sandy soils, an average of 1.35 hours of labor was used per acre in spreading water for each seasonal irrigation of

sorghum. This was nearly twice the requirement for irrigating on heavy soils on which irrigation runs were longer and siphon tubes were re-set less often. Also, more time was spent in repairing broken ditches on sandy soils.

With 2-row equipment on sandy soils, the time spent spreading water and ditching was about 50 percent of the total for all preharvesting operations, and was 60 percent of the total with 4-row machinery. On heavy soils, the time spent spreading water and ditching accounted for 40 to 50 percent of the preharvesting labor.

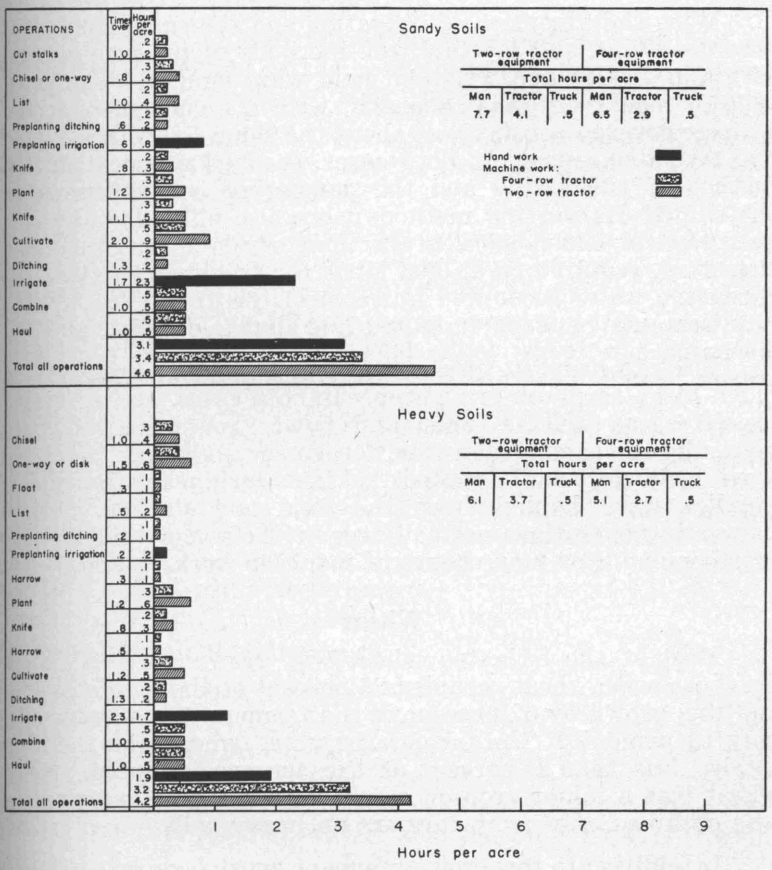

Figure 6. Labor and power required for irrigated grain sorghum production per acre and by operations, 1947-49.

Most of the combines used for harvesting sorghum were operated by one man. Labor requirements for combining, as shown in Figure 6, were calculated on this basis. In some cases, however, two men were required in combining, one to operate the combine and the other to drive the tractor. In the latter case, labor for combining was nearly double that indicated in Figure 6.

The labor required to grow and harvest sorghum was only about 15 to 20 percent of that used to grow and harvest cotton. This is an important factor when seasonal labor is scarce and high priced, and should be considered in making year-to-year adjustments in cropping plans.

With the exception of irrigation and the small amount of accompanying land leveling, the methods of producing grain sorghum on dry and irrigated land were similar. The same type of machinery was used and, with a given machine, the acreage covered per day was about the same for both dry-land and irrigated crops. In both cases, seedbed preparation, the method of cultivating and the number of cultivations were the same. Harvesting methods were also alike, but the irrigated crop yielded more grain than dry-land sorghum and, therefore, required additional labor for trucking. In general, spreading water accounted for most of the difference in labor requirements between irrigated and dry-land sorghum.

Prior to harvest, sorghum grown for forage was handled much like a sorghum grain crop. In both cases, preharvesting practices, as well as labor and power requirements, were generally the same. However, forage sorghum was harvested with a binder and shocked. After curing in the shock, bundles were hauled from the field and stacked. These harvesting operations normally require between 6 and 7 hours of labor and 2 or more hours of machine work.

Wheat

Most of the irrigated wheat was grown on heavy land. On these soils, wheat occupied 23 percent of the land irrigated and was grown by 62 percent of the farmers. On sandy soils, only 13 percent of the farmers irrigated wheat and the crop totaled less than 2 percent of the acreage irrigated. Since wheat was a minor crop on sandy land, practice information was obtained only from farmers on heavy soils.

In addition to row crop equipment, most farmers on heavy sons owned a one-way, a disk, a Graham-Hoeme plow or tool-bar attachment for chiseling and a combine. A grain drill

was the only additional equipment needed to grow wheat. Farmers having a large wheat acreage used larger machines than did those with relatively small acreages.

Usual Field Operations and Materials Used

In preparing the seedbed, the usual practice was to chisel the land once with a Hoeme and to repeat the operation on about one-third of the acreage. Next, the seedbed was cut once with a one-way, and the acreage that had been chiseled only once was cut a second time with either a one-way or a disk. Thus, the entire acreage was normally gone over three times to prepare the seedbed.

The amount of leveling varied from year to year, but an average of 30 percent of the acreage was floated each year of the study. This operation was usually preceded by disking.

Wheat was seeded at the rate of about two-thirds of a bushel per acre (Table 1). On the average, about 10 percent of the acreage was reseeded.

During the years when the growing season was not abnormally dry, most of the wheat was irrigated in April. However, the extremely dry fall of 1947 resulted in nearly 50 percent of the irrigated crop being watered before planting to insure germination. That year, some wheat was irrigated during the late fall and early winter to prevent loss of stand.

During the study, only 20 percent of the irrigated wheat was watered before planting, whereas 30 percent of the crop received a second seasonal irrigation. Including both preplanting and seasonal water, irrigated wheat received an average of 1.5 irrigations yearly. An average of 4.7 acre-inches of water was used per irrigation, or a total of approximately 7 inches per acre irrigated.

