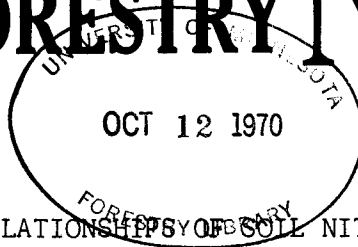


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GROWTH OF GREEN ASH SEEDLINGS AND INTERRELATIONS OF SOIL NITROGEN,  
PHOSPHORUS, AND POTASSIUM IN A TRIANGULAR COORDINATE SYSTEM

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This is the second report dealing with a greenhouse study of green ash (Fraxinus pennsylvanica Marsh.) seedlings grown in upland forest soils<sup>2/</sup>.

Total nitrogen, available phosphorus, and exchangeable potassium were chosen to represent the coordinate axes. In the NPK coordinate system the same techniques were followed as in the soil organic-mineral coordinate system (Minn. For. Notes No. 134<sup>3/</sup>). However, the extremely large values of N in comparison with those of P and K made it impossible to use directly the data from analyses of the three nutrients for construction of the triangular model. Relative N values were obtained by dividing the actual values by the mean N value of all 30 plots. The computation was made for the top soil and individual horizons separately. In the same way relative values were also computed for P and K. The percentages necessary for use in triangular coordinates were computed from these relative values.

The Figure shows the actual values of N, P, and K from analyses in the coordinate system based on the relative N, P, and K values. The intensity of nutrient values is indicated by different degrees of shading. The distribution pattern of actual N, P, and K values is quite regular. The NPK triangular coordinate system permits emphasis to be placed simultaneously on the nutrient ratios (based on relative values) and on the actual values of the individual nutrients.

The increase in actual N values in the top soil and individual soil horizons follows closely the changes in relative values of nitrogen. This relationship between actual and relative values is less pronounced for phosphorus. In the case of potassium there is little relationship between actual and relative values.

The increase in actual K values tends to follow the pattern of increasing N values in the top soil because of positive correlation between these two nutrients over a rather extensive range. Phosphorus proves to be negatively correlated with nitrogen. There appears to be no simple linear correlation in the top soil between phosphorus and potassium. The relationship between these two nutrients varying with the amount of nitrogen present.

Nitrogen decreases markedly with increasing soil depth. Phosphorus reaches a peak in the A<sub>2</sub> and B horizons. The highest K values are reached in the A<sub>0</sub> horizon. Potassium decreases with soil depth but shows an accumulation in the B horizon.

The Figure also shows the total weight of seedlings in relation to nitrogen, phosphorus, and potassium. The highest seedling weights are reached in the top soil and A<sub>0</sub> horizons. Starting with the A<sub>2</sub> horizon, the seedling weights decrease rapidly. Maximum weights of seedlings grown in top soil (2 grams and over) are located in the central position of the coordinate system and are, on the average, characterized by N values of 0.5 to 1.0 per cent, P values of 20 to 35 ppm, and K values of 90 to 120 ppm.

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- 2/ Kurmis, V. 1963. Growth of green ash seedlings in upland forest soils. M.S. thesis, unpubl. Univ. Minnesota. 71 pp.
- 3/ Kurmis, V. 1963. Growth of green ash seedling in relation to soil organic-mineral components in a triangular coordinate system. Minn. For. Notes No. 134. 2 pp.

In addition, the Figure indicates that the distribution of plots in the coordinate system has a rather compact pattern in the upper soil horizons as compared to the B and C horizons. The compactness of the plot distribution may be interpreted as a reflection of the role played by organic matter in the upper soil horizons.

A number of soil factors and growth characteristics can be plotted in this triangular model which provides a frame of reference for consideration of other problems.

