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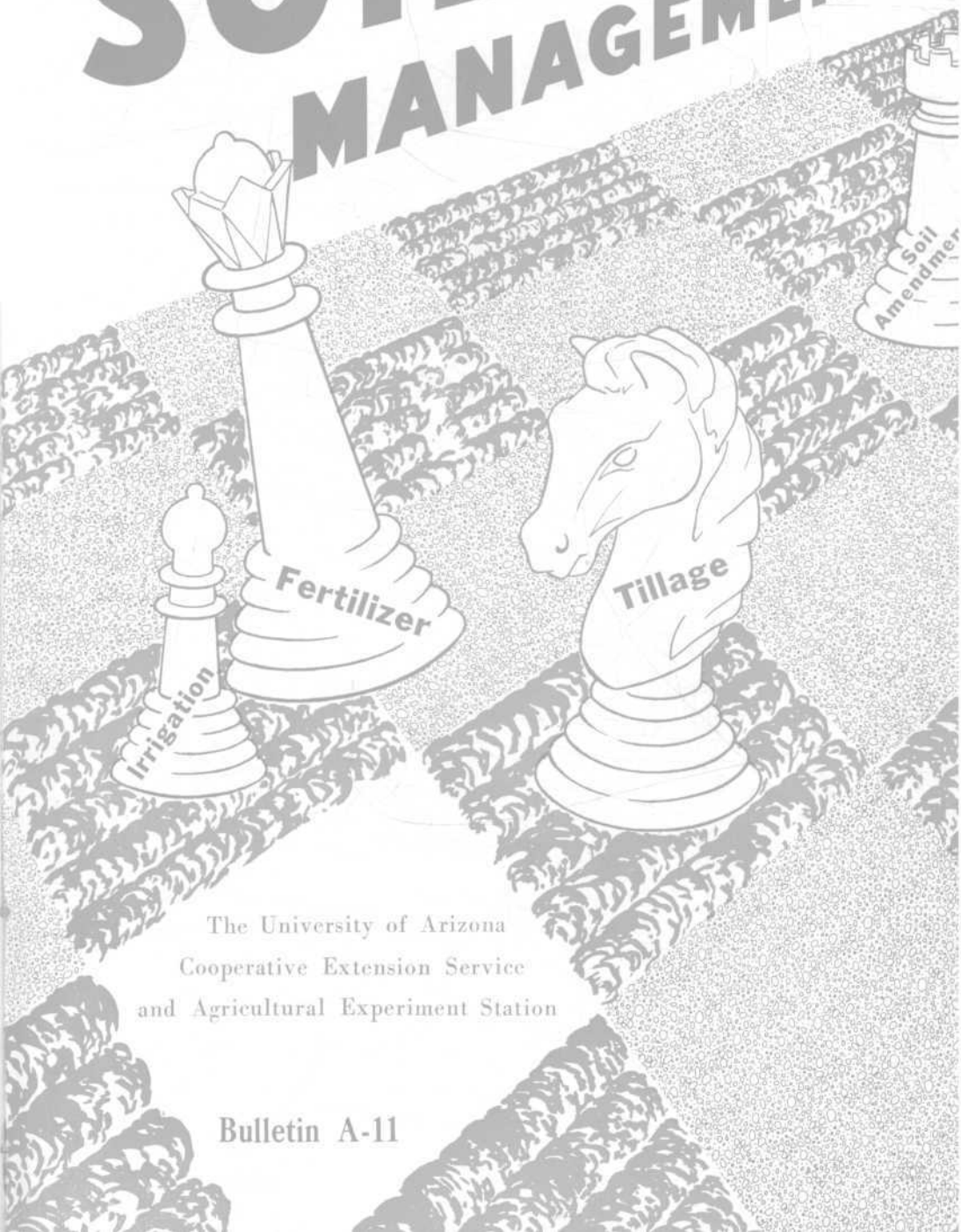
SOIL MANAGEMENT



The University of Arizona
Cooperative Extension Service
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Bulletin A-11

Contents

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SOIL MANAGEMENT

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Your soil is "alive."

Good management makes a soil produce an abundance of high quality crops. Poor management makes it unproductive.

