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PREPARATION AND USE OF SEEDBED

BY

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FOREWORD

This publication is concerned for the most part with proved seedbed practices with field crops on the heavier soils commonly found in the irrigated valleys of southern Arizona. The success or failure of a grower is often predicted on his ability in the preparation of an adequate seedbed. Mr. Wood's long years of service as superintendent of the Salt River Valley experiment farm near Mesa, together with his previous experience at the Yuma Experiment Station, have made him an authority on the handling of soils. The material has been written with Salt River Valley conditions in mind unless otherwise indicated. However, since many basic principles of soil management are largely independent of climatic differences, much of the material presented in this bulletin may be used over the entire state with little or no modification.

R. S. HAWKINS

Acting Dean College of Agriculture

PREPARATION AND USE OF SEEDBED

By C. J. Wood

The preparation and manner in which a seedbed is used are two of the most important factors in the production of a profitable crop. Nowhere is this of more consequence than in the heavy soils in the irrigated valleys and mesas of southern and central Arizona.

When first brought into cultivation these soils are poorly aerated and in bad physical condition. The air will more easily permeate such land, and the soil will become more absorptive by the addition of organic matter through the use of barnyard manure, the planting of green cover crops (preferably legumes), or a combination of both.

LEVELING

Experimental tests at the University Farm near Mesa, where the run of water is approximately 300 feet, have demonstrated the advisability of leveling heavy soils. The crops are more nearly uniform from one end of the field to the other, and the yields have been increased as much as 30 per cent, with the crop increase from the first harvest paying for the cost of leveling.

Reducing the fall or leveling the fields on other Salt River Valley farms has in some instances brought about an even greater increase in yield than the 30 per cent noted on the University tract.

The manner of leveling is dependent upon the grade and length of the field. On short runs where the fall is not great the land may be leveled by pulling dirt from the higher to the lower end. On long runs or where the fall is too steep to make this practicable, the desired grade may be obtained by running the water in the direction that has the proper fall. Terracing is not usually an expensive operation and may be advisable if the land has considerable side fall.

Leveling will assist the moisture to penetrate the soil uniformly and to the proper depth. Uniform penetration to the desired depth is perhaps the most important essential for the economic use of water in the production of maximum crops.

DETERMINING WORKABILITY OF HEAVY SOILS

If worked too soon following an irrigation, heavy soils will puddle. It is impossible to make a good seedbed for from one to three years after a puddled condition has resulted from working heavy soils when they are too wet. The time required to overcome this condition varies, depending upon how badly the field has puddled and how it is handled afterward. One of the best

methods for handling such puddled soils is to plow deeply and let the field dry until it is air slacked.

More land must not be irrigated at one time than can be cared for while it is in proper condition. The operator must make certain that the land is in suitable condition before it is worked following irrigations or heavy rains. Some farmers refer to certain soils difficult to work as "noonday soils," saying that they are too wet to work just before noon and too dry immediately afterwards. Sometimes the operator can judge the moisture condition of the soil by looking at the surface; at other times closer scrutiny is required.

It is well to examine the soil at least to the depth it is to be worked. A flat stick sharpened on one end may facilitate this examination. The operator can push the stick into the ground to the depth that will be stirred for the seedbed. The stick should then be pried to one side until it lifts a chunk of dirt out of the ground. If this dirt does not crumble readily when rubbed after compacting in the hand, the soil is too wet to disk. If it does crumble readily upon rubbing after being compacted, it should work into a good seedbed.

An operator may examine a field late in the afternoon following an irrigation and decide that it is ready to work, but in the night the climatic conditions may change from a low to a high humidity almost causing the evaporation from the surface to cease, while the capillary circulation continues to bring the water to the surface. This causes the land to be too wet to work on the following morning and possibly during the entire day.

TILLAGE OPERATIONS

The owner or farm superintendent should know his implements and what they will do in the field to be worked. He should go to the field with his men. Verbal instructions should be given in the field where they can be modified as the effect of the implements is noted. Good laborers follow instructions. Changes in soil conditions and variations in different parts of the field require changes in implement operation. The laborer hesitates to make the change with the result that often more harm than good is done. Many prospective seedbeds are ruined in this manner.

Plowing is the most expensive and perhaps the most important tillage operation. Nearly all heavy soils should be plowed before the seedbed is prepared. The plowing should be thorough and the depth of cutting should be uniform. The implement should be set to cut all the land and not cut and cover. Plowing can be done to a depth of from 6 to 14 inches. Previously plowed land should be plowed to a sufficient depth to break up any plow sole which may have formed.

