

Available phosphorus determined by the Bray P1 test in the MSU study (Ellis et al., 1978) was adjusted to labile P as used in **GLEAMS** by the relationships given by Sharpley et al. (1984). The adjusted observed concentrations were compared with simulated values in figures 28-33. In general, the model over-estimated labile P in the plow layer. Ellis et al. (1978) indicated that phosphorus content in the watersheds was at such a high level that fertilization was really not needed. Over estimation by the model could be at least partially caused by an over estimate of initial values when simulation began.

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A cooperative field study between the Iowa State University-Agricultural Engineering Department and the US Environmental Protection Agency was conducted on Four Mile Creek Watershed near Traer, Iowa from 1976 to 1978 (Johnson, 1978). The principal objective of the study was to collect data to calibrate the ARM model (Donigian et al., 1977). Included in the overall project was a study of runoff, sediment transport, and plant nutrient losses on two field-size areas in a corn-soybeans rotation (Johnson, 1978). The two fields, designated ISU-1 and ISU-2, had different crops each year. The two fields had a common connecting boundary, and the soils differed only by the amount of alluvium along the principal drainageway. The 5.6-ha watershed ISU-1 was selected for the present validation study because the drainage system was a little more simple (fewer branching channels) than ISU-2. The crop sequence on ISU-1 during the project (1976-78) was soybeans-corn-soybeans.

Tama silt loam (mesic udic Argiudoll) occupies approximately 80% of the drainage area, and 20% along the drainageway is the poorly drained Colo series, a clayey Haplaquoll. Since the cropped Tama silt loam is of primary interest with nitrate, ammonia, and phosphorus samples, it was used in the model validation study.

Runoff was measured with a 1.22 m type-H flume equipped with a continuous water level recorder. Runoff was sampled with a pumping sampler periodically during events for determination of sediment and nutrient content of the flow (Johnson, 1978). Runoff samples were analyzed for $\text{NO}_3\text{-N}$, $\text{NH}_4\text{-N}$, and $\text{PO}_4\text{-P}$, and sediment samples were analyzed for $\text{NH}_4\text{-N}$, and available phosphorus was determined by the Bray test. Soil samples were taken to a depth of 150 cm in the spring, at midseason, and in the fall for the same analyses. The depth intervals for sampling were: 1-7.5, 7.5-15, 15-30, 30-45, 45-60, 60-90, 90-120, and 120-150 cm depth. The soil samples were analyzed for $\text{NH}_4\text{-N}$, $\text{NO}_3\text{-N}$, and available P.

Profile descriptions were not available for the Four Mile Creek Watershed soils, and published pedon data had to be used for the Tama silt loam (USDA-SCS, 19--). The best estimate for effective root depth was 76 cm, and this was used without adjustment in the model simulations. Observed and simulated concentrations of $\text{NO}_3\text{-N}$, $\text{NH}_4\text{-N}$, and labile P are shown in figures 34-42 for the three sampling dates in 1977: May 24, July 15, and November 3. These were the only readily available data (Johnson, 1978) for model comparisons.

Nitrate-nitrogen concentrations simulated on May 24 and July 15 were well within range of values observed at eight sampling sites within watershed ISU-1 (Figs. 34-35). However, $\text{NO}_3\text{-N}$ was under-estimated at the late sampling, November 3 (Fig. 36). Magnitude of the under-estimate was relatively small as shown by the change of scale from figures 34-35 to figure 36. The good early and mid-season comparisons are more significant when considering that simulation began in 1976 when a starter nitrogen fertilizer was applied on the leguminous crop.

Comparisons of $\text{NH}_4\text{-N}$ concentrations in the root zone for the same sampling dates are also relatively good (Figs. 37-39). The concentration was over-estimated in the surface layer in the mid-season sampling, but was within the sampling variability for the November 3 sampling.