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Fertilizer

Recommendations

FOR ARIZONA



Circular 208

Agricultural Extension Service, University of Arizona, Tucson

Fertilizer Recommendations for Arizona

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Fertilizers are not a substitute for good management on your farm. Commercial fertilizers have a definite place in a good soil-management program, but they will not replace other sound cultural practices.

For maximum benefit from fertilizer, a soil must be in good tilth. Soil in such a condition allows water, air, and roots to penetrate easily. This provides a good home for crops.

Proper tillage and maintenance of organic matter by plowing under crop residues and green manure crops will keep soil in good tilth. Legumes, such as alfalfa, have tap roots which penetrate deep into the soil and open up channels through which water can enter. If properly inoculated, legumes obtain most of their nitrogen from the air. This helps to maintain a high nitrogen level in the soil.

Plan your fertilizer program for an entire rotation rather than for an individual crop. For example, on land that is low in available phosphate, apply phosphate to alfalfa liberally. No fertilizer should be needed the first year after the alfalfa is plowed under unless the land is extremely sandy. A moderate amount of nitrogen would probably be needed the second year, and the full recommended amount the third year.

Read the Label

A fertilizer formula shows which plant nutrients are in the fertilizer. It is usually printed on the bag or tag as a series of three numbers.

The first number in the formula always refers to the percentage of total nitrogen (N). The second number refers to the percentage of available phosphoric acid (P_2O_5). The third refers to the percentage of water-soluble potash (K_2O).

As very few fertilizers used in

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Arizona contain potash, the third number is often omitted from the formula. Thus, 100 pounds of a 16-20-0 fertilizer (sometimes called 16-20) contains 16 pounds of N, 20 pounds of P_2O_5 , and no potash.

Buy Plant Food

Fertilizer requirements vary with different soils and crops. As stated above, the plant nutrients commonly contained in commercial fertilizers are nitrogen (N), phosphoric acid (P_2O_5), and potash (K_2O).

Fertilizers which are simple chemical salts, usually containing only one of these nutrients, are called **simples**. Those which are mixed to contain more than one are called **mixed** fertilizers.

The plant nutrients contained in the common simple and mixed fertilizers are in general about equally available to crops. **Therefore, the most economical fertilizer to buy is usually the one which furnishes the desired nutrients for the lowest cost.**

Fertilizers which contain high percentages of plant nutrients are generally more economical than those which contain low percentages.

Fertilizer can be bought in the form of a solid material or as a gas or liquid. Regardless of the form that is chosen, however, the response obtained will depend upon the amount of plant food applied

and the uniformity of that application.

Solid materials such as ammonium sulfate or superphosphate can be placed wherever desired in relation to the seed or plant. This is particularly true when you wish to apply fertilizer in a band at seeding time.

Gaseous materials such as anhydrous ammonia, or liquid materials such as aqua ammonia, are very effective if properly used. They may be applied in the irrigation water or as direct injections into the soil.

Closer control of the amount applied is usually possible, of course, when these materials are applied as direct injections. Fertilizer in the irrigation water will be applied just as evenly as the water itself.

On well-leveled land where the water is applied uniformly, and very little is lost as tailwater, the fertilizer also will be applied uniformly. If considerable water is lost as tailwater, however, some fertilizer will be lost.

The recommendations given in this circular will help you to determine which of the fertilizer nutrients you need to apply for best results. The amount of a fertilizer needed per acre should be determined by the actual pounds of plant nutrients in that fertilizer.

To obtain the pounds of fertilizer that you need per acre, use the formula below.

Formula for Fertilizer Needs per acre

$$\frac{\text{lbs. of nutrient needed}}{\text{lbs. of nutrient contained in 100 lbs. of fertilizer}} \times 100 = \text{lbs. of fertilizer needed per acre}$$

Pounds of some common fertilizers required to furnish 50 pounds of N or P₂O₅

Fertilizer	Analysis N—P ₂ O ₅ —K ₂ O	lbs of fertilizer to supply 50 lbs. of N (approximate)	lbs of P ₂ O ₅ also supplied (approximate)
		Ammonium nitrate	33- 0- 0
Ammonium sulfate	21- 0- 0	238	0
Anhydrous Ammonia	82- 0- 0	61	0
Urea	44- 0- 0	114	0
Ammonium Phosphate	16-20- 0	312	62
Ammonium Phosphate	11-48- 0	455	218
		lbs. of fertilizer to supply 50 lbs. of P ₂ O ₅ (approximate)	lbs of N also supplied (approximate)
Single Superphosphate	0-18- 0	278	0
Treble Superphosphate	0-46- 0	109	0
Ammonium Phosphate	16-20- 0	250	40
Ammonium Phosphate	11-48- 0	104	11

Use Test Strips

The only way to determine the true value of fertilizer applied to crops on your farm is by the use of test strips.