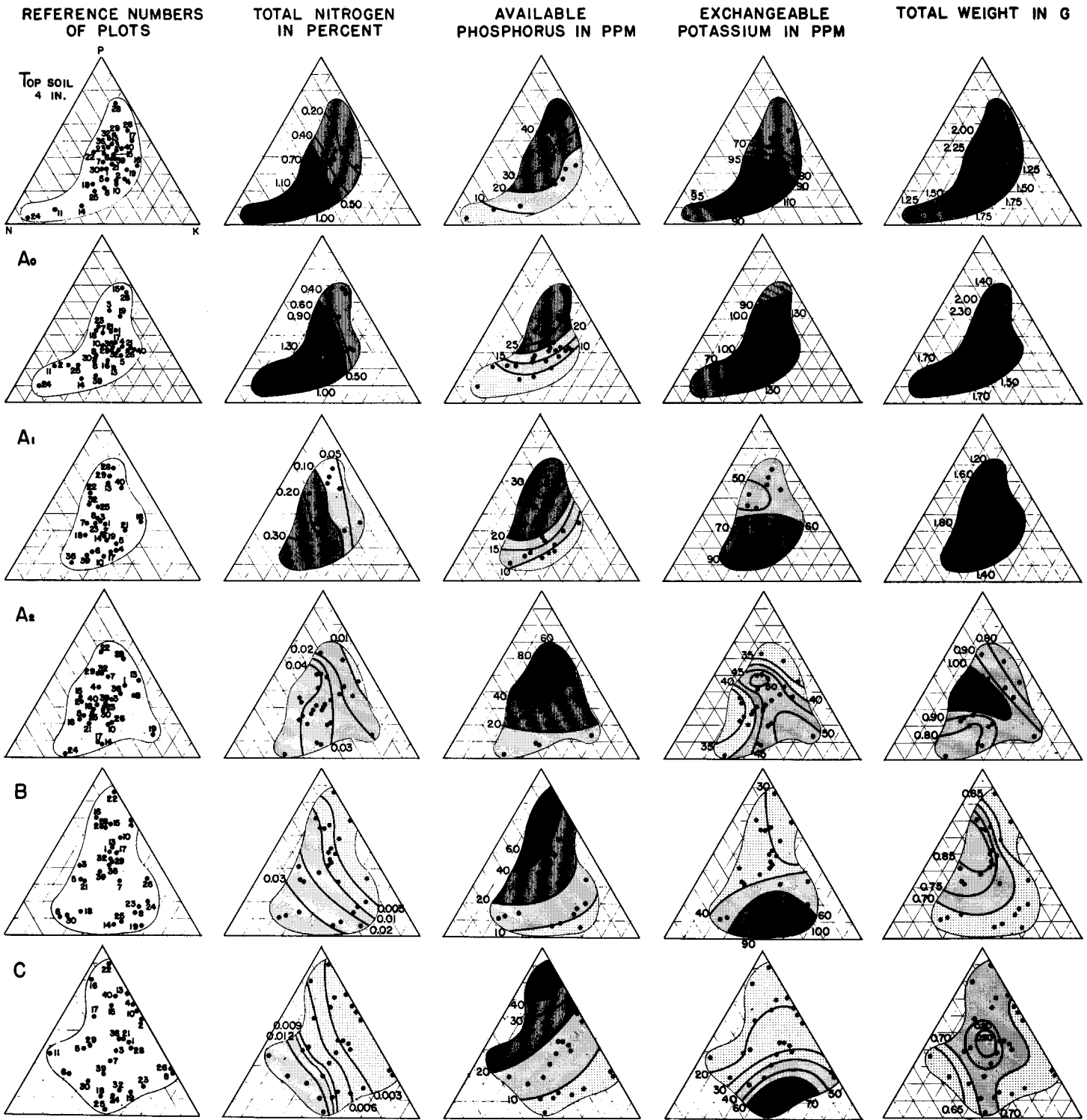


Figure. Actual values of nitrogen, phosphorus, and potassium from analyses and total weight of green ash seedlings in the soil NPK triangular coordinate system in the top soil and individual soil horizons. Weight measurements in grams refer to 10 seedlings.