

Fertilize Small Grains

Arizona Farmers Are Realizing That They Must Replenish Soil Resources

By H. P. CORDS
and L. C. CHAPMAN

When Arizona's agricultural soils were first cropped, they contained all the essential plant nutrients in plentiful amounts, and the use of commercial fertilizers was unnecessary. Today, after years of cropping, this favorable situation has largely disappeared. Farmers are beginning to realize that they cannot continually draw on these soil resources without a thought of replenishing them.

Which Fertilizers?

In common with most other members of the grass family, small grains are heavy nitrogen feeders, and are sensitive to any nitrogen shortages in the soil. Since nitrogen is easily removed from soils through the leaching action of irrigation water and by cropping, small grains more often respond to nitrogenous fertilizers than to any other kind.

On the other hand, most Arizona soils still contain enough phosphorus and potassium for the needs of these crops. On certain soils, however, responses to phosphate fertilizers have been demonstrated.

When Are Fertilizers Needed?

It is impossible to look at a soil and tell whether or not a fertilizer application will pay. How then is a farmer to know when his land needs fertilizer? Fortunately, methods of estimating this need are available.

Chemical soil tests are valuable when properly taken. When the sampling has been insufficient, however, they are liable to be misleading, since fertility varies considerably even in areas of a few hundred square feet. Only rarely will a single sample, or even two or three samples, be representative of a large field.

To an experienced farmer, cropping history will supply a reliable estimate of need for fertilizing. Certain crops deplete the soil more rapidly than others, while many legume crops such as alfalfa actually increase the soil

nitrogen supply. Nitrogen fertilizer is rarely needed following an alfalfa crop.

Certain crops, however, leave bulky residues which are low in nitrogen. The soil microorganisms decomposing these residues draw upon the available nitrogen in the soil and effectively tie it up for considerable periods. The sorghums are a prime example of this phenomenon.

Several years ago an experiment was originated on the University Mesa Farm to find a cure for this sorghum after-effect. In 1947, short combine types were checked against forage types like Hegari along with a series of fallow plots to serve as a check. In all cases, a greater depressing action was apparent on a following wheat crop with the heavy forage types than among the smaller or combine types of sorghum.

On half the plots, liquid ammonium nitrate at the rate of fifty pounds of nitrogen per acre was applied just ahead of the wheat in an attempt to counteract the ill effects of the preceding sorghum. The fallow or checks plots far outyielded all others, both on the fertilized and unfertilized areas. There was also a significant difference between the combine types and the forage types.

Hegari decreased the wheat yield

42 percent, while Martin decreased the yield only 23 percent. Furthermore, the nitrogen application overcame the effect of the sorghums to the extent that even following Hegari, the fertilized plots outyielded the unfertilized fallow plots.

On the non-fertilized plots, the depressing effect was greatest after Hegari, followed by Early Hegari, Double Dwarf 38 Milo, Caprock and Martin in the order named. Yields ranged from 1,507 pounds of grain per acre on the check plots to 881 pounds per acre following Hegari. In 1948 and 1949 the test was enlarged with Vaughn barley and California Red oats used as the indicator crops. Results were essentially the same as in 1947.

It is recommended then, to make a fairly heavy nitrogen application following a sorghum crop. Preferably, half the amount should be applied at the time the sorghum stalks are worked under, and the remainder just prior to planting. Removal of the sorghum stalks is never recommended, since this removes a valuable source of organic matter sorely needed by most Arizona soils.

How Much?

The question of how much fertilizer to apply is one that is difficult to answer, since every soil is different. Tests at the Mesa Farm indicate that rates up to 75 pounds of nitrogen

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The Vaughn barley in this picture followed a sorghum crop. That in the foreground received nitrogen fertilizer. That in the background was unfertilized.



Toxicity of Pigweed

By WILLIAM J. PISTOR

Every year numerous death losses have been reported in cattle grazing in areas where summer weeds are in abundance. Several of these weeds, because of the rapid, lush growth, cause acute bloat and some of them contain toxic properties. *Amaranthus palmeri*, commonly called pigweed or careless weed, is the most common of these weeds that causes bloat and also contains a toxin.

Pigweed grows very rapidly when sufficient water is present. It is a weed in many irrigated pastures and grows on ditch banks and on many ranges. It is generally grazed by cattle in all stages of growth and in some areas it is cut and used as dry roughage or put into silos with sorghums.