Labor and Power Requirements

An average of 3.8 hours of man labor and 2.2 hours of tractor work was required per acre of irrigated wheat (Figure 7). This was the lowest labor requirement among the main crops irrigated on the High Plains. With wheat, modern large-scale tillage machinery was used and all harvesting was by combine. Spreading water was the only field operation not mechanized.

Only a little over an hour's work with machinery was needed to prepare the seedbed. This, together with the amount

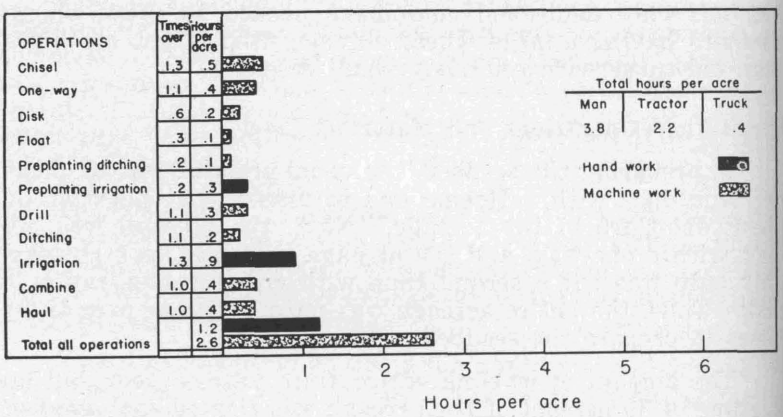

Figure 7. Labor and power required for irrigated wheat per acre and by operations, 1947-49.

of labor for leveling, was the total work prior to seeding when there was no preplanting irrigation. An average of about 1.5 hours of labor was used in spreading water for each acre irrigated before planting. At this time, the soil irrigated was usually loose and very dry, and water spread slowly.

Most wheat was irrigated by flooding from field ditches. Water was run down the slope between field ditches spaced at intervals that varied with the slope, type of soil and head of water. Unless these ditches are carefully laid out, unequal distribution of water is likely to result. With this method, the time required to change sets largely accounts for the .6 hour used for each acre of wheat irrigated.

Preharvesting operations were completed for wheat before most other irrigated crops were planted. This was an advantage when more than one crop was to be irrigated. Wheat and sorghum go together well in an irrigation system of farming as there is relatively little competition between the two crops for labor and for irrigation water. This no doubt was reflected in the fact that more than 60 percent of the irrigated cropland on heavy soils was in these two crops.

The combines used were divided about 3 to 1 between one and two-man operation. Since more of the farmers owned the former type, labor needed for combining was calculated on the basis of one-man operation. In case two men were used for combining, the labor requirement was about one-third hour

per acre more than shown in Figure 7. Although most wheat growers owned one or more combines, some custom combining was used. The usual charge for custom combining was $3.00 per acre (Table 2). Some of the hauling was also hired.

With the exception of those operations associated with irrigation, labor and power requirements and production practices for wheat production are essentially alike on either irrigated or dry land. The additional operations of land leveling, ditching and applying water, which are associated with the irrigated crop, require 1.6 hours of labor and .4 hour of tractor use per acre. This more than doubles preharvesting labor and increases preharvesting tractor work by more than one-third.

Alfalfa

Alfalfa is not grown without irrigation on the High Plains. This crop was raised by more than half of the farmers on heavy soils but by only about one-fourth of those on sandy soils. On heavy soils, alfalfa was a relatively important cash crop with an average of 30 acres per farm. For those reporting alfalfa on sandy soils, the average crop was 11 acres.

Once established, it was usually possible to maintain a good stand of alfalfa for 4 or more years without reseeding.

Figure 8. Border irrigation in preparation for seeding alfalfa. This field has been carefully leveled.

This crop was grown primarily for hay and the requirements herein discussed are for the production of hay exclusively.

Alfalfa is a heavy user of water and required an average of 30 to 35 acre-inches per year. Alfalfa is irrigated frequently throughout the season and competes for water with all other irrigated crops.

Some farmers own all haymaking equipment, including a mower, rake and baler. Others hire some or all of the haymaking operations on a contract basis. Still others sell the standing crop in the field, the harvesting to be done by the buyer, usually a dehydrating plant.

Usual Field Operations and Materials Used

The irrigation of alfalfa is begun in late March or early April, the ditches having previously been cleaned and rebuilt. On sandy soils, the ditches were recleaned after two irrigations, but ditches on heavy soils were reworked only once during the season. When fertilizer was added, it was usually distributed before the first irrigation.

The frequency of irrigating varied with weather conditions, but usually it was necessary to irrigate at intervals of 2 or 3 weeks. When spring rains were sufficient, only one irrigation was made before the first cutting. Two irrigations before cutting were more common on heavy than on sandy soils. In the latter case, more water was used per application than was the practice on heavy soils. Alfalfa was irrigated once or twice between cuttings, depending on rainfall. Unless rainfall made it unnecessary, water was applied as soon as possible after each harvest. When seasonal conditions were unfavorable, the crop was irrigated after the last cutting. The effect of rainfall on irrigation practices is indicated by the fact that alfalfa received two or three more irrigations in 1948, the driest year of the study, than were applied during 1949, a year of much more rainfall. During the study, alfalfa on sandy soils was irrigated an average of six or more times, whereas on heavy soils the crop was given seven or more irrigations.

An average of 34.9 acre-inches of water was applied annually to alfalfa on sandy soils and 29.3 acre-inches on heavy soils (Table 1). Alfalfa is usually watered by border irrigation. Land was leveled carefully between borders prior to seeding to get an even distribution of water.

Nearly 40 percent of the alfalfa acreage was top-dressed annually with 20 percent superphosphate. The usual applica-

tion was 200 pounds per acre (Table 1). Fertilizer was usually distributed in the fall for new fall seedings and during March and April on old seedings.

The first cutting of hay was harvested late in May or early in June and the last in September or October. Approximately two-thirds of the acreage on both types of soil was cut four times, with the remainder cut three times.

Bales were usually tied with wire, although a few of the balers in use were equipped to tie with twine. A bundle containing 250 wires would tie the entire crop from approximately 2 acres of average-yielding alfalfa.

Labor and Power Requirements

The amounts of labor and power used to produce alfalfa on both sandy and heavy soils are shown in Figure 9. The total time spent per acre of alfalfa for all operations ranged from approximately 16 hours on heavy soils to 20 hours on sandy soils. This was only about half the total labor required for cotton, but was roughly two and one-half times that used for grain sorghum or seven times the labor used in wheat production.

