NITROGEN BOOSTS RANGE PRODUCTION

By Phil R. Ogden, Jack L. Stroehlein and E. M. Schmutz

What effect does nitrogen fertilization of a native range have on livestock production? That was the objective of a cooperative study by Frank Appleton, owner of Elgin Hereford Ranch; Chevron Chemical Company; and the Departments of Agricultural Chemistry and Soils and Watershed Management of the University of Arizona.

Native desert grassland near Elgin, Ariz. was fenced into six 60-acre pastures in late June and early July of 1966. Four pastures were fertilized wth 50 pounds of nitrogen per acre (150 pounds of ammonium nitrate), and two pastures were not fertilized. The graph below shows the pasture plan for the study. Fertilizer was applied by fixed-wing aircraft on July 21, 1966 after the soil was moist from initial rains (1.75 inches prior to fertilization).

The authors are members of the Departments of Watershed Management and Agricultural Chemistry and Soils.

Use Three Groupings

Bill Piper, manager of the Elgin Hereford Ranch, selected 80 heifers which were weighed and assigned to the six pastures as follows:

a) five 2-year-old, bred heifers and 5 yearlings to each of two unfertilized pastures as checks;
b) five 2-year-old, bred heifers and 5 yearlings to each of two fertilized pastures; and
c) ten 2-year-old, bred heifers and 10 yearlings to each of two fertilized pastures.

The replicated pasture treatments provided a comparison of a group of animals on check pastures with an equal number of animals on fertilized pastures and with double the number of animals on fertilized pastures. Data from plot studies in the Elgin area in 1965 had shown that 50 pounds of nitrogen per acre approximately doubled forage yield.

3-Month Pasture Test

Heifers were branded with a dye number, weighed, and placed on the pastures on July 20, 1966. They were reweighed Oct. 20, 1966 and weight gain was used to evaluate animal response to fertilization of the pastures. The bred heifers were removed from the pastures on October 20, 1966 but were replaced with calves. The calves and yearlings grazed the pastures from October 20, 1966 to December 20, 1966 and weight changes were also determined for this period.

Precipitation from July 1 to September 21, 1966 averaged 12.5 inches. Storms were well distributed throughout the growing season.

Both bred and open heifers gained more per individual animal on fertilized pastures compared to nonfertilized pastures when grazed with the same number of heifers. (Figure 2). The average heifer weight gain from fertilized pastures grazed with 10 heifers was 36 pounds more per heifer for the 90 days than for the same number of heifers on nonfertilized pastures. This was a highly significant difference.

Doubling the number of animals grazing fertilized pastures resulted in a similar gain per individual heifer on fertilized pastures compared to nonfertilized pastures (Figure 2). The average gain per acre, however, was greater for 20 heifers on 60 acres of fertilized pasture compared to gain from 10 head on 60 acres of nonfertilized range (Figure 3). The 20 heifers on fertilized pasture gained

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brain centers as to cause a lowered body temperature. This enables us sometimes to diagnose an illness as being infectious or toxic in its nature. At such times, as body metabolism reaches a critical low ebb, the body temperature also becomes what is called subnormal. This is notable preceding death.

When the environmental temperature reaches severe upward limits we sometimes see the effects of heat stress. When this occurs we find the animals in a condition referred to as 'heat stroke'. This condition also causes a disturbance in the brain centers and is reflected by very high body temperatures.

Normal Ranges of Temperature (internal)

Horse	99.5 - 101.3
Colt	99.5 - 102.2
Beef cow	98 - 102.4
Dairy cow	100.4 - 102.8
Sheep	101 - 103.8
Pig	101.6 - 103.6
Dog	100.2 - 103.8
Cat	100.5 - 104.2