Alfalfa and Bermuda grass fields should be plowed twice. Following the first plowing, which is shallow to crown the alfalfa or turn the Bermuda sod, the land should be disked and left dry until the alfalfa crowns or Bermuda grass is dead. Then it should

be plowed at least 7 or 8 inches deep. This will cover the alfalfa crowns and Bermuda sod deep enough to permit seedbed preparations.

Both types of breaking plows, the disk and the moldboard, will do good work if properly used. The disk plow is popular for tractor work and for general needs.

The moldboard plow is more suitable for turning under green cover crops and is particularly desirable when teams are used. The two-way plow does the most nearly ideal work, leaving the land level and free from ridges and dead furrows. However, it is more expensive to operate than the disk plow. The disk is better adapted to tractor use and is being used more extensively as power equipment supplants the team.

Plowing moist soils is preferable to plowing dry and is less expensive both in power and wear and tear on tools. The land is left in better condition for future operations, and air slacks the ground more readily. Those who do contract plowing prefer soils only slightly moist.



Plate I.—This ground is being harrowed approximately an hour and a half after plowing operations. Note that the single harrowing operation breaks down the clods and leaves the soil in excellent condition for further working.

Disking is an important operation and in a few instances takes the place of plowing. It sometimes precedes the plow in preparing seedbeds and should follow the cutting of stalks on cotton land and cutting of grain or silage from sorghum or corn land. Disking is also effective after land has been plowed to break up the clods and pulverize the soil. Disk harrows are extensively

used in seedbed preparation. The crop to be planted should be determined before the disking operations begin, and the soil stirred only to the proper depth for that particular seed.

The spike-tooth harrow is used where light surface cultivation is to be done following an irrigation so that the land will not crust. It is advisable to set the teeth at an angle of approximately 45 degrees, putting sufficient weight on the harrow to break down and pulverize the clods which may be exposed and to scratch the surface sufficiently to prevent a crust from forming until the field is ready to disk. This harrow is used also after a disk harrow to pulverize and slightly firm the land and to finish the seedbed following the drill or cultipacker. This implement may also follow the plow to assist in pulverizing the land.



Plate II.—Delay in cultivation and the use of the wrong shovel results in cloddy soil condition, makes additional operations necessary, delays growth, and requires more power than cultivation at the proper time.

The float is used mostly for smoothing the land between the plowing and irrigation. A light float is sometimes used in seedbed preparation when planting is delayed or the weather is very dry. Occasionally it is used following seeding.

The cultipacker will break up clods and firm the mulch after planting. The operator should be sure that the land is dry enough not to puddle. The adobe brick so familiar to dwellers of the Southwest is made by puddling soil and exposing it to the sun. The action of packing machinery on the surface of wet soil with subsequent exposure to the sun results in a condition surprisingly similar. Care must be used, especially with the cultipacker, to see that there is a layer of dry soil between the moist soil and the sun. A friable soil condition is thus maintained. An adobe brick so treated would crumble in the hand while one properly puddled and exposed will almost ring when struck with a hammer.

Cultivators are used principally for weed control and prevention of crusting and cracking; they also assist aeration of the soil and promote absorptiveness. This operation should follow each irrigation until the plants are too large to permit a cultivator to get down the rows without damaging the plants.

Deep cultivation should be done before the lateral roots spread far enough to be damaged by the cultivator teeth. The last cultivation should be only deep enough to kill the weeds. When possible, weeds should be eliminated before the crop has been planted, not afterward.

PREPARING AN ALFALFA SEEDBED

Alfalfa is one of the longest term crops grown in Arizona, but it is difficult to secure a good stand; consequently the farmer should use sufficient seed and carefully prepare the bed for its germination. Twenty to 25 pounds of seed should be used per acre when the land is seeded dry or with a drill on a wet seedbed; 25 to 30 pounds of seed should be broadcasted on a wet seedbed. Alfalfa for best results must be thick. A good stand is often secured with much less seed, but tests and observations support the need for heavy planting rates.

Nurse crops are frequently planted with alfalfa, but they can only be recommended when winter feed is needed. The maximum production of number one alfalfa hay cannot be obtained the first year if nurse crops are used. Barley is the most generally used nurse crop, but wheat or oats are also good. This discussion of the use of nurse crops applies to the lower elevations, for nurse crops are sometimes used to advantage at higher elevations.

Plantings may be made in areas up to 2,000 feet in elevation between the latter part of September and the first of April, the month of October being considered most desirable. November seeding is sometimes damaged by cold; December and January plantings are frequently damaged. February and March plantings do not have time to get established before the summer weeds sprout and the weather becomes hot. At elevations of 4,000 to 5,000 feet, April or early May is the best planting time. Above 6,000 feet, summer planting is usually practiced.