Other than harvesting, the main labor with alfalfa was for spreading water. Here, as in the case of other crops, differences in soil texture required that more attention be

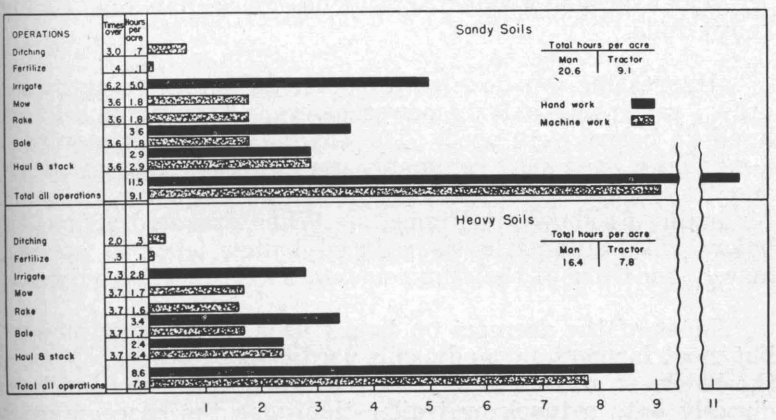

Figure 9. Labor and power required for irrigated alfalfa production per acre and by operations, 1947-49.

Figure 10. All row crops were cultivated with either 2 or 4-row equipment. It was common to use rotary hoe attachments for cultivating young crops.

given to spreading water on sandy than on heavy soils. Also, a factor in this connection was the fact that although alfalfa on sandy soils, received one less irrigation, the total water used per year averaged about 5 acre-inches more than was used on heavy soils.

Harvesting was done with tractor-driven mowers, tractor-drawn rakes and pick-up power balers. Both automatic and hand-tie balers were used. The latter type, which requires a 3-man crew, was most commonly used by cooperating farmers, and its use was the basis for calculating the requirements for baling as shown in Figure 9. When operated efficiently, balers with automatic tie reduced baling labor to approximately one-third of the requirements with hand-tie equipment.

Most of the farmers on heavy soils used 7-foot mowers, but most farmers on sandy soils used 6-foot mowers. More of the balers in use on heavy soils were equipped to load bales directly onto a truck or trailer than was the case on sandy soils. Consequently, growers on heavy soils used less labor for harvesting. On the sandy soils, however, higher yields tended to increase the time required for baling and hauling.

Sudan

Sudan was grown on a large number of farms but averaged only about 3 acres per farm. The crop produces a large amount of good quality, succulent pasture and was the main source of summer grazing on many farms. Data for the small acreage of Sudan harvested for hay and seed are not included in this report.

Usual Field Operations

Seedbed preparation for Sudan was much the same as for grain sorghum. On sandy soils, most of the acreage was chiseled, all was listed and beds were knifed as needed to destroy weeds. About 50 percent of the beds were irrigated before planting. The usual practice on heavy soils was to chisel and follow with either a one-way or a disk, or with both. Either operation left the land in good shape for leveling. Less than half the acreage was bedded and very few beds were irrigated before planting.

Sudan was one of the first crops planted in the spring. The amount of seed used per acre (one time over) averaged 9 to 10 pounds (Table 1). Most of the seed were purchased at an average cost of 12 cents per pound.

On sandy soils, Sudan was knifed and cultivated, and 60 percent was cultivated a second time. All the knifing and most of the cultivating were done before irrigation. On heavy soils, Sudan was knifed, some was knifed twice and nearly all was cultivated once with sweeps. The crop was not hoed.

Sudan was commonly irrigated in July. Only about 30 percent of the crop on sandy soils was irrigated a second time, usually in August. On heavy soils, farmers irrigated Sudan at least twice and nearly half of the acreage was given three irrigations. The third irrigation was usually late in August or early in September. The total water used to irrigate an acre of Sudan averaged 8 inches and 9 inches, respectively, on sandy soils and on heavy soils.

Labor and Power Requirements

The labor and power requirements shown in Figure 11 are for a grazing crop only. Spreading water was the only task not mechanized. Sudan production required an average of about 5 hours of labor and 3 hours of tractor work when 2-row equipment was used. When 4-row tractors were used,

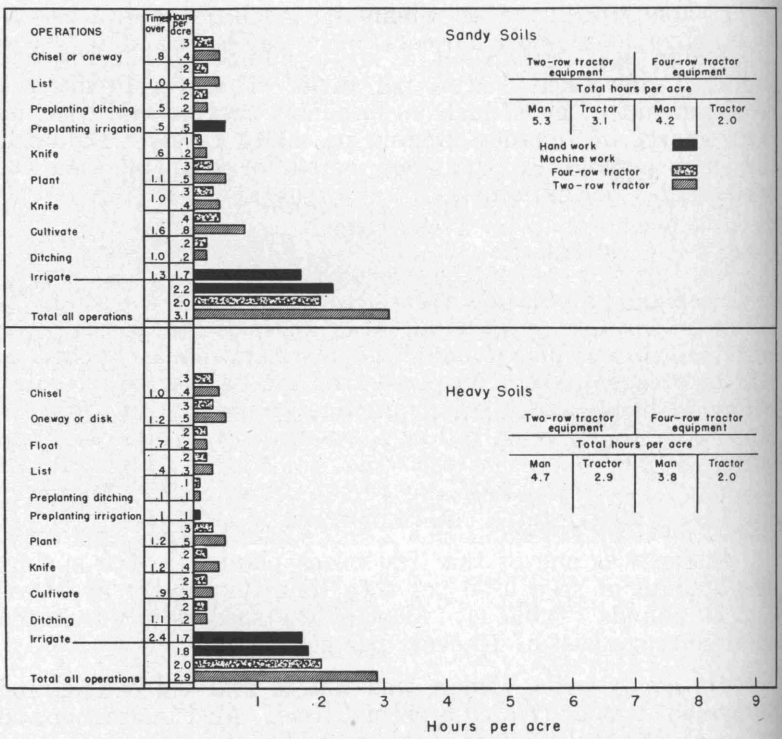

Figure 11. Labor and power required for irrigated Sudan pasture per acre and by operation, 1947-49.

these requirements were reduced by 1 hour. A little more labor and power were used on sandy than on heavy soils. Labor and power needs were less than the preharvesting requirements of any of the other row crops grown under irrigation.