Toxic Material

Pigweed was suspected several years ago as the possible poisonous plant in the reported death losses in cattle. Tests showed that the leaves, stems and seed heads contained varied amounts of nitrate. Tests were made on many samples and the nitrate (KI) contents varied greatly from traces of nitrate to over 9 percent nitrate. These larger amounts were usually found in the mature plants after the stems turned red and in the mature harvested plants.

Although these large amounts of nitrate are not toxic, they can quickly be changed to the toxic nitrite by ~~enzymatic~~ ^{enzymatic} action. It has been reported that rain or snow activate the enzymes in oat hay or straw to change the nitrate to nitrite. This contributing factor has been noted in Arizona but we have found that the proper conditions in the Rumen

Typical pigweed plant, left; typical tassel of pigweed plant, right.



(paunch), can also quickly stimulate this ~~enzymatic~~ ^{enzymatic} action in the plants soon after eaten.

Since these conditions in the weather, plant, and the rumen are necessary to change the non-toxic nitrate to a toxic nitrite, pigweed is not always poisonous. This answers in a general way the fact that pigweed is regarded as a good feed by many stockmen who have not experienced losses.

Symptoms and Lesions

The symptoms of bloat are readily recognized in animals if they eat too rapidly of the young succulent plant. The symptoms in the animal that is poisoned with the nitrite are not usually seen because the animals affected die suddenly. If the animal is seen, there are symptoms of suffocation and the animal falls without much struggle.

The only lesion found in the dead animal is a very dark blood, both in the veins and arteries. Nitrite poisoning is a chemical action on the red blood cells causing a methemoglobinemia or an inability of the red cells to release the oxygen to the tissues.

Control

The control of death losses from the plant offers the same general problems to stockmen as does Johnson grass or cyanide poisoning. The plants can be utilized by cattle but they should be watched carefully for any symptoms of poisoning. A history of the area is necessary because, as with Johnson grass, there are many areas in which the plant does not contain sufficient nitrate to be toxic.

Cattle should not be placed on pastures containing pigweed too suddenly unless there is sufficient other food available. Pigweed hay can be utilized if mixed with other hay so that the percentage of the poison is reduced.

A solution of methylene blue and several other solutions advertised for forage poisoning act very quickly on poisoned animals and these should always be on hand for immediate use. Stockmen who have this plant in their pastures and have experienced losses should consult their local veterinarian or get in touch with the County Agricultural Agent for information and tests on this plant.

—William J. Pistor is Head of the Animal Pathology Department.

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per acre were economical on depleted soils and after a sorghum crop. On the other hand, tests at the Safford Experiment Farm have failed to show a response to any type of fertilizer.

There are several factors that could have been responsible for this difference. First of all, the Safford soils are naturally higher in organic matter than those at Mesa, hence a larger nitrogen reservoir is available. Secondly, the soils at Safford are higher in soluble salts and alkalinity, factors which limit the utilization of fertilizer elements by plants. And third, the Safford soils had no history of successive cropping with soil-depleting crops as at Mesa.

The safest thing for a farmer to do is to familiarize himself with his own soils by making his own small-scale fertilizer test. A few borders, each fertilized at a different rate of nitrogen, along with a drill strip of phosphate fertilizer crossing them should be indicative. An unfertilized border should be left as a check, of course. Yield figures will be valuable, but observation may be enough for a rough estimate.

At What Stage?

Time of application is one part of this fertilizer story that has a pretty definite answer. Except on excessively light soils, all the fertilizer should be applied prior to the jointing stage of the small grain. Later applications are likely to delay maturity without increasing the yield.

Tests conducted at the various Experiment Station farms all indicate that application prior to planting is the most practical. Rates normally used for small grains will not interfere with germination or emergence as has sometimes been supposed.

What Nitrogen Source?

Tests at the Mesa Farm show little advantage for one nitrogen source over another, as long as equal amounts of nitrogen per acre were uniformly applied. Under certain conditions, it is difficult to obtain a uniform application of the liquid forms when they are applied in the irrigation water.

The fertilizer which furnishes nitrogen (or phosphorous when that is the fertilizer element needed) at the cheapest price per pound when applied to the soil is the one to buy.

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