Alfalfa is a free and extravagant user of water, so the land should be carefully prepared before it is seeded. The field should be well leveled, terraced, or otherwise prepared so the water can spread evenly and penetrate to a good depth. Straw or trash, which may be on the land which is to be used for the alfalfa seedbed, should not be burned but disked or plowed under. The young plants may be retarded for a time, but this is more than offset by the beneficial results which follow.

Deep plowing is usually advisable in preparing land for alfalfa as it leaves the soil in a desirable condition. The plow sole, if formed by uniform plowing for several years, is broken up by deep plowing, and proper water penetration is secured.

Following sorghum crops in the fall, when time is a factor, disking may be substituted for plowing. The land must be gone over twice and preferably three times with a heavy disk. This is a method which will increase in popularity because of the time and labor saved.

Ridges and deep furrows should be avoided when plowing. After the land is plowed it should be disked, then a heavy float should be drawn over the land at right angles to the direction that the field was plowed. Borders should then be built.

A buck scraper or some implement which will not leave a furrow along the side should be used in building the borders. The actual height of the border will depend upon the level of the land and the size of the head of water used. A well rounded, medium high border is best. It is relatively easy to cover this type of border with alfalfa. Machinery can also be operated more efficiently; seeding is facilitated; fewer weeds and grasses are grown; and the hay can be cut cleaner.

Alfalfa may be seeded in either wet or dry soils. Each type of seedbed has its merits and disadvantages. The dry seedbed is in general use. This is more nearly foolproof, and a stand is usually obtained. However, more water is required than when a wet seedbed is used; the weeds sprout with the alfalfa; and the land will crust or bake. As a result, the young plants are handicapped. The wet seedbed requires less water but more labor and skill in its preparation and in the seeding. The young alfalfa plants have no competition in this type of bed, since the weeds which germinate following the first irrigation are killed.

Seed is broadcasted when a dry bed is used; then the land should be harrowed lightly at right angles to the border if possible. The first irrigation which follows should be very thorough, the water being held if possible until the border ridges are wet across. A second light irrigation should be made within four or five days unless there has been sufficient rain to prevent crust formation. After the plants have emerged it will be necessary to irrigate to keep them in a healthy condition and to prevent the ground from cracking. The use of muddy water on young plants must be avoided.

The operator who elects to use a wet seedbed should irrigate his land thoroughly. As soon as the teams or light tractor can get onto the field without bogging, the seedbed should be harrowed to prevent a crust from forming.

If the land is to be seeded by broadcasting, this operation should follow the harrowing in order that the seeds will remain where they first hit the ground. Then the operator should disk the field to a depth not exceeding 2 inches. A harrow should be trailed behind the disk with the teeth set at an angle of approximately 20 to 30 degrees. The harrow will serve more as a light float than as a harrow. When the field is sufficiently dry to prevent puddling, the cultipacker should be used with a harrow trailed behind it. The teeth of the harrow should be nearly flat. This operation will leave a light, dry mulch on the surface.

If the seed is to be drilled into the ground, the land should be harrowed following irrigation, then disked to a depth of 1½ inches. A harrow with teeth set well back should trail the disk. The seed should then be drilled in slightly below the bottom of the mulch. The operator should trail a harrow behind the drill with teeth set nearly flat, or he should follow the drilling immediately with a harrow, and then follow this operation with the cultipacker trailed with a harrow.

Alfalfa will follow small grains or sorghums in crop rotation. It does not follow cotton to the best advantage, for this crop is not harvested until too late for fall seeding of alfalfa.

PREPARING A SEEDBED FOR COTTON

Cotton is planted in most sections of Arizona, suitable for growing this crop, after March 1 and before June 1 with the exception of some of the short staple, early maturing varieties which may be planted later. In the Safford area, May 15 is the deadline for late planting. The Pima, or long staple varieties, can best be planted between March 25 and April 15. After April 15 it is safer to plant the short staple varieties.

Twenty to 30 pounds of seed per acre should give a good stand. The heavier rate of seeding should be used for the earlier planting dates, as the ground is apt to be cold and the percentage of germination will be smaller.

The land should be well plowed and left dry as long as possible prior to planting, so the ground will have an opportunity to rest and become air slacked.

There are three seedbeds most commonly used for the planting of cotton: the wet, level seedbed; the wet, ridged seedbed; and the dry, level seedbed. The flat, wet seedbed is preferred on level soils where uniform irrigation can be had. The wet, ridged seedbed is best on land which is not uniform, since it is easier to secure a stand with this method on this type of field. The dry, flat seedbed was popular in the Salt River Valley at one time, but it has been replaced to a great extent by the other two types of beds.