With the exception of requirements for irrigation, labor and power needed for irrigated Sudan were similar to production requirements of Sudan on dry land. Seedbed preparation, planting and cultivating had similar requirements in both cases.

Sugar Beets

Sugar beets are a relatively new crop on the High Plains. Few farmers in this area have grown sugar beets more than 7 or 8 years. Because of a high value per acre, interest in the crop centers around the possibility of its substitution for

lower value crops such as wheat and grain sorghum. Sugar beets have been more successful in competing with these crops than with cotton. To date, only a small acreage of sugar beets has been grown each year.

There are no processing plants in the area, and beets were grown under contract with a sugar company in Colorado where they were shipped when harvested. The producer and the processor shared the freight cost equally.

Beet production centered in Deaf Smith county with only small acreages grown in a few other counties. On the farms where grown, the crop averaged 67 acres and was a major cash enterprise. Beets were usually grown in combination with large acreages of both wheat and sorghum. The large investment in special equipment for planting, cultivating and harvesting has discouraged small-scale production of sugar beets.

Usual Field Operations

Seedbed preparation for sugar beets commonly consisted of the following operations in the order listed: flatbreak, fertilize, chisel, one-way or disk, float, list, irrigate and harrow. Occasionally, chiseling preceded flatbreaking. After flatbreaking, all beet land was either chiseled or one-wayed, regardless of whether fertilizer had been distributed. About two-thirds of the acreage was worked again before leveling, either with a one-way or disk.

Fertilizer was used on all sugar beets, but the kind of fertilizer and the time and method of application varied. Most farmers used 16-20-0 and a few also used superphosphate. Beet growers were about equally divided between those applying such fertilizer before planting and those making application during planting. Those following the former practice usually spread fertilizer after flatbreaking and before chiseling or one-waying. The amount of fertilizer used during or prior to planting varied from 150 to 400 pounds per acre but the most common application, as well as the average application, was 200 pounds (Table 1). About two-thirds of the growers used ammonium nitrate as a side-dressing at the rate of 100 to 150 pounds per acre. Ammonium nitrate was applied either in irrigation water or by special cultivator attachments.

The seedbed was listed before the preplanting irrigation. This irrigation was normally in the latter half of March and shortly before planting. When dry enough, the beds were

harrowed and planted. Shortly after seeding, there was another irrigation to insure good germination.

Sugar beets were planted in 24 to 28-inch rows. The 24-inch row was used by most farmers. On an average, 4.5 pounds of seed were planted per acre for once over. All seed were purchased at a uniform price of 45 cents per pound.

Irrigation water was run in the small furrow between the rows to get the crop up and in making subsequent irrigations. After coming up, the crop was irrigated at intervals of 2 or 3 weeks, depending largely on rainfall. The total number of irrigations varied from year to year but the usual practice was to irrigate 8 to 10 times during the season. This required the pumping of about 35 to 40 acre-inches of water.

Normally, beets were cultivated once before thinning and three times afterward. Thinning was done by hand, usually after the plants were well established. Contract labor was used for this work. In 1949, most beet growers paid $14.00 per acre for thinning (Table 2). Beets were thinned to single plants spaced 12 to 15 inches apart in the row.

All sugar beets were hoed once, and about 20 percent of the acreage was hoed a second time later in the season to destroy large weeds. Hoeing also was performed by hand labor on a contract basis.

Harvesting usually was started in late October or early November when the purchasing company announced readiness to accept the crop. Beets were dug with a single-row digger

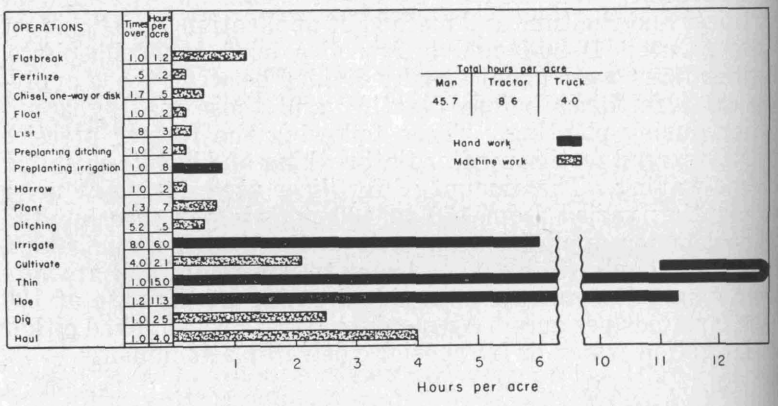

Figure 12. Labor and power required for sugar beet production, per acre and by operations.

mounted on a tractor. This machine topped, dug and elevated the beets into a carrier in one operation. From the carrier, beets were elevated into a truck and hauled to a railroad loading point.

Labor and Power Requirements

Labor and power required for sugar beet production are shown in Figure 12. Only farms on heavy soils contributed to the data.

With an average requirement of 45 hours of labor per acre, sugar beets were second only to potatoes in total labor needed. About 72 percent of the time spent producing sugar beets was hand labor. Thinning and hoeing accounted for 26 hours of labor, or nearly 57 percent of the total. Spreading water required an average of 6.8 hours, or about 15 percent of the total labor. Beet harvesting was entirely mechanized and utilized only 6.5 man-hours per acre, of which 4 hours were for hauling.

Listing, planting and cultivating were 4-row operations and did not require large amounts of power. In working

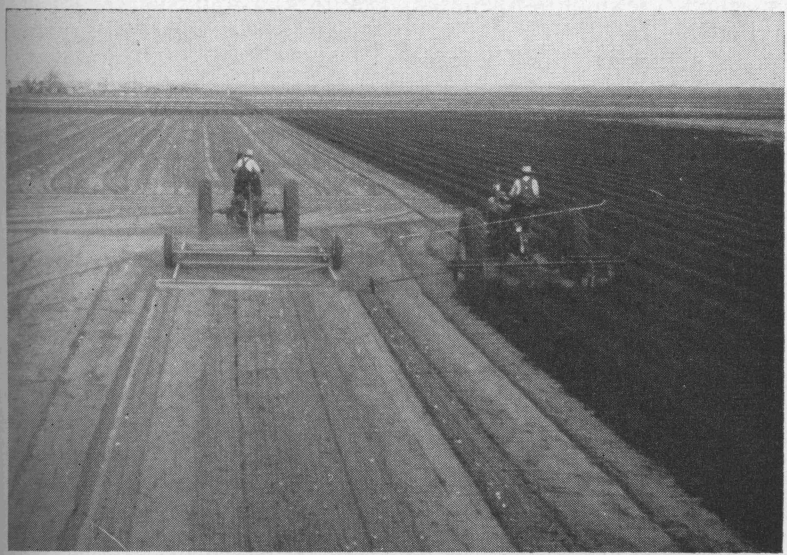

Figure 13. Floating with a land leveler prior to listing facilitates uniform distribution of irrigation water.

beets, the same size tractors were used to cover 4 rows as were used for 2-row work with other crops.

