duced a 5-year average of 7.65 tons of green forage and 3.29 tons of dry hay. These yields exceeded the averages for all entries by about 20%. Ballard is one of the tallest growing and latest heading of all entries included.

Yields of green and dry forage of Lee and Arlington, two locally grown, grain-producing oats, differed considerably. In yield of green forage Lee averaged somewhat above the mean of all entries, whereas Arlington's yields were below average. Yields of dry forage from Lee approximated the average of all entries, but Arlington's dry-forage yield was some 8% below the average of all entries. As a result, Arlington, for over 10 years the leading oat for grain production in the area, appears to be inferior to most of the other entries grown as far as dry forage yields are concerned. The comparatively poor showing made by Arlington resulted in part from the fact that it was severely winterkilled in 1958–59.

Seed of Ballard is not available in quantity; hence, it appears that Lee is definitely the best variety available at this time for growing for forage purposes in the Beltsville area of Maryland.—FRANKLIN A. COFFMAN, Research Agronomist, Cropp Research Division, ARS, USDA, Beltsville, Md.

RESPONSES OF FOUR CROPS TO VERY HIGH RATES OF SUPERPHOSPHATE

AT THE Storrs, Connecticut, Station alfalfa had grown much more rapidly during the seedling stage when superphosphate (46% P₂O₅) was banded 1.5” below the seed than when it was mixed with the soil. In one greenhouse experiment the rate of growth was still increasing at rates between 1600 and 3200 pounds per acre of superphosphate, with either banded or mixed-in placements. In view of those results it was deemed advisable to measure the responses of several crops to even larger applications.

In February 1959, alfalfa, cabbage, ryegrass, and tomato were planted in 1-gallon cans of Paxton very fine sandy loam with a pH of 5.5 and “medium” amounts of Ca, Mg, and K, but low in P. It contained approximately 50% sand, 30% silt, and 20% clay and had an exchange capacity of 20 me. per 100 grams.

Banded and mixed-in placements of superphosphate (46% P₂O₅) were applied at 0, 400, 1600, 6400, 25,600, and 102,400 pounds per acre to soil treated with either 4000 or 8000 pounds of dolomitic hydrated lime. The standard fertilization was 200 pounds each of urea (45% N) and muriate of potash (50% K), plus 40 pounds of borax (10% B). Each treatment was triplicated for alfalfa and ryegrass, quadruplicated for cabbage and tomato. Thus, a total of 336 cultures were established.

The banded superphosphate was toxic at the 25,600 and 102,400 rates. Nevertheless, ryegrass produced the largest yields at the second cutting on the 102,400-pound mixed-in treatment and on the 25,600-pound banded placement. The 6400-pound rate stimulated the greatest early growth and largest yields in most of the other comparisons. In a few cultures the 1600-pound rate was nearly as effective as 6400 pounds but 400 pounds seldom equalled any of the higher, nontoxic applications.

These exploratory tests indicate that some very interesting results might be obtained from experiments with different species, soils and rates of superphosphate.—B. A. BROWN, Emeritus Professor of Agronomy, Connecticut Agr. Exp. Sta., Storrs, Conn.

EFFECT OF PLACEMENT AND TIME OF INCORPORATION OF VETCH ON RICE YIELDS

THE use of vetch as a green manure crop prior to the planting of rice is a common practice in California. The vetch, usually purple vetch, Vicia benghalensis