Soil management deals with the way you handle your soil to produce crops. The main objective of a soil-management program is to provide a **permanent** as well as a **profitable** agriculture.

Good structure or tilth, adequate supplies of organic matter, and plenty of plant food elements are necessary to meet this objective. Included in good soil management are proper tillage, irrigation, and organic matter turnover — with the **wise** use of soil amendments and commercial fertilizers where needed.

Such a program, to be good, must be flexible. Arizona soils vary widely throughout the state. Even on your own farm the soil has wide differences of which you are aware.

Different soils call for different treatment. The same soil may require different treatment from year to year or from crop to crop.

You also must consider differences in economic conditions. A soil-management practice that is good this year may be unsuitable next year due to changing conditions.

Soil conditions are extremely complex. Blanket recommendations to cover the requirements of all soils and all crops are impossible. There are, however, certain basic principles you must consider in planning any soil management program.

The aim of this bulletin is to discuss these principles so they may be applied to conditions on irrigated cropland on your own farm.

SOIL TILTH

Tilth refers to the physical conditions of a soil which affect plant growth. Your soil, to have good tilth, must have both good physical condition and available moisture for plants.

Soil Structure

The most important factor in tilth is **structure**. Good water penetration, efficient soil aeration, and satisfactory seedbeds are dependent on good soil structure.

Structure refers to the arrangement of individual particles in the soil. In nearly all soils, the particles group together in granules. This is often called aggregation.

Soils having good structure are granular (grainy). The particles are well grouped into granules, and movement of water and air in the soil is good. You maintain good structure only by regular care of your soil.

Water and air enter the soil through spaces or pores in the soil. These are formed by the particles and their granulation. A network of connected passages is formed by these pores.

The number and size of these pores are determined by (1) soil texture (particle size), and (2) structure (granulation). Good structure means that a soil has large enough pores to allow rapid movement of water and air.

Excessive or long continued cultivation tends to break up the granules, reducing the ability of the soil to absorb water. The soil "runs together" or becomes dispersed, and the pores become much smaller. Easy entrance of water, air, and plant roots is lost. Soil structure has been destroyed.

Soil structure may be compared to a river bridge. A bridge is a structure with pieces of steel and other building materials fastened together. Properly designed, constructed, and maintained it will do its work for many years. Neglect in design, construction, or maintenance will cause the bridge to fail. Its collapse under a heavily loaded bus would be a disaster.

Skilled engineers design and build structures such as bridges. You are the engineer who supervises the building of structure in your soil. The structure you build will be strong and useful, or weak and undependable, depending on your management of the soil.

Your building materials are the soil particles. On close examination you will find that these particles are of different sizes and shapes. Gravel and sand are the largest particles. They do not readily enter into soil structure.

Silt particles are next in size and may be seen through an ordinary microscope. Their behavior in the soil is like flour. Silt alone does not enter into structure, but is an important building material when combined with clay.

Clay is the smallest soil particle, reaching sizes too small to be seen through powerful microscopes. It is the most active building material that you as a farmer-engineer use in building soil structure.

You build soil structure by fastening together these soil particles into granules or aggregates. Size, shape, and arrangement of these granules are determined by the nature of the materials used.

Soils high in silt content are often problem soils. They form relatively few granules, causing pore space to be so small that water and air penetrate very slowly.

Those soils containing appreciable amounts of clay form granules readily when properly managed. This permits rapid entrance of water and air. If improperly managed, they "run together" or disperse and may be among the worst problem soils.

Organic matter turnover and **proper tillage** are two main factors in building and maintaining good soil structure.

Organic Matter

Bridge steel is fastened in place by riveting or welding. So, too, must the soil granules be fastened together to give structure. The best "welding" material for this purpose is the organic matter you return to the soil each year.

Soil organic matter is the partially rotted remains of plants and of soil organisms. The average irrigated soil in Arizona contains only one-tenth of one percent organic matter. Compared to an average of 2 percent in the middle west, this is but one-twentieth as much.

So small an amount of organic matter, however, can greatly influence structure, bacterial action, and plant growth in your soil.

The most important single function of organic matter probably is its influence on soil structure. Its value to you as a soil conditioner is discussed in that section of this bulletin (see page 9).