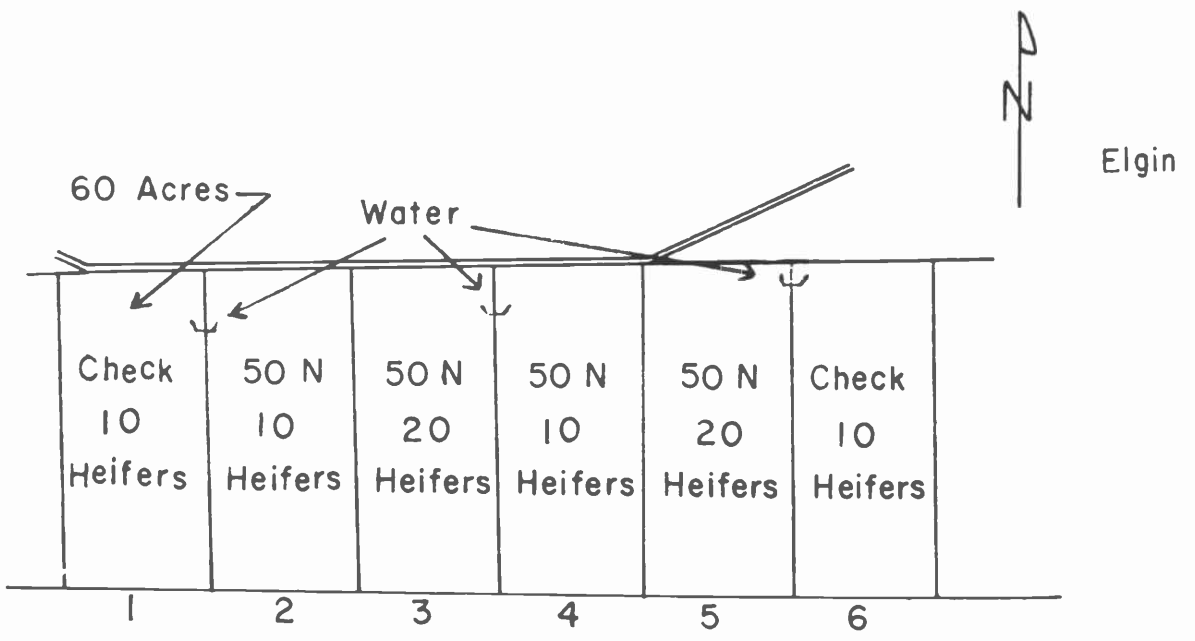
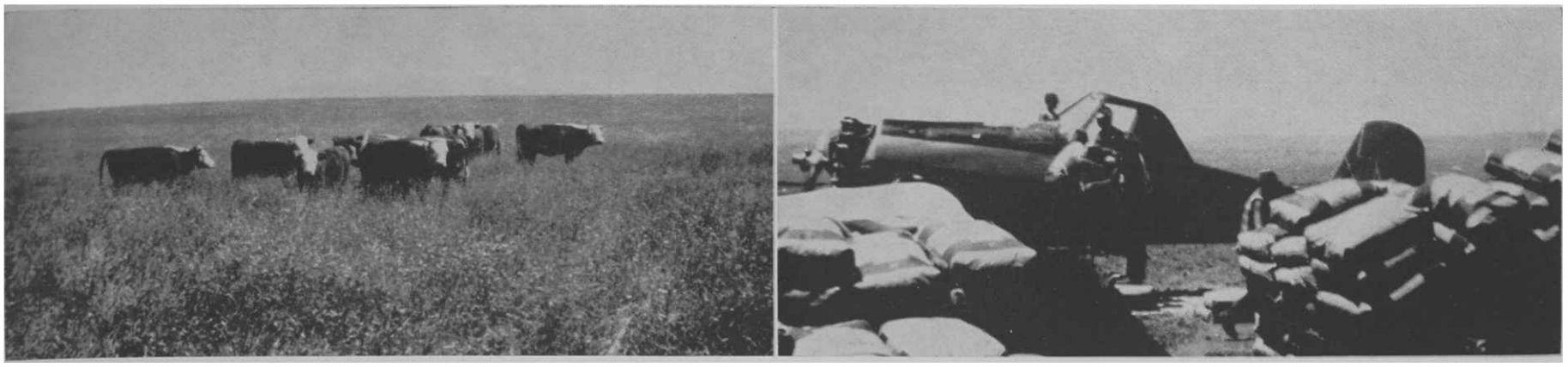


Fig. 1. Pasture plan of range fertilization study near Elgin, Arizona



PUREBRED HEREFORD heifers at Elgin (left) stand belly deep in rank grass of fertilized pasture. Fertilizing (right) was done by airplane spreading of ammonium nitrate.