It is misleading to compare one field that has been fertilized with another field that has not been fertilized. There may be differences in cropping history, soil, irrigation, etc.

By leaving an unfertilized strip through the middle of a fertilized field, a fair comparison can be made. Of course, more reliable information can be obtained by leaving two or more unfertilized strips in different parts of the field.

In case the need for fertilizer is doubtful, fertilize one or two strips through the field to find out whether or not it is needed. Different rates of fertilization can also be checked in this same manner on your own farm.

Test strips should always be har-

vested separately and the yields determined. It is impossible to tell by inspection how much the fertilizer has influenced yields.

Test strips should be used for several years because crops do not always give the same response to fertilizers every year.

Recommendations

The fertilizer recommendations listed below are based on the best information available from experimental results with fertilizers in the field and from careful observations under field conditions. They are made for average conditions of soil fertility.

The following rules will help to adjust the general recommendations to your own farm:

- Crops to be grown on land just out of alfalfa should need little or no nitrogen fertilizer. Phosphate applications can also be reduced or eliminated if the alfalfa was phosphated heavily.

● Phosphate recommendations apply only to soils which are deficient in this element. Past cropping history, a soil analysis, or small test areas on each field will help to determine whether or not a soil contains sufficient phosphorus.

● When heavy crops of sorghum or small grain stubble are to be plowed under, broadcast 50 pounds of N per acre ahead of plowing to hasten decomposition.

● In general, sandy soils require more fertilizer than fine-textured (heavy) soils.

● More frequent nitrogen fertilizer applications are needed on sandy (light) soils than on fine-textured (heavy) soils.

● Do not place fertilizers in direct contact with the seed because of the danger of lowering germination.

● To get maximum returns from fertilizer, apply it carefully and uniformly.

● Potash is not recommended on Arizona soils at the present time.

● When in doubt, consult your County Agricultural Agent.

What to Expect from Fertilizers

Nitrogen

Nitrogen encourages above-ground growth. This produces luxuriant dark green foliage if the supply of other nutrients is adequate.

An excess of nitrogen tends to delay maturity and cause lodging. Plants lacking in nitrogen are small, weak and yellowish in color.

Of the elements commonly applied in commercial fertilizer, nitrogen has the quickest and most pronounced effect. It is the element most commonly needed on all crops in Arizona except legumes.

The need for applications of nitrogen in the form of commercial fertilizers can be lessened by the proper use of legumes, green manure crops, and crop residues, in the rotation. More information on this subject is given in Circular No. 211 — "Soil Management," available at your County Agricultural Agent's office.

Phosphorus

Phosphorus stimulates the early development of an extensive root system and tends to hasten matur-

ity. A lack of phosphorus is rather difficult to detect by merely looking at a plant.

The phosphorous content in fertilizers is commonly expressed as available phosphoric acid (P_2O_5) rather than as pure phosphorus. Although the total supply of phosphorus in Arizona soils is rather high, the amount available to plants is often low. Therefore, additional phosphorus must be supplied by commercial fertilizers to obtain maximum yields for such crops as alfalfa on some soils.

Potassium

Potassium, another essential plant food element, is necessary for starch formation and chlorophyll development. A lack of potassium may cause leaves to die at the edge and to be mottled with yellow. The yellow areas may later turn brown.

The potassium content in fertilizers is commonly expressed as water soluble potash (K_2O). As there is an abundant supply of potassium in most Arizona soils, very little potash fertilizer is used in the state.