Machine work was fairly well distributed throughout the crop season. Of the 8.6 total hours of tractor work, 2.8 hours were for seedbed preparation, 2.8 hours for planting and cultivating and 2.5 hours for harvesting. Truck work was needed only at harvest time.

Potatoes

Potatoes were grown only under irrigation and provided a high-value crop for farmers who had plenty of water. The most extensive production area was in the vicinity of Hereford. This is a relatively new crop and, although the acreage on the High Plains was comparatively small, farmers growing potatoes reported an average of 74 acres. Thus, potatoes were an important cash crop where grown. Most potato growers also raised wheat and grain sorghum.

Special equipment required in growing potatoes include a planter and a digger or harvester. These special machines were owned by each grower. Other equipment generally used by potato growers were hiller attachments for cultivators and special attachments for listers, planters and cultivators for distributing fertilizers and a vine beater for destroying potato vines and weeds just before harvest.

Usual Field Operations

Potatoes were usually planted on land that had been kept free of weeds following wheat. This was flatbroken in the fall or winter and later one-wayed, chiseled or disked in preparation for floating. All growers applied fertilizer before or during planting. In about 40 percent of the cases, fertilizer was applied after floating and before listing. Fertilizer applied then or during planting was either ammonium sulphate or 16-20-0. Although the amount varied from 100 to 400 pounds, applications of 200. 250 or 300 pounds per acre were most frequent and averaged about 250 pounds per acre (Table 1).

The seedbed was listed in February or early in March. Early-listed land was sometimes relisted. The irrigation before planting averaged about 5 inches per acre and was normally completed before March 15. About 60 percent of the land was harrowed before planting.

Potatoes were planted in 38-inch rows and were usually put in during the last 2 weeks of March or early in April. Two-row planters were used and replanting was seldom needed. Although the planting crew varied in size, two men (one on the tractor and one on the planter) formed the usual crew. A pick-up or a truck was used in getting seed potatoes to the field. Those who did not apply fertilizer prior to listing used a special planter attachment to distribute either ammonium sulphate or 16-20-0 during planting.

Although the rate of seeding ranged from 800 to 1,500 pounds per acre, the average for the farms studied was 1,125 pounds per acre. In most cases, certified seed were used. Seed potatoes were cut by hand. This service was performed at a local shed and cost 25 cents per hundred pounds in 1949. About one-third of the growers treated their seed with formaldehyde before planting.

Growers differed in methods of cultivating. As a rule, the first operation after planting was a combination of cultivating and hilling. In addition to regular sweeps, cultivators were equipped with special sweeps or disks for hilling. Some repeated this operation, whereas others followed with a weeder or harrow, or both, and then hilled and cultivated a second time. Weeding was done with a finger-type attachment which broke the crust and destroyed small weeds. In some cases, a harrow was used for the same purpose. Potatoes were not hoed.

About half of the growers applied ammonium nitrate as a side-dressing, usually during one of the later cultivations. Generally, those who had made a relatively light application of ammonium sulphate or 16-20-0 during or prior to planting side-dressed with ammonium nitrate. The amount of ammonium nitrate used commonly ranged from 100 to 150 pounds per acre. A few farmers distributed this fertilizer in the irrigation water.

Between planting and the last cultivation, the potato crop was usually watered once or twice. After the last culivation, irrigation ditches were carefully prepared for the remainder of the season. Considerable hand work was involved in getting each set properly adjusted. Once established, the system of ditching was not changed.

Following the last cultivation, the soil was kept moist continuously. This was accomplished by frequent but light irrigations. Water was applied at intervals of 5 to 7 days. Each

irrigation after planting averaged about 2.5 acre-inches. A common practice was to run water down the middles between alternate rows. At the next irrigation, water was run down the middles that were missed the previous time. This practice of watering alternate rows was continued during the remainder of the season. Although the soil was kept moist, standing water was carefully avoided. Ditch ends were kept open so that surplus water would drain off quickly. Normally, potatoes received one preplanting irrigation and 8 to 10 additional irrigations, or a total of 25 to 30 inches of irrigation water per acre.

Growers used insecticides or a combination of insecticide-fungicide dust to control insects and potato diseases. The number of applications ranged from 1 to 5 and averaged 2.5. In nearly all cases, dusting was by airplane. In 1949, this service cost 4 cents per pound of dust applied. At that time, the most common types of dust used consisted of DDT, sulphur, dithane and copper in various combinations. The usual rate of application was 20 pounds per acre for each time over, or an average of 50 pounds per acre for 2.5 applications.

High Plains potatoes were usually harvested during July or August. A rotary vine beater was used to destroy potato vines and weeds prior to digging. Growers without beaters could rent one for $3.50 per acre (Table 2).

Potatoes were dug with a 2-row digger, most commonly operated by one man but occasionally requiring two men. A crew of 30 to 40 hands working on a contract basis was used to pick up and sack potatoes where one digger was operating. One truck was needed for every 10 persons in the crew. Two or more additional men were needed to load each truck in the field. From the field the crop was trucked to the packing shed. The cost of picking up, sacking and hauling averaged 25 cents per hundred pounds (Table 2).

At the packing shed, potatoes were washed, graded, sacked, inspected and sold. The cost of these servics in 1949 averaged 40 cents per hundred pounds. Sacks for shipping to market also were purchased at the packing shed. An average of 125 sacks was needed per acre. Number 1 potatoes (about 75 percent of the crop in 1949) were waxed for an additional charge of 5 cents per hundred pounds.