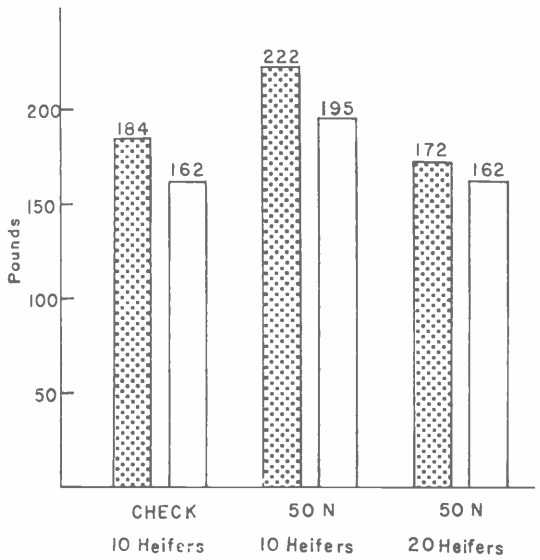


Fig. 2. Gain per heifer on native range near Elgin, Arizona, July 20-Oct. 20, 1966

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56 pounds per acre for the 90 days compared to 29 pounds for 10 heifers on the check pastures.

Fertilizer Effect Tapers Off

The fertilizer treatment in July of 1966 did not improve the performance of individual heifers grazing the pastures when the forage was dry during the October 20, 1966 to December 20, 1966 grazing period. In fact, there was a slight but statistically nonsignificant trend of greater weight loss on fertilized pastures than on checks (Figure 4).

The yearling heifers lost 50 to 62 pounds on the pastures in the 60-day period. The calves showed a slight gain on the check pastures, compared to an averaged loss of 16 pounds on the fertilized pastures grazed with 20 heifers. The livestock had ample forage on all pastures throughout the study period.

Although there were no significant differences in weight changes of individual animals due to fertilizer treatments in the early winter, the fertilized pastures grazed with 20 heifers continued to carry double the number of animals compared to the check pastures. Comparable utilization of blue grama on the check pastures with 10 heifers and fertilized pastures with 20 heifers illustrates that fertilization did double the carrying capacity of the pastures.

