Indiana Results with Lime and Fertilizers on Permanent Pastures

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In Recent years considerable progress has been made in improving the pastures of the nation. Some of this improvement has come through the increased acreage of rotation pastures, some through the more or less complete renovation of existing pasture fields, and some from merely the application of lime and fertilizers to permanent pastures.

While much can be said for rotation pastures and renovation, it would appear that on many acres pasture improvement will be limited to applications of lime and fertilizer, at least for some time, because of the conditions affecting those acres. Among these conditions are the erodibility of the land, the need for uninterrupted pasture forage, and the general resistance of farmers to changes in established practices.

If top-dressing permanent pastures with lime and fertilizer is to be a recommended practice, more knowledge is needed of the kinds and amounts of materials to apply, when and how best to apply them, and the effects of these materials on the quantity and quality of forage as well as their effects on the various soil types that will be used. Fertility balance and permanent agriculture should be as important in the pasture as in the corn field.

REVIEW OF LITERATURE

Donaldson (2) reports on 3-year experiments in Massachusetts by Beaumont. Average yearly increases for an initial application of 2,400 pounds of limestone were 282 pounds of dry matter per acre. For 480 pounds of superphosphate, average yearly increases were only 49 pounds per acre. Highest average yields were obtained wherever nitrogen as nitrate of soda was used, either alone or in combination with P.O., K.O., and lime.

Fink (3) concludes that excellent native pasture can be maintained in high production by annual applications of 60 pounds each of N, P.O., and K.O. Under Maine conditions nitrogen has been very necessary.

In Michigan, Tyson (14) shows the effect of fertilizers and lime on the seasonal distribution of pasture and reports the fertilizer response of a number of Michigan soil types. He reports ammonium sulfate as the principal source of nitrogen used in 1939, and says, "There are a few areas in the state where applications of phosphatic and potassic fertilizers encourage sufficient clover growth that nitrogen in the fertilizer is unnecessary."

Robinson and Pierre (9) working in West Virginia found that the use of lime and superphosphate materially increased the dry matter and protein in pastures. In spite of the fact that nitrogen fertilizers used at rates of 25 pounds and 64 pounds of N per acre reduced the percentage of clover, they report increases in protein where nitrogen was supplied in addition to P.O., K.O. and lime.

Noll et al. (7) found in Pennsylvania experiments on the Rayne silt loam that annual applications of 24 pounds of nitrogen per acre gave an increase of 3%, 48 pounds per acre an increase of 21%, and 72 pounds per acre an increase of 51%. These were digestible nutrient increases on grazed pasture over a period of 10 years. In hay and clipping experiments these investigators report that nitrogen, phosphorus, and potassium all increased the total protein production.

Prince et al. (8) report quite consistent gains in protein production for nitrogen top-dressed in addition to lime, phosphorus, and potassium.

In experiments on a Chester gravelly loam in New Jersey Sprague and others (12) report reductions in both dry matter and protein where nitrogen was supplied along with lime, phosphorus, and potassium. Also, a depressing effect of single spring applications of soluble nitrogen on growth in July and August was noted.

The penetration of surface-applied phosphate and lime into the soils of permanent pastures has been reported by a number of investigators, Sell and Olson (11), Brown and Mansell (1), Longnecker and Sprague (4), Midgley (5), Nelson (6), Schaller (10), and others have reported various depths and rates of penetration which emphasize the many factors which affect results. Variations in rates and kinds of fertilizers, soil properties, climate, and types of vegetation make it inevitable that penetration will not be uniform in all experiments.

EXPERIMENTAL

In the fall of 1939, pasture fertility experiments were started in Tippecanoe and Lawrence Counties in Indiana. These were identical experiments placed upon two different soil types, the Crosby silty loam at Lafayette in Tippecanoe County and the Frederick silt loam at Springfield in Lawrence County. In 1941, a third site was selected on the Gibson silt loam at Putnamville in Putnam County.

The Crosby is derived from late Wisconsin high-lime till, the Gibson from the older Illinoian till, while the Frederick is residual from limestone.

To the relatively poor pastures on these soils were added 26 different applications involving lime, manure, and fertilizers. The experiment included six series of plots 6 feet by 30 feet to a series. The plots in series were randomized as were the series blocks.

Lime was applied on the turf at the beginning of each experiment at the rate of 2 tons per acre to three of the six series. Fertilizers were applied with a Gandy spreader early in the spring before growth started.

No seedings were made except at Springfield where Korean lespedeza was seeded when needed to maintain a stand.

No grazing was permitted. Harvests with a power mower were made two to five times a growing season depending upon the amount of growth. Moisture samples were taken from each plot at each harvest and yields were calculated as dry matter per acre.

Botanical analyses by the inclined point quadrant method were made each year except when dry weather interfered.

Nitrogen determinations of the forage from certain plots were made for each harvest during the entire experiment.