

Soil Conditions after 60 Years in a Purdue Pasture Lot

T. M. BUSHNELL, Purdue University

The new Life Science building at Purdue is being constructed in a 4 acre blue grass lot which had been heavily pastured for over 60 years. Before basement excavations were begun, some soil samples were taken and tested to check whether or not the land-use had affected the ground. Little modification was expected because data at hand indicated little change below plow-depth in other land, which had received heavy applications of limestone or fertilizers.

When the data from the first samples showed surprisingly great and deep accumulations of "available" P_2O_5 and K_2O additional samples were taken to check and fill in the picture. In October, 1950 additional samples were taken from the undisturbed profiles along the basement excavations. When construction proceeded the chance for further sampling and study was lost forever.

The soil of the pasture was Warsaw silt loam—a grassland type with a dark brown silt loam, A horizon about 10" or 12" deep; brown to reddish-brown silty clay loam to clay loam, moderately acid, main B horizon; with a darker, neutral, gravelly clay loam zone above the abrupt contact with dry, coarse, calcareous gravels at a depth of 3 or 4'. The mat of blue grass roots was 2 to 4 inches deep.

The land sloped gently towards the southwestern corner, as shown by contours on Figure 1. Rainfall readily penetrated the porous soil and substratum and there was no waterlogging even when there was some run-off to the depression south of the border of this lot.

For many years, up to 45 or 50 dairy cows grazed this area from late April or early May to about June 15 or 30. The lush early grass gave way to patchy growth where cattle avoided droppings. The close cropped sod was dormant during the drier summer, but fall growth was pastured again from about September 1 or October 15 to December 1. Sheep were also on that lot at various times. Stock grazed the whole area but often congregated at the corners. The southwest corner near the gate and water trough was most heavily trampled, covered with droppings and short on grass.

In addition to natural droppings the whole area received top dressings of about 5 tons of manure per acre in the spring for 7 years or more. About 300# per acre of 3-12-12 fertilizer was applied for 5 years. No one knows how much more may have been added in other years.

Warsaw silt loam normally tests about as shown in Figure 2. It is estimated that the profile to a depth of 3 feet contains about 300 pounds of available K_2O and 400 pounds of available P_2O_5 .

When it was found that the "available" P_2O_5 and K_2O were about normal in the soil samples taken from the 3 corners of the lot farthest

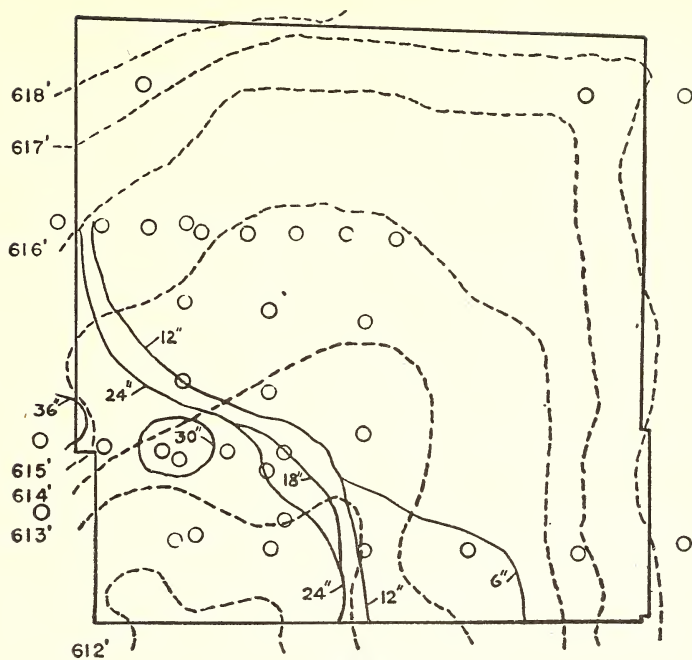


Fig. 1

Fig. 1. Outline of Purdue Dairy pasture lot showing elevations by dotted lines, sample locations by small circles and depths of very high K_2O tests by solid lines.

from the gate, samples were taken from the land just outside the pasture for comparison. Altogether the data show little if any increase in available P_2O_5 and K_2O in those corners which are about 400 feet from the lot gate. Using these data as a basis for comparison, it is evident that large accumulations of available P_2O_5 and K_2O have occurred in the southwestern portion.