Organic matter is the main binding agent holding soil particles, granules, and aggregates together. It prevents dispersion or running together and aids water penetration and aeration. It also reduces soil erosion.

Soil organic matter is the storehouse for most or all of the nitrogen found in your soil. It also stores other plant foods such as phosphorus, potassium, iron, etc. The process of rotting or decomposition is actually feeding of the soil organisms. This releases the plant food elements in a form which is available to plants.

Organic matter in your soil is constantly decomposing. Its benefit to you in increasing production can take place only when it is decomposing. Therefore, the supply of organic matter must be renewed regularly and often. This is especially true in southern Arizona where high temperatures result in a very rapid breakdown of organic matter.

Actually, you trade on what may be called **organic matter turnover** in soil management. Organic matter plowed under that

decomposes, releasing plant food to the current year's crop is the most beneficial part. The average (0.1% in Arizona) and how your soil measures up to it is an indication of your soil-management abilities.

You can maintain satisfactory supplies of organic matter in Arizona soils by the following:

1. Return all crop residues to the soil and plow them under. Crop residues are the main source of organic material you have and should **always be turned** under. Destroy them only if insect or disease control requires it.

2. Spread barnyard manure on your fields. This is especially good if you have hard spots in a field.

3. Grow and plow under green-manure crops. Some of these are: Sesbania, guar, Papago peas, clover, or young barley. This is of great value on soils in poor physical condition.

A GOOD PRACTICE!

Plowing under crop residues conserves organic matter and helps maintain good soil tilth.

A POOR PRACTICE!

Burning crop residues wastes organic matter which is badly needed in Arizona soils.

Tillage

The best design and construction in a bridge will not prevent its eventual collapse if abused. The structure of your soil also breaks down under the misuse of improper tillage.

Mechanical operations used to provide soil conditions favorable to crop growth are known as tillage operations. These may be done for one or more purposes such as:

1. Loosening the soil to improve water penetration, root penetration, and aeration.
2. Plowing under crop residues and other materials.
3. Preparing a seedbed.
4. Controlling weeds.

Done properly, and at the right time, tillage makes your soil a better home for crops (growing plants). It helps to keep the soil in good tilth.

Too much tillage (on the other hand) may pulverize your soil — severely restricting water, root, and air penetration. Heavy equipment may compact layers in the soil until roots and water cannot penetrate them.

It is a common practice often to cultivate intertilled (row) crops such as cotton and corn. A mulch formed by light cultivation is thought to prevent capillary movement of water to the surface. This is assumed to prevent evaporation losses of water. Experiments show, however, that there is little or no saving in moisture, and that areation (air movement) may be decreased.

Weeds require water for their growth. You save moisture by cultivating to control weeds. **Cultivations should be made only when necessary to control weeds and to break up hard surface crusts.**

The following precautions with tillage will help you maintain good soil tilth:

1. Work your soil only enough to provide a satisfactory seedbed and control weeds.
2. Use a two-way moldboard plow. This leaves your land level and eliminates excessive land planing, etc.
3. Vary plowing depths to prevent forming an impervious hardpan layer.
4. Till your soil only at the proper moisture content. Working it too wet causes puddling. Working it too dry causes powdering or loss of structure.
5. Before using special practices, be sure your soil needs them. Some of these are subsoil plowing, ripping, etc.

There are several tillage practices which you should use only for the correction of specific conditions. Some of these practices are subsoil plowing, deep plowing, ripping, chiseling, or renovating.

Subsoil plowing refers to plowing to a depth well below the plow layer. This is usually to a depth of 18 inches to 3 feet.

The purpose of this operation is to (1) mix together the surface soil and the deeper zones when they differ in texture, or (2) break up cemented or compacted

layers in the subsoil. This practice will seldom be profitable if your soil is uniform to a depth of some 2 to 3 feet.

Deep plowing describes plowing to a depth below the plow layer but usually not more than 12 to 16 inches. The purpose of deep plowing is to break up and aerate compacted layers you have formed as a result of tillage, irrigation, or harvesting operations. Such a condition is quite commonly called a plow-sole layer or a plow pan.

Ripping or subsoil chiseling is an operation designed to break up hard or compacted layers which exist in the soil below the plow layer. It is performed with an implement having one or more long, narrow, slightly curved teeth. Ordinarily, results are most satisfactory when the soil is dry and will fracture widely.