The wet, level seedbed

After the land has been plowed, it should be disked and floated, then bordered and irrigated. As soon as a team or light tractor can be used in the field without bogging, the land should be harrowed; then when in the proper moisture condition it should be disked with a harrow trailing the disk. The field should then be allowed to cure for an indefinite time, depending upon the weather, usually from twenty-four to seventy-two hours, or until the soil will not cake or puddle but can be pressed into a firm mulch.

The planters may then enter the field. They should be equipped with furrow openers, either disk or wing. The furrow openers should be set in such a manner as to push the top dry dirt back and allow the seed to be planted on the wet undisturbed soil at

the bottom of the mulch. The seeds should be covered to a depth of approximately 1½ to 2 inches. Drag an auto chain behind each planter box so as to slightly mulch the ground directly over the seed.

The wet, ridged seedbed

After the land has been plowed, disked, and floated, it should be furrowed or listed so that the centers of the ridges will be the same distance apart as the rows are to be planted. The land should then be irrigated thoroughly. When the ground has reached the proper moisture condition, the ridges should be harrowed down almost flat. After curing, the seedbed is ready to plant using the same method as for the flat, wet bed.

The dry, flat seedbed

The land should be plowed, disked, and floated; then the seed should be planted at or near the surface. The operator should then ridge slightly over the seed and furrow between the rows. The field should be irrigated sufficiently to wet the ground around the seeds. The field should be harrowed as soon as possible after the irrigation, being careful not to puddle the soil. The harrow teeth can pass within an inch of the seed without doing any harm.

PREPARING THE SEEDBED FOR SMALL GRAINS

Small grains are planted in the Salt River Valley from the latter part of September to March 1. November is the ideal time to plant oats for grain production. Wheat and barley usually do better seeded in December or the first part of January. Wheat is usually planted in December at Yuma and in February for the Safford district. For elevations ranging from 4,500 to 5,500 feet, February or March are good planting months, while May and June are more suitable for elevations of 6,000 to 7,000 feet, such as at Springerville.

If grain is to be used for pasture in the Salt River Valley, it should be planted early with 75 to 100 pounds of seed to the acre. If it is to be grown for grain, it should be planted between November 15 and January 15, at the rate of 45 to 70 pounds of seed to the acre, depending upon the date of planting, the method used in planting—whether drilled or broadcasted, and the fertility of the soil. When the crop is being grown for grain the rate of seeding is lighter for the earlier plantings and for the richer soils.

To prepare the seedbed, the land should be plowed to a depth of not less than 6 inches and preferably 8 to 10 inches, then bordered and irrigated. The land should be harrowed after the irrigation, as soon as the moisture condition will permit, so the soil will not crust. The field should be disked to a depth of 2 to 3 inches with a harrow trailing the disk. Care should be taken not to disk deeper than the depth at which the seed is to be planted.

The seed should be drilled in on the wet, undisturbed ground at the bottom of the mulch. The drill should be followed closely with a harrow with the teeth set well back. Drilling and harrowing should be done across borders.

If a drill is not available and the seed is to be broadcasted, the land should be plowed, bordered, and irrigated as for drilling. The seed should then be broadcasted, using at least 20 per cent more seed than for planting with a drill. The bed should be disked to a depth of approximately 3 inches, trailing a harrow behind the disk with the teeth set well back. If the weather is dry and windy, the operator should next use a cultipacker with a harrow trailed behind. If a cultipacker is not available, a light float can be used.

Small grains do not follow sorghums to advantage but will follow alfalfa or cotton.

PREPARING A SEEDBED FOR SORGHUMS

Sorghums are planted from June 1 to July 15, with June 20 to July 10 being the best planting period. The Sooner milo may be planted as late as August 1 except in sections with an altitude of more than 3,000 feet. At this elevation the latest planting date should be June 15.

The field should be well plowed, bordered, and irrigated. When the land is dry enough, it should be harrowed and disked. A harrow should either trail the disk or follow the disking operation closely.

The ground should be allowed to cure until it is in the proper condition for planting. This will usually require approximately twenty-four hours. The same method is used for planting sorghums as is used for cotton. From 2½ to 4 pounds of seed should be planted to the acre, with the rows from 3 to 3½ feet apart. Proportionately more seed should be used if the rows are closer together. This will apply particularly to Wheatland milo and similar varieties.

Sorghum will follow any crop but does particularly well after an alfalfa or legume crop.

PREPARING A SEEDBED FOR CORN

The same seedbed preparation methods as described for sorghums may also be followed for corn. The dates of planting are similar if the corn is to be grown for grain or silage. If it is to be grown for roasting ears, it can be planted as late as August 1. July 1 to July 15 is the best planting period.