Labor and Power Requirements

The amount of labor and power normally used to produce potatoes is shown in Figure 14. Potatoes had the highest

labor requirement of the irrigated crops studied. The total requirement of more than 62 hours per acre was approximately one-third more than that of sugar beets and 70 percent more than for cotton production.

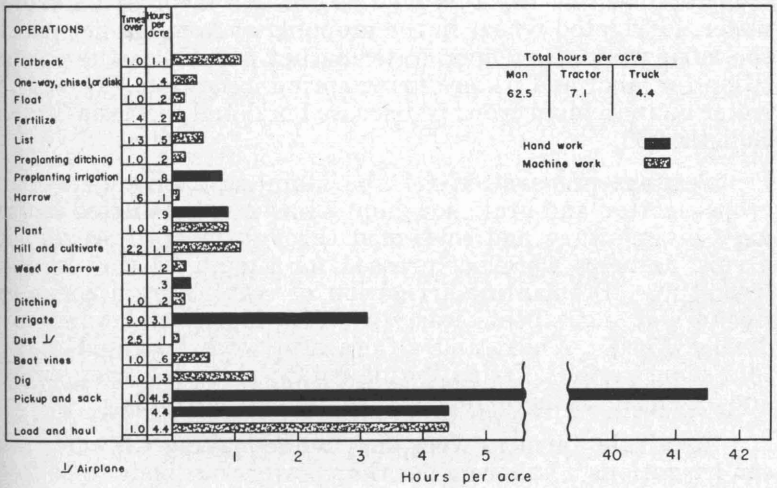

Figure 13. Floating with a land leveler prior to listing facilitates uni- and by operations.

With the exception of irrigation, all preharvesting operations were mechanized. However, more than 80 percent of the total labor with this crop was for harvesting, and more than 80 percent of the harvesting labor was hand work. Picking up and sacking, the most time-consuming operation, averaged 41.5 hours per acre, or more than two-thirds of the total labor requirement for all operations. Other harvesting work required 10 to 11 man-hours per acre.

An average of about 3.5 hours per acre was used in preparing the seedbed and in giving the preseasonal irrigation. All remaining work prior to harvest averaged 6.9 man hours, of which 3.10 hours per acre were for seasonal irrigation.

Of the total tractor work, about 80 percent, or 5 hours per acre, was required in seedbed preparation and to plant and cultivate. The 4.4 hours of truck work per acre for hauling potatoes to the packing shed totaled more trucking time than was used with any other of the irrigated crops studied.

DISTRIBUTION OF LABOR AND POWER

Labor requirements on High Plains irrigated farms were at a peak during the relatively short growing season, particularly on those farms that grew mainly row crops. This was true for machine work as well as for the labor of spreading water. Irrigated wheat in the cropping system did not add to the labor peak of summer watering but did add to the competition for labor and water during spring irrigation. The use of water on individual crops is discussed in detail in Texas Station Bulletin 756.

Seedbed preparation for the main summer-growing row crops—cotton and grain sorghum—was usually started in January or February and continued through most of April. As a rule, farmers were not pressed for time until they started irrigating. Preplanting irrigation of cotton, grain sorghum, Sudan and sugar beets was started in March and was heavy during April. Wheat and alfalfa also were irrigated during this same period. Irrigation of potatoes started even earlier and extended through June and sometimes into July.

As a rule, farmers were busy while making the early season irrigations. Labor rather than power was likely to be fully utilized at this time. Normally, planting of row crops followed shortly after preplanting irrigation. Demands were heavy for both labor and power. Wheat harvest sometimes came before sorghum planting was complete. Shortly after planting came cultivation, hoeing and preparation for irrigation. These operations extended the busy period for both labor and power.

A period of peak labor demand occurred at the time of cotton hoeing. This work was concentrated during the last week of June and during July. As previously stated, hoeing was done by hired seasonal workers, but the operator had the task of locating, hiring and checking on the work of hoe laborers. This came at a time when other work also was urgent.

Irrigation of alfalfa, sugar beets and potatoes occurred throughout the period when row crops were being planted and given early cultivations. Summer irrigation of cotton, sorghum and Sudan was largely done during July and August. This was also a time of heavy watering of alfalfa and sugar beets.

With cotton, the greatest labor demand was during harvest. The large cotton acreage on the High Plains intensified labor needs at harvesting, and a large influx of transient labor was necessary to meet this labor demand.

Some grain sorghum was ready for harvest before cotton, but much of the crop ripened at about the same time cotton opened. In such cases, when sufficient help and power were available, both crops might be harvested at the same time. Otherwise, cotton was given preference.

MATERIALS AND SERVICES USED

A summary of the materials used for production of irrigated crops is shown in Table 1. Among the items included are seed, fertilizer, insecticides and fungicides, defoliants, containers and irrigation water. Variations that occur as a result of soil differences are indicated.

High-quality seed were used for all crops. With the exception of wheat and cotton on sandy soils, most seed were purchased. In the case of cotton, a small acreage was planted to certified seed each year from which most of the seed to be planted the following year were saved. It is relatively easy to keep wheat seed fairly pure for several crops, and farmers did not consider it necessary to renew wheat seed as often as they renewed other crop seed.

Table 1. Summary of materials used with irrigated crops, 1947-49

Item	Cotton	Grain sorghum	Wheat	Alfalfa	Sudan	Sugar beets	Potatoes
Seed:							
Sandy soils—lbs. per acre	24	5	40	20	9	—	—
Percent purchased	20	98	25	100	45	—	—
Heavy Soils—lbs. per acre	24	7	41	25	10	4.5	1,125
Percent purchased	65	90	26	95	77	100	100
Fertilizer at planting or before:							
Ammonium sulphate:							
Percent of acreage covered	—	—	—	—	—	—	50
Lbs. per acre covered	—	—	—	—	—	—	250
16-20-0:							
Percent of acreage covered	—	5	—	—	—	100	50
Lbs. per acre covered	—	100	—	—	—	200	250
Fertilizer as side or top-dressing:							
Ammonium nitrate:							
Percent of acreage covered	—	—	10	—	—	66	50
Lbs. per acre covered	—	—	100	—	—	125	125
20% Superphosphate:							
Percent of acreage covered	—	—	—	37	—	—	—
Lbs. per acre covered	—	—	—	200	—	—	—
Insecticides:							
Percent of acreage covered	20	—	—	—	—	—	—
Av. number applications	1	—	—	—	—	—	—
Insecticide & fungicide combined:							
Percent of acreage covered	—	—	—	—	—	—	100
Av. number applications	—	—	—	—	—	—	2.5
Defoliant—percent of acreage covered	11[1]	—	—	—	—	—	—
Baling wire—bundles per acre	—	—	—	.5	—	—	—
Sacks—no. per acre	—	—	—	—	—	—	125
Irrigation water used:							
Sandy soils—no. irrigations	2.5	2.3	1.5	6.2	1.8	—	—
Av. total inches per acre	10.8	9.8	7.1	34.9	8.0	—	—
Heavy soils—no. irrigations	2.3	2.5	1.5	7.3	2.5	9.0[2]	10[2]
Av. total inches per acre	9.5	10.5	7.3	29.3	9.2	37.5	27.5

[1] 1949 only.
[2] Normal practice.