Chiseling is an operation designed to break up hardpan or plowpan layers in the plow layer. It is performed with implements having one or more narrow teeth

Unproductive areas (as below) don't contribute to crop production, but actually reduce the average yield-per-acre for your farm. This lowers your net returns.

By planting a green manure crop (as sesbania above) on "bare spots" in your fields, you can hasten the process of bringing such areas into production. Plow the green manure crop under just before seed matures.

which may or may not have sweeps.

Renovating is an operation performed to correct surface compaction. It is sometimes used in alfalfa fields to break up the hard surface layer and to help control weeds.

Soil Conditioners

Poor tilth in your soil may be caused by many things such as alkali, high clay content, etc. Materials sometimes called soil conditioners may be added to soils to help improve tilth. These may be used to assist in the reclamation of alkali soils or to improve the physical condition of soils which have poor water penetration or low water-holding capacities.

Organic Matter

Organic matter, such as barnyard manure and the green-

Spreading gypsum on a field before preplanting irrigation for cotton.

manure crops previously mentioned, is one of your best soil conditioners. Hard spots or salt spots in your fields render many acres unproductive.

Plant salt-tolerant green-manure crops in these unproductive areas to hasten their reclamation. Organic matter plowed under may well be considered the first step in improving soil structure or tilth.

Many chemicals also are used as soil conditioners. Some of the more common are discussed below. Good drainage (water penetration) is a principal requirement in using chemicals. It is also your main problem in reclaiming the problem areas.

Lime

Since there are few acid soils in Arizona, very little lime is needed for soil conditioning. In fact, practically all of the irrigated lands in the state contain rather large amounts of calcium carbonate as caliche. Lime or calcium carbonate is used to correct the unfavorable soil conditions associated with soil acidity in areas where acid soils do occur.

Gypsum

Gypsum, the common name for hydrated calcium sulfate, is widely used to aid in the reclamation of alkali soils. When it is used properly it will often give excellent results.

Alkali soils have too much sodium attached to the surtace of the clay particles. This causes a soil to disperse or run together and results in high alkalinity and stickiness, thus decreasing the penetration of air and water. Such a condition may exist naturally, or it may be caused by irrigation or seepage water which contains too much sodium.

The calcium in gypsum replaces sodium attached to the clay particles. These particles then tend to group together so that larger pore spaces are formed. Irrigation water can then pass through and wash out the sodium and other excess salts displaced by the calcium.

Gypsum and similar materials are of doubtful benefit unless a sodium problem exists. A chemical analysis of the soil helps determine whether gypsum is needed and, if so, how much should be applied.

Adding gypsum to your soil is but one part of the problem involved in alkali reclamation. To obtain maximum benefits from the use of gypsum the following conditions must be met:

1. Your land must be well leveled so that water will be distributed evenly on all parts of the field.

2. Land must be well drained so that the salts can be leached below the root zone of growing plants.

3. Gypsum must be broadcast and disked into the soil or applied in the irrigation water.

4. Sufficient water must be applied to leach out excess salts.

5. The first crop will probably have to be one that is tolerant of alkali, such as Bermuda grass, barley, or possibly cotton.

The quality of irrigation water that is relatively low in total soluble salts but high in sodium can be improved by the addition of finely ground gypsum. This prevents a build-up of sodium in the soil, and may in some instances improve the rate of water penetration into the soil.

(See Bulletin A-27 — "Gypsum and Sulfur-bearing Amendments for Arizona Soils.")

Sulfur

Sulfur furnishes calcium to the soil indirectly. Through chemical reaction with calcium it forms calcium sulfate or gypsum.

It is obvious that sulfur should not be used as a soil conditioner if your soil does not contain calcium carbonate. A simple soil test will tell you whether or not calcium carbonate is present in adequate amounts. Another test will help to determine whether or not you need a soil amendment on your soil.

In soils high in calcium when a sodium problem is present, sulfur should give the same response as gypsum, but the reaction will be somewhat slower. One ton of sulfur is eventually of about equal value as a soil conditioner to five or six tons of high-grade gypsum.