The highest readings given by the testing methods are 294# P_2O_5 and 400# K_2O . In many cases the soil samples evidently contained much more than those amounts. In Figure 1 there are lines indicating about where these maximum tests for K_2O occurred, and the depths to which they extended. It is obvious that great accumulations of fertility in top soils were found about 300 feet from the southwest corner, and enrichment continued thru concentric zones towards the gate to increasingly greater depths. High tests for K_2O extended down to over 3 feet in some spots. High tests for P_2O_5 were located about the same as for high K_2O in the 6" layer, and high P_2O_5 extended to 12" in about the same locations where high K_2O reached depths of 24".

Available information will not permit quantitative or sure conclusions about the conditions described in this paper but some inferences seem fairly reasonable.

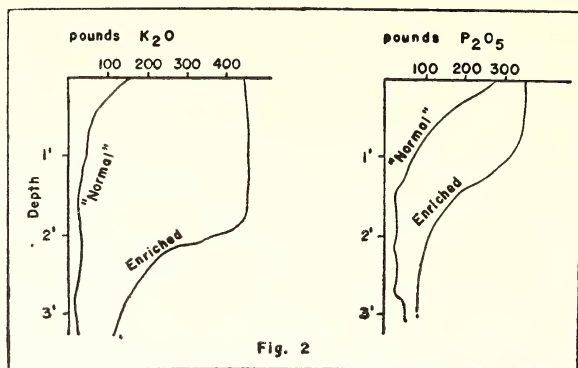


Fig. 2. Amounts of K_2O and P_2O_5 in "normal" Warsaw silt loam according to tests in distant corners of pasture lot, and in the "enriched" soil of the southwestern corner near the gate.

There was little if any change in the appearance of the soils or in the reaction profiles within this field. The blue-grass sod seemed rather mediocre considering the fertility it received. There was little indication of soil change related to land use and management in the corners distant from the gate.

The amounts of fertility nearer the gate ranged up to concentrations of about 2100# available K_2O per acre in 3 feet, or about 7 times as much as the 300# in 3 feet of "normal" Warsaw silt loam. Similarly the available P_2O_5 was over 1000# or about $2\frac{1}{2}$ times the 400# in 3 feet of "normal" profile.

The penetration of K_2O was greater and deeper than that of P_2O_5 , which is in line with recognized principles of soil chemistry.

The estimated accumulation of K_2O is about double of that of the P_2O_5 . This fact is in harmony with the relative proportions of K_2O and P_2O_5 in manure, although it cannot be assumed that composition of manure is the cause of the correspondence.

It is uncertain why the local concentration of fertility is so pronounced. It is estimated that the density of animals per unit of area and time might easily have been 10 times as great in the southwestern corner as in other corners of the lot. That alone might be enough to account for having from 3 to 7 times the "normal" amount of fertility. On the other hand, the slope of the lot from the 3 distant corners toward the lower area near the gate probably helped to increase the fertility contrast by washing something from the 3 corners and adding it to the one low corner. However the 1 foot contours of slope and the lines of relative fertility concentrations differ enough to weaken the correlation between those two factors.

The amount of K_2O and P_2O_5 added to this land during 50 years or more may be roughly estimated at 10,000 and 5,000 pounds respectively. The amounts removed in 50 years of pasturing might be 3,000

and 500 pounds of K_2O and P_2O_5 respectively. This all goes to show there are many things unaccounted for by the available information and points to data needed for a complete study. The tests *do* show greater accumulation of fertility than the writer has ever seen reported elsewhere.