Fertilizers were not used extensively except for sugar beets and potatoes. The data available did not permit an appraisal of the effect of fertilizer on crop yields.

During the study, there was no widespread use of insecticides except with potatoes. However, it is believed that through the efforts of the Texas Agricultural Extension Service and other agencies, farmers are becoming increasingly aware of the problems of insect control. At the same time, improved methods of control have been made available. As a result, it is believed that the use of insecticides is increasing. Farmer interest in defoliants also is increasing each year.

A summary of the cost of seasonal labor, custom work, hired equipment and other hired services is shown in Table 2. Occasionally, some item of equipment not shown in this table may be hired, but such instances are too infrequent to be important among the farming practices of the area.

There is a wide range in the costs of seasonal labor and of hired services between different crops. For instance, most growers did not use seasonal labor for grain sorghums or wheat and many did not hire any custom work. When custom work was hired, the cost per acre was relatively low. On the other hand, cotton growers, and particularly potato growers, had heavy expenses for seasonal labor and for services normally hired. Seasonal labor and hired services were needed the most at harvest time for all crops except sugar beets. Here, thinning and hoeing, which came relatively early in the season, accounted for the seasonal work that was hired.

Most custom work and other services hired were done by local persons. Combines were brought in from outside the area when there was a large wheat crop.

CROP YIELDS WITH AND WITHOUT IRRIGATION

Yield data were obtained for all crops on the farms studied. Since most farmers with wells also had some dry-land crops, it was possible to compare dry-land and irrigated yields for those crops commonly grown without irrigation. A summary of the yield data obtained is shown in Table 3. A comparison of yields also is made on sandy and heavy soils.

Irrigation has made it possible to plant crops having high water requirement such as alfalfa, sugar beets and potatoes. For other crops, irrigation has increased as well as stabilized

yields. On the average, yields of cotton and grain sorghum were more than doubled on either soil type by irrigation. Wheat apparently did not respond to irrigation in the same manner as did most row crops. Most wheat was grown on heavy soils and there was no significant difference in yields between dry-land and irrigated wheat in 1947 and 1949. There was a big difference in 1948 when most dry-land wheat failed.

For the four main irrigated crops—cotton, sorghum, wheat and alfalfa — there was no significant difference in yields between the two soil types. However, the effect of irrigation was greater on heavy soils. This was indicated by the greater spread between irrigated and dry-land yields on heavy soils, in comparison with the spread obtained on sandy soils.

Year-to-year yield variations are much more extreme for crops on dry land than for irrigated crops. These variations are greater on heavy soils than on sandy soils.

Table 2. **Summary of costs of seasonal labor, custom work, machine rental and hired services used in producing irrigated crops, 1947-49**

Item	Cotton	Grain sorghum	Wheat	Alfalfa	Sudan	Sugar beets[1]	Potatoes[1]
Hand work hired seasonally:				Dollars			
Cut seed—rate per cwt.	—	—	—	—	—	—	.25
Av. cost per acre	—	—	—	—	—	—	2.81
Thinning—rate per acre	—	—	—	—	—	14.00	—
Hoeing—rate per hour	.60	—	—	—	—	.50	—
Av. cost per acre	3.10	—	—	—	—	5.63	—
Snapping—rate per cwt.	2.00	—	—	—	—	—	—
Av. cost per 500-lb. bale	37.00	—	—	—	—	—	—
Pick and sack—per cwt.	—	—	—	—	—	—	.25[2]
Av. cost per acre	—	—	—	—	—	—	31.25[2]
Custom machine work or hired equipment:							
Airplane							
Spraying—rate per acre	1.00	—	—	—	—	—	—
Dusting—rate per lb.	.04	—	—	—	—	—	.04
Stripping—rate per cwt.	1.00	—	—	—	—	—	—
Av. cost per 500-lb. bale hired	20.25	—	—	—	—	—	—
Ginning—rate per cwt.	.50	—	—	—	—	—	—
Bagging and ties—per bale	4.25	—	—	—	—	—	—
Av. cost ginning and bagging:							
Per 500-lb. bale snapped	13.50	—	—	—	—	—	—
Per 500-lb. bale stripped	14.38	—	—	—	—	—	—
Combining—rate per acre	—	3.00	3.00	—	—	—	—
Mowing and raking—per acre	—	—	—	2.00	—	—	—
Baling—rate per ton	—	—	—	4.50	—	—	—
Av. cost per acre when hired	—	—	—	16.25	—	—	—
Rental for vine beater—per acre	—	—	—	—	—	—	3.50
Hauling—rate per cwt.	—	.10	.10	—	—	—	—
Wash, grade, sack—per cwt.	—	—	—	—	—	—	.40
Av. cost per acre	—	—	—	—	—	—	50.00
Wax—rate per cwt.	—	—	—	—	—	—	.05
Av. cost per acre	—	—	—	—	—	—	5.00

[1] Based on 1949 rates of cost.
[2] Includes hauling to packing shed.