Other Sulfur Materials

Sulfuric acid, sulfur dioxide, polysulfides, and other sulfur-bearing materials are sometimes used as soil conditioners. Nearly all of these materials, like sulfur, do not contain calcium and fur-

nish it only through chemical reaction with the calcium carbonate found in the soil.

For maximum benefit in soil reclamation using sulfur compounds, the conditions described under **Gypsum** must be met (see page 10).

Polyelectrolytes

A group of synthetic organic compounds have been marketed from time to time for use as soil conditioners. Used properly these materials tend to stabilize the aggregates in almost any type of soil.

They probably are of greatest value if you have a fine textured soil. At present, however, their use is restricted due to the high cost of materials.

Land Preparation

One of the first requirements for successful crop production is an abundant supply of water for each and every plant. The first step is to level your land so that uniform water distribution is assured.

Level land aids in obtaining better and more even water penetration in the soil. It increases crop yields, helps reduce your losses in water and plant food, and saves you labor. It might be called the foundation for good water management.

Although this bulletin is not intended to deal with the technical phases of land leveling, some problems in soil management that may arise as a result

Level land insures even distribution of irrigation water.

of leveling cannot be overlooked. Before you begin leveling operations a thorough investigation should be made of your soil. The type of leveling must depend upon the characteristics of the soils such as depth, texture, water-holding capacity, rate of water penetration, and hardpan formations.

Deep cuts should not be made in shallow soils because enough soil must be left in all parts of the field to support plant growth. Also, in some cases, sand at rather shallow depths will be exposed if cuts are too deep. This will result in uneven water penetration.

Extreme variations in yield and in plant growth are quite obvious in newly leveled land. This is to be expected since the topsoil which contains most of the organic matter and soil organisms has been displaced and deposited in the lower spots in the field. Compaction by heavy machinery also brings on this difference in growth.

You may speed up the improvement of these newly leveled areas by incorporating liberal amounts of organic matter into the soil. Where available, barnyard manure is excellent for this purpose. Additional crop residues such as straw may be used.

In some instances, a form of deep tillage such as ripping or subsoil plowing may be of benefit due to improved soil aeration which follows. Liberal amounts of commercial fertilizers may also be of some benefit.

The use of good soil-building practices during these initial years has a great influence on the length of time required to bring this land into full production and on the level of production that can be obtained from it. Your interest, of course, is to secure rapid improvement and to reach an ultimate goal that is at least equal to the other fields in the area.

Your local County Agricultural Agent has more information available on the subject of leveling land.

SOIL FERTILITY

Soils in good tilth promote the growth of healthy root systems that plants need to obtain mineral nutrients from the soil. These mineral nutrients, commonly known as "plant-food" elements, are essential for plant growth. Nitrogen, phosphorus, calcium, potassium, and sulfur are a few of the essential "plant-food" elements.

Fertile soils, or those said to be well supplied with available plant food, are capable of producing excellent crops without additional plant food. Other soils, deficient in one or more of the essential "plant-food" elements, must receive extra plant food before maximum crop growth and yields may be obtained.

All soils require good crop

rotation and the intelligent use of commercial fertilizers where needed in order to make the best use of the plant food which is already present.

Irrigation water management is directly related to soil management and plant growth. Adequate plant nutrients require an adequate water supply in order to support top yields of high quality crops. Deficient water supplies restrict yield and quality as does a nutrient deficiency.

(See Bulletin A-20 — "Irrigation: When? How Much? How?")