Fertilizer Recommendations for Arizona Field Crops

Crop and Areas in Which Recommendations Apply	Pounds Per Acre Plant Nutrients Recommended	Notes on Applications
	N P ₂ O ₅	
ALFALFA (hay, pasture, seed) ALL counties (except on the Yuma-Mesa) to establish a stand	0 90-140	Apply with a drill at least 3 or 4 inches deep at time of seeding. If no drill is available the phosphate may be broadcast and disked in ahead of the preplanting irrigation before seeding. Band placement of the seed over the fertilizer may be desirable, especially on sandy soils.
 o o 	0 45-90	Apply as a top-dressing during the winter or before spring growth begins. The lighter rate should be used for annual applications or the heavier rate for biennial applications.
CASTOR BEANS Maricopa, Pinal	50-100 0-50	Apply in a band about 2 inches below and 2 inches to one side of the seed at planting time or as an early side-dressing. On sandy soils, apply half of the nitrogen at planting time or as an early side-dressing, and the remainder as a side-dressing in July.
Yuma	50-100 0	Apply half of the nitrogen at planting time or as an early side-dressing and the remainder as a side-dressing in July.
CLOVERS (sweet, sour, or hubam for green manure) All counties	0-20 40-50	Apply 3 to 4 inches deep with a drill at seeding time. If no drill is available, the fertilizer may be broadcast and disked in ahead of the preplanting irrigation before seeding.

<p>CORN (grain or silage) All counties</p>	75-125	0-50	<p>Apply phosphate and 1/2 of nitrogen at planting time in a band 2 inches below and 2 inches to one side of the seed or before corn gets knee-high as a side-dressing. Apply remainder of nitrogen as a side-dressing before tasseling time if needed.</p>
<p>COTTON (Upland) Yuma</p>	75-150	0-50	<p>Apply 50 pounds per acre of nitrogen at chopping time. Make subsequent applications according to need as indicated by plant growth. Final applications should be made by August 1.</p>
<p>Pinal, Pima</p>	50-125	0-50	<p>Apply as side-dressing before July 15. A single side-dressing application at chopping time should be satisfactory on fine-textured soils.</p>
<p>Maricopa</p>	50-125	0-50	<p>Apply 1/2 of nitrogen and all of phosphate at planting time on fine-textured soils. Apply remainder of nitrogen at or before first irrigation following planting. On very sandy soils apply 1/2 of nitrogen as an early side-dressing and apply the remainder of the nitrogen before July 15.</p>
<p>Graham, Greenlee, Cochise, and Santa Cruz</p>	50-100	0-50	<p>Apply in band at planting time or as side-dressing by chopping time. Use higher rate of nitrogen with caution due to short growing season.</p>
<p>COTTON (Long Staple) All cotton counties</p>	50-100	0-50	<p>Apply as a side-dressing at or before chopping time.</p>
<p>FIELD BEANS (Irrigated) Northern counties and</p>	50	50	<p>Apply fertilizer in a band at planting time. This is only a tentative recommendation as practically no research information is available.</p>
<p>FLAX Yuma, Maricopa</p>	50-100	0-60	<p>Apply phosphate and about one-half of the nitrogen as a broadcast application to be disked in before planting. Apply the remainder of the nitrogen as a top-dressing prior to the flowering stage.</p>

IRRIGATED PASTURES (Grass and grass-legume mixtures)
All counties

100-150 40-50

Apply phosphate ahead of seeding if legumes are included in mixture. Additional annual early spring phosphate applications may be made as necessary.

Apply one-third of the nitrogen in each of 3 top-dressings during the growing season. Phosphate stimulates legume growth while nitrogen stimulates grass growth. Therefore, the mixture can be controlled to some extent by the fertilizer applied.

SMALL GRAINS (Barley, Oats, Wheat)
Irrigated
For grain or hay

50-100 40-75

Apply phosphate at planting time on phosphorus-deficient soils. Nitrogen may be applied at planting time or as an early top-dressing.

For pasture and grain or hay

100-150 40-75

Apply an additional 50 pounds per acre of nitrogen at the end of the pasturing season. Otherwise use above recommendations.

Dryland

50 30-50

Apply at planting time. Nitrogen may be applied as top-dressing before growth gets too rank.

SORGHUMS (Grain or forage)
All counties

50-150 0-40

Broadcast and disk in 50 pounds per acre of nitrogen plus the phosphate ahead of planting, if sorghum follows small grain. Otherwise apply this amount in a band about 2 inches below and 2 inches to one side of the seed at planting time. Apply remainder of nitrogen as a side-dressing before heading if needed.

SUDAN GRASS

50-125 0-40

Broadcast and disk in 50 pounds of nitrogen per acre plus phosphate, if any, ahead of planting. Apply remainder of nitrogen as a top-dressing if the grass appears to need it.

NOTE: As alfalfa makes more efficient use of phosphate than many other crops, it is recommended that phosphate be applied to the alfalfa in the rotation and to other crops only in case the land has not been in alfalfa for several years.