Table 3. Crop yields on sandy and heavy soils, irrigated and nonirrigated, 1947-49

Item	Unit	1947		1948		1949		1947-49[1]	
		Irrigated	Dry land	Irrigated	Dry land	Irrigated	Dry land	Irrigated	Dry land
Sandy Soils									
Cotton (lint)	Lbs.	536	278	402	106	460	296	466	227
Grain sorghum (grain)	do.	2,305	1,055	2,272	606	2,609	1,513	2,395	1,058
Forage sorghum	do.	5,747	2,659	4,777	2,069	6,222	3,895	5,582	2,874
Wheat[2]	Bu.	26	21	18	2	17	14	20	12
Alfalfa hay[2]	Lbs.	6,386	—	8,126	—	7,717	—	7,410	—
Sudan seed[3]	do.	1,128	323	1,100	—	1,387	1,200	1,205	762
Heavy Soils									
Cotton (lint)	Lbs.	492	196	415	73	476	295	461	188
Grain sorghum (grain)	do.	2,498	955	2,598	289	2,636	1,271	2,585	914
Forage sorghum	do.	6,568	2,387	4,688	1,353	5,386	4,072	5,547	2,604
Wheat	Bu.	18	18	20	1	20	19	19	13
Alfalfa hay	Lbs.	5,725	—	7,927	—	7,533	—	7,061	—
Sugar beets	do.	25,200	—	27,400	—	27,400	—	26,600	—
Potatoes	do.	—	—	—	—	12,360	—	12,360[4]	—

[1] Arithmetic average.
[2] Wheat and alfalfa are minor crops on sandy soils.
[3] Yields of Sudan seed based on small sample.
[4] One-year average.

Irrigation has done much to stabilize crop acreage on the High Plains. Spring rains may come late, making it difficult to carry out planting intentions under dry-land conditions. In a situation of this kind, farmers without irrigation sometimes have to substitute a quicker-maturing crop in place of cotton. On the other hand, with irrigation, the seedbed may be irrigated to permit planting near the optimum time. Similarly, without irrigation, lack of fall rains may greatly affect the acreage of wheat seeded and disrupt production plans. Here again, preplanting irrigation may be important in maintaining the desired cropping plan.

SUMMARY

Irrigation on the High Plains has been developed largely since the middle thirties and is entirely from wells. One of the effects of irrigation has been to increase the emphasis on cash crop production. On sandy soils, almost 70 percent of the irrigated acreage was planted to cotton and 21 percent to sorghum. No other crop occupied as much as 2 percent of the land. On the heavy soils, sorghum occupied 39 percent of the irrigated acreage with cotton and wheat each accounting for about 22 percent. The only crop of major importance was alfalfa.

Materials used in irrigated crop production consisted mainly of irrigation water, seed, fertilizer and insecticides.

Individual crops on sandy soils used the following amounts of water per acre, on the average, for the 3-year period, 1947-49: cotton, 10.8 inches; sorghum, 9.8 inches; wheat, 7.1 inches; alfalfa 34.9 inches; and Sudan, 8 inches. On heavy soils, the amounts of water used during the same period were as follows: cotton, 9.5 inches; sorghum, 10.5 inches; wheat, 7.3 inches; alfalfa, 29.3 inches; Sudan, 9.2 inches; sugar beets, 37.5 inches; and potatoes, 27.5 inches.

Cotton seed were planted at the average rate of 24 pounds an acre. About one-fourth of the seed were purchased each year from a seed breeder, and the remainder were largely homegrown and from pure seed planted the previous year.

During 1947-49, 20 percent of the irrigated cotton was sprayed or dusted with an insecticide. In more recent years, the proportion of the crop thus treated appears to have been greatly increased.

Spreading water, hoeing and snapping of cotton was done by hand and required an average of 35 hours of labor per acre.

Seasonally-hired workers did all hoeing and hand harvesting. Other operations in the production of cotton were completely mechanized. Machine work for 2 and 4-row equipment averaged 4.8 and 3.3 hours, respectively, on sandy soils and 5.2 and 3.6 hours, respectively, on heavy soils. These totals include machine stripping of 40 to 50 percent of the acreage following hand harvesting.

Sorghum planted for grain was seeded at the rate of 5 to 7 pounds per acre. Most of the seed were certified.

The labor of spreading water, the only hand operation in sorghum production, averaged 3.1 and 1.9 hours, respectively, on sandy and heavy soils. Machine work for 2 and 4-row equipment averaged 4.8 and 3.3 hours, respectively, on sandy soils and 5.2 and 3.6 hours, respectively, on heavy soils.

Wheat production was largely on heavy land where the average rate of seeding was 41 pounds per acre. About three-fourths of the wheat seed were home-grown.

Hand labor with wheat was entirely for irrigation and averaged 1.2 hours per acre. Machine operation required an additional 2.6 hours of labor. Twenty to 25 pounds of seed were used per acre to establish alfalfa. Once established, a stand of alfalfa normally lasted 4 or 5 years. Each year, approximately 40 percent of the alfalfa acreage was given an application of 200 pounds of 20 percent superphosphate.

Five hours of labor were used annually in irrigating alfalfa on sandy soils, while only 2.8 hours were used on heavy soils. Other operations requiring hand labor include baling and hauling. Total labor requirements for alfalfa on sandy soils include 11.5 hours of hand work and 9.1 hours of work with machinery. On heavy soils, total hand work averaged 8.6 hours and machine work 7.8 hours.

All operations in the production of Sudan, with the exception of irrigation, were mechanized. Spreading water required 2.2 and 1.8 hours per acre, respectively, for sandy and heavy soils. Machine work required approximately 3 hours per acre with 2-row equipment and 2 hours per acre with 4-row equipment.

Sugar beets production was on heavy soils. Materials used in connection with this crop included seed and fertilizer. An average of 4.5 pounds of seed was used per acre, all of which was purchased. Nearly all sugar beets received 200 pounds of 16-20-0 and two-thirds of the acreage was side-dressed with 125 pounds of ammonium nitrate.

Sugar beets required large amounts of hand labor. Seasonal workers were hired for 26.3 hours of thinning and hoeing per acre. Water was spread by the regular labor force and averaged 6 hours per acre. Machine work included 8.6 hours with a tractor and 4 hours of trucking per acre.

An average of 1,125 pounds of certified seed was used per acre of potatoes. Growers used 250 pounds of either ammonium sulphate or 16-20-0 at planting time or before. About half of the growers later applied a side-dressing of 125 pounds of ammonium nitrate. Two or 3 applications of insecticide-fungicide dust were made. The usual rate of application was 20 pounds per acre each time over. On the average, 125 sacks per acre were purchased for use at the packing shed.

Approximately 46 hours of seasonal hand labor were hired during harvest to pick up, sack and load an acre of potatoes. Other hand work included 3.4 hours for ditching and irrigation and .9 hour at planting time. Machine work consisted of 8.6 hours with a tractor and 4 hours of trucking per acre.

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