Commercial Fertilizers

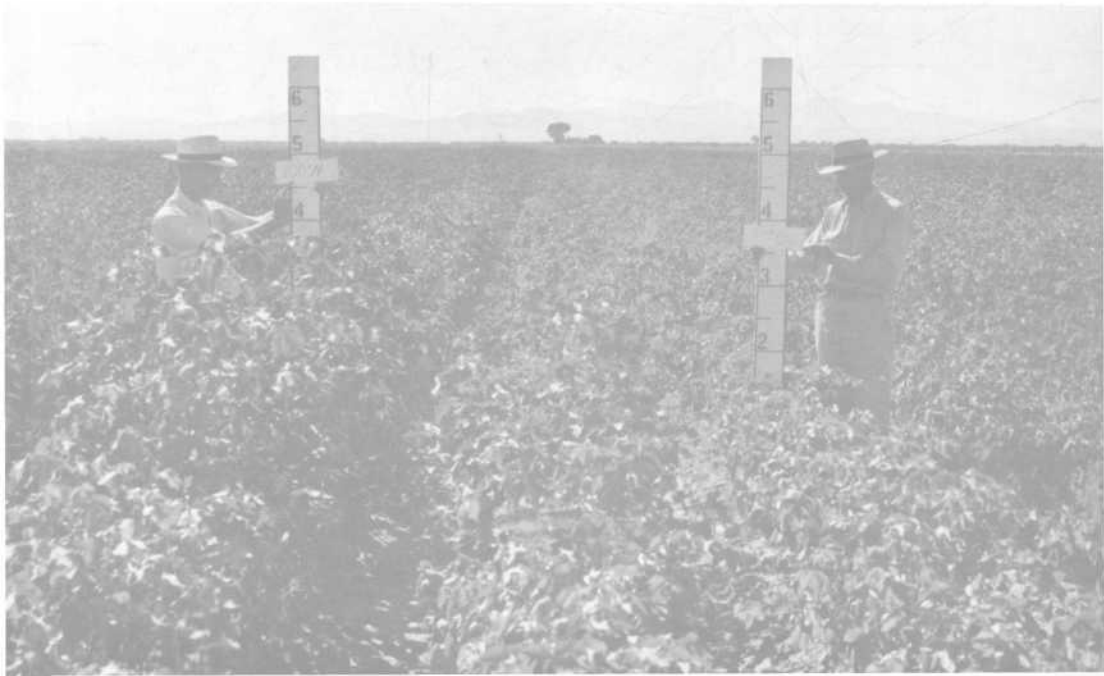
As soils become older and are cropped longer and longer, they lose most of their available plant food and some type of fertilizer is needed by most crops. Good crop rotations may decrease the need for nitrogen fertilizer but increase the need for some other plant food element.

Nitrogen

Soil nitrogen is nearly all in the organic form, and Arizona soils are extremely low in organic matter. Therefore, at present nitrogen is the element that you most often need in fertilizing an Arizona soil, except when legumes are growing or have just been grown.

Nitrogen encourages aboveground growth and produces luxuriant, dark green foliage if

A good fertilizer program can increase crop yields. In the Cochise County test below, cotton shows a good response to nitrogen (on the left) but none to phosphate (on the right).



the supply of other nutrients is adequate. Plants starved for nitrogen are small, weak, and yellowish in color, and may not mature properly. Too much nitrogen tends to delay maturity and cause lodging (falling over) of plants.

The proper use of legumes, green-manure crops, and crop residues in the rotation will help to maintain a satisfactory supply of nitrogen in the soil. Thus, less nitrogen in the form of commercial fertilizer will be needed.

Phosphorus

Although supplies of phosphorus in most Arizona soils are thought to be high, the amount available to plants is often rather low. Therefore, you must add additional phosphorus for maximum yields of some crops on some soils. As an example, since legumes are heavy users of phosphorus they will often respond to phosphate fertilization on soils already having enough available phosphorus for good crops of cotton or citrus.

Phosphorus stimulates the early development of a healthy root system and the production of seed. Field crops lacking in phosphorus usually are stunted and have poor root systems. Phosphorus deficiencies are often rather difficult to detect by merely looking at a plant.

The phosphorus contained in commercial fertilizers is generally expressed as available phosphoric acid (P_2O_5)* rather than as pure phosphorus. It is sometimes called phosphate. Fertilizer recommendations are nearly always expressed in the same manner.

Potassium

Potassium is also sometimes included in commercial fertilizers. It is commonly expressed as water soluble potash (K_2O)* rather than as pure potassium.

Arizona soils are, in general, well supplied with potassium; therefore potash fertilizers are not recommended at the present time. It is highly probable that they will be needed sometime in the future, however.

Other Plant-Food Elements

Crops grown in Arizona soils have not shown any shortage of the other plant-food elements up to the present time. (Iron is sometimes not available to plants, however, due to the alkaline nature of the soils.) As plant food continues to be removed from soils in harvested crops, some of these elements may be in short supply. When that time comes they will have to be supplied in commercial fertilizers.