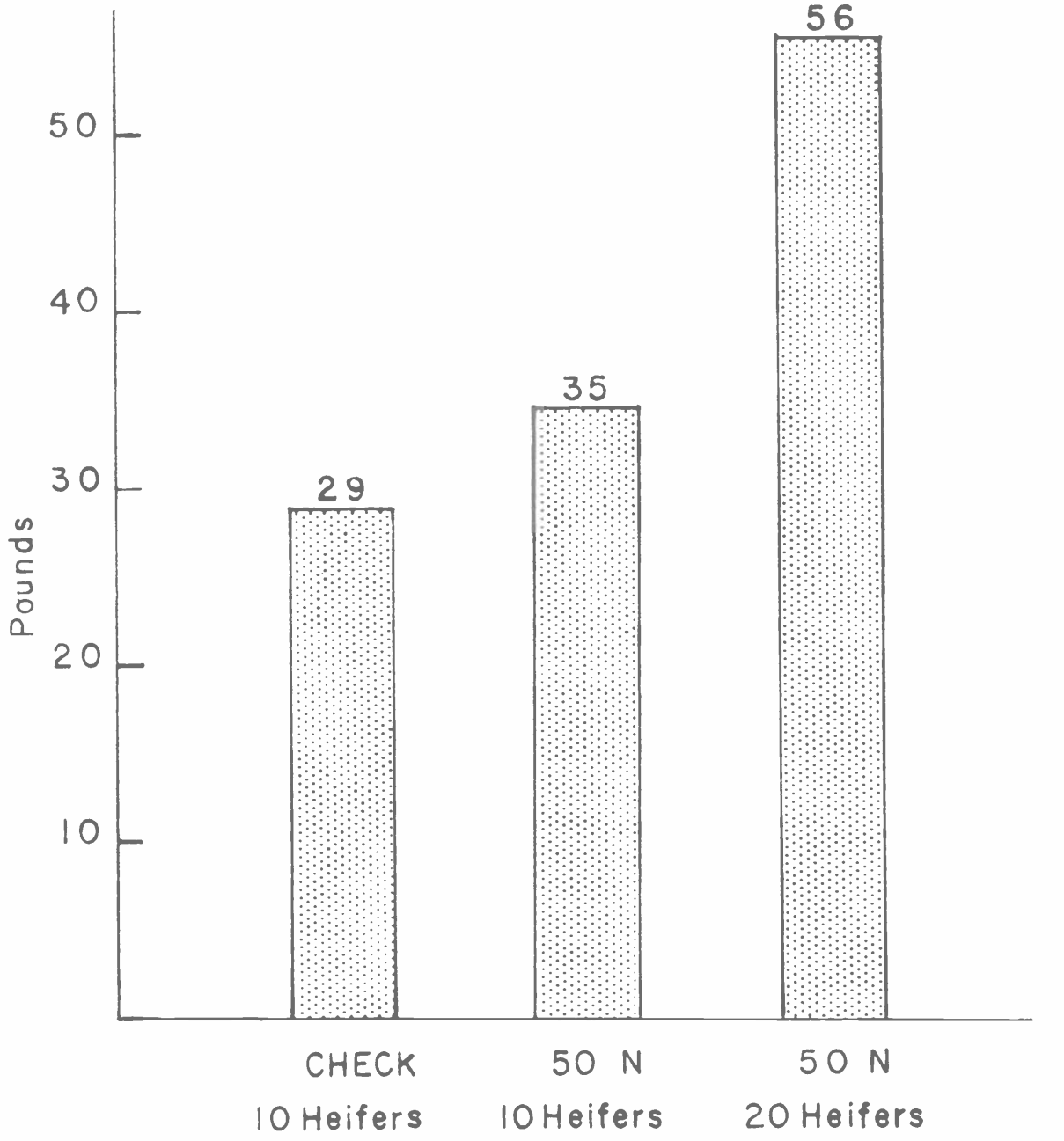

Fig. 3. Gain per acre by Hereford heifers grazing native range near Elgin, Arizona, July 20-Oct. 20, 1966

Utilization of blue grama on the major soil type of the pastures after completion of the grazing in December averaged 48% for the check pastures, 43% for the fertilized pastures grazed with 20 heifers, and 25% for the fertilized pastures grazed with 10 heifers.

What Was Learned

Individual heifers gained slightly more on fertilized pastures than heifers on check pastures when grazed

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Reclaiming Sewage Effluent

By L. G. Wilson and G. S. Lehman

To the layman, sewage effluent represents a necessary but aesthetically undesirable byproduct of community living. To the water conservationist, on the other hand, sewage effluent constitutes a valuable source for a water conservation and re-use program.

Of particular importance for this purpose are the relatively large quantities available in metropolitan areas on a continual basis. In Arizona, for example, sewage flows equal or exceed 50 percent of the total water requirements of the municipalities in the state. By 1975, according to data in an Arizona Town Hall on Arizona's water supply, the total sewage flow from the greater Phoenix area should be 423 ac ft/day (acre feet per day); and for the Tucson area, 111 ac ft/day.

At present a large portion of sewage effluent from treatment plants is being used for irrigation of non-edible crops (so-called sewage farming). Since effluent normally contains an abundance of the nutrients required for crop growth, the farmer reaps an additional benefit by utilizing this supply. Other re-use possibilities also exist, such as for industry, recreation, and for irrigation of edible crop varieties.

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To Upgrade Quality

One drawback to the use of sewage effluent for such purposes is the need to upgrade the quality to levels commensurate with public health safety standards. Two possible methods for "tertiary" treatment of sewage effluent prior to re-use are grass filtration and soil filtration.

Grass filters consist of grassed areas through which sewage effluent is passed. Apparently treatment is effected by the following mechanisms: (a) removal of settleable materials, by the filtering action of grass, and (b) reduction of organic pollution by oxygen at the water surface, and by a biologically active film on the grass surface.

Soil filtration, one of the oldest water treatment methods, consists of percolating sewage effluent through soil material either to a subsurface collector or directly to ground water. With proper management, the soil serves as an effective filter for both solid material and microorganisms.

Grass Filtration Studies

This paper presents data on preliminary studies, conducted cooperatively by the Water Resources Research Center, and the Sanitary District No. 1 of Pima County. Main purpose of these studies was to determine the effectiveness and durability of grass filters during tertiary treatment of sewage effluent under Arizona conditions. Auxiliary studies were made to determine intake rate and depth of penetration of percolating effluent to provide data for future soil filtration studies.

Three plots, each 25 x 1000 feet (0.3% slope) were constructed in 1965 near the outfall from the Ina Road Oxidation Pond operated by the Sanitary District. Each plot was seeded to common Bermudagrass. The outer checks served as guard strips, restricting lateral subsurface flow from the central test strip. An asbestos cement liner was installed in the head ditch to minimize leakage.

Effluent was by-passed to the head ditch through a four-inch pipeline. An earthen ditch was used to conduct tail water to the Santa Cruz River for disposal. Three-inch Parshall flumes were located in the head ditch and tail water ditch for measurement of inflow and outflow rates. Two 100-foot access wells, for use with a recording moisture logger, were installed at 200 feet and 800 feet from the head end of the strip.

Three Tests Used

Three trials were conducted on the test strip in 1966. The guard strips were well irrigated before each test in an effort to minimize lateral subsurface flow from the central strip during testing. For these trials all the water available at the by-pass line was applied to the strip. This was done so that we could observe treatment during maximum loading conditions. The principal analytical method for characterizing treatment during the first two trials was the B.O.D. test, conducted on inflow and outflow samples. (B.O.D. values provide a measure of the biologically decomposable material in a stream). In the third trial the Chemical Oxygen Demand (C.O.D.) test was used. (This

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with comparable numbers of livestock during the summer grazing period.

When increased numbers of animals were placed on the pastures to utilize additional forage obtained from fertilization, individual animal gains were similar to those on check pastures, but the gain per acre was approximately doubled.

Heifers lost weight on dry grass during the October 20 to December 20, 1966 grazing period and fertilization in July did not reduce this loss.

The full story cannot be determined from data from a single year. This study will continue next year to determine carryover effects of the 1966 fertilization.

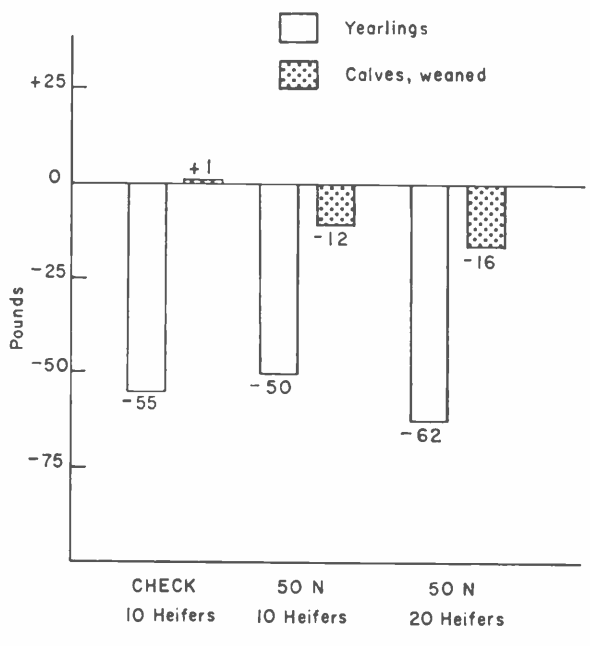

Fig. 4. Weight change per heifer on native range near Elgin, Arizona, Oct. 20-Dec. 20, 1966