Buying Plant Food

Fertilizer requirements vary with different soils and crops. It is beyond the scope of this bulletin to give specific recommendations as to kinds and amounts of fertilizers to apply. Such recommendations are given in Folder 107, entitled "Fertilizer Recommendations for Arizona." Get a copy from your County Agricultural Agent.

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*Current trends indicate that P_2O_5 may be expressed as actual phosphorus (P) and K_2O as actual potassium (K) as has been done with nitrogen (N) for a number of years. For purposes of conversion: $P_2O_5 \times 0.44 = P$; and $K_2O \times 0.83 = K$. These are the amounts of the actual plant nutrient applied.

Always purchase fertilizer on the basis of the **plant-food** that it contains. The nutrients in common fertilizers are, in general, about equally available to crops. The most economical fertilizer you can buy in most cases is the one which furnishes the desired nutrients for the lowest cost.

Crop Rotations

Several crops grown on one field or a group of fields in a more or less definite order over a period of years is known as crop rotation. For general farming in the irrigated sections of Arizona a good crop rotation adapted to local conditions is practical and is essential to maintain soil productivity at maximum efficiency.

A good crop rotation:

1. Improves soil tilth by maintaining a supply of active organic matter. This usually means that you secure higher crop yields.

2 Decreases the need for nitrogen fertilizers because legumes can obtain nitrogen from the air if properly inoculated.

3. Encourages more efficient use of fertilizers. Plant-food needs of all crops in the rotation may be considered and proper fertilizers applied to the crops giving the greatest response.

4. Distributes labor more evenly throughout the year.

5. Makes more efficient use of your available water supply.

6. Aids in the control of diseases such as Texas Root Rot.

7. Aids in the control of weeds.

8. Provides diversification, a buffer against sudden price drops in any one crop.

9. Helps provide for a permanent and profitable agriculture.

No single crop rotation may be devised to fit all conditions in Arizona. The size of the farm as well as interest and experience of the farmer aid in the determination of the most desirable rotation for that individual farm. Also, the crop rotation plan must be flexible so that changing economic conditions may be met successfully.

Any crop rotation plan must be planned around the principal crop that you plan to grow. In southern Arizona, for example, this might be cotton.

To accomplish the functions listed above, the rotation also should include a legume such as alfalfa. Small grains or grasses are also desirable since their roots grow in the upper few feet of soil and help you to maintain good soil tilth.

An example of a good crop rotation in southern Arizona, then, might be alfalfa followed by cotton and small grain. The number of years in each crop could be adjusted to fit changing economic conditions. **It at all possible, land should be in a legume at least three years out of every seven.** (See drawing at right.)

In northern Arizona, corn might be substituted for cotton in the same rotation. High price periods make it desirable sometimes to grow one crop nearly continuously for a period of several years. Under such conditions, green-manure crops often can be used to help maintain high productivity.

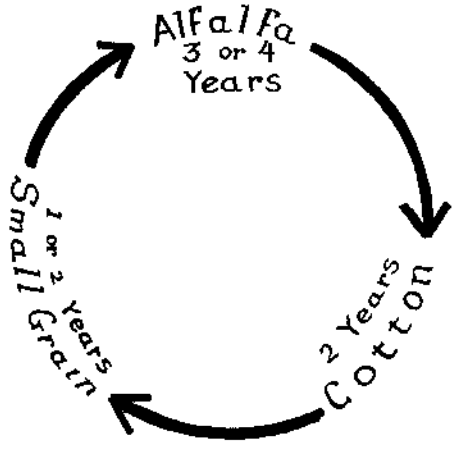
For example, in the warmer valleys a winter green-manure

crop such as Papago peas may be planted following cotton in the fall and plowed under in time for cotton to be planted again the following spring. Sesbania or guar may be planted in the summer between winter vegetable crops in a similar manner.

In some cases it may be desirable to combine more than one rotation on your farm. For example, some years it may not be economical for you to grow enough alfalfa to keep all of the land in a legume for three years out of every seven. In such times you could use green-manure crops to supplement the alfalfa. In other words, two rotations would be used on the same farm.

Fertilizers In The Rotation

The crops you grow differ in their needs for the various plant-food elements, and in their ability to obtain these nutrients from the soil. Also, crops following alfalfa should require much less nitrogen fertilizer than crops growing on land which has not grown alfalfa for several years. To plan a good fertilizer program you must take into consideration the entire crop rotation.



An excellent crop rotation for sandy soils in southern Arizona.

Phosphate for Legumes

In Arizona, legumes usually respond to phosphate fertilization more readily than many other crops such as cotton or corn. For this reason it is more profitable for you to apply phosphate on legumes rather heavily, and to apply little or no phosphate to cotton or corn.

Since legumes, if properly inoculated, obtain nitrogen from the air, little or no nitrogen fertilizer should be needed for these crops. Experience has shown that on most soils the crop immediately following alfalfa should not need nitrogen fertilizer.

The second crop following alfalfa may respond to a moderate amount of nitrogen fertilizer. You should apply the full recommended amount of nitrogen for the third crop.

Soil and petiole analyses are recommended to determine nitrogen needs for cotton. (See Folder 97, "Soil and Petiole Analyses Can Pinpoint Cotton's Nitrogen Needs," for further information on this subject.)

Add "N" to Crop Residues

Green-manure crops and crop residues sometimes present a special problem in fertilization. If you have large amounts of crop residues or nearly mature green-manure to incorporate into the soil immediately ahead of another crop, that crop may suffer from a temporary shortage of

nitrogen. When this happens, soil bacteria that are decomposing the organic materials are competing with the crop for the available supply of nitrogen. It may be said that the bacteria "eat at the first table."

You can prevent this condition by broadcasting nitrogen fertilizer on the land before plowing under the crop residues or green manures. A good general rule is to apply 30 pounds of nitrogen per ton of dry matter. Usually 40 to 50 pounds of nitrogen per acre is a good average figure for this purpose.

Determining the best fertilizer program for your farm may be done through trials which you carry on from year to year. The general recommendations of the Agricultural Experiment Station are a good guide, but they must be modified by experience to fit individual circumstances.

MANAGEMENT

Your success in the production of crops depends upon many factors, some of which have been discussed in this bulletin. Arizona soils are good soils but require a lot of good management if they are to remain productive.

As an example, many soil and plant problems may be due largely to structure. They may be brought on by poor air or water movement in the soil.

The evidence of chlorosis in plants is an indication of mineral deficiencies and other things.

Under your climatic conditions, organic matter may quite possibly be considered more important as a soil conditioner than as a storehouse of plant food. Good management of this organic matter, providing organic matter turnover from one year to the next, is of great importance.

Some of the other factors which cannot be covered fully in this bulletin are:

Efficient Irrigation

Good Cultural Practices

Adapted Varieties
Inoculation of Legumes
Proper Planting Dates and Methods
Proper Harvesting

Control of Weeds

Control of Insects and Diseases

Satisfactory Drainage

Efficient Marketing

See your local County Agricultural Agent for information on these and other farm and farm-home subjects.

Maximum Production

In outlining a good soil- and crop-management program, you must consider all of the factors concerned with growing and marketing crops. These factors must be related to one another so that they fit the circumstances found on your farm.

Use the principles of soil management presented in this bulletin in this manner. Ask your County Agricultural Agent for assistance.

This publication is issued by the
Cooperative Extension Service and
the Agricultural Experiment Station
of The University of Arizona. See
your local County Extension Agent
for additional information.

Check List for Good Soil Management

√ Level your land to obtain uniform water distribution.

√ Provide good tilth of your soil by proper organic matter management and tillage.

√ Use the least amount of tillage that will (1) Get a satisfactory seedbed, and (2) Control weeds.

√ Use soil conditioners if you need them for alkali reclamation or poor quality irrigation water.

√ Use a good crop roation on your farm

√ Provide an adequate supply of nutrients for all crops.

√ Consider the entire crop rotation when planning your fertilizer program.

√ Relate your soil management plans to your other crop-production problems.

See your County Agricultural Agent for additional information. Ask for a copy of Bulletin A-27, **Gypsum and Sulfur-bearing Amendments for Arizona Soils**, and for Folder 97, **Soil and Petiole Analyses Can Pinpoint Cotton's Nitrogen Needs.** Publications on other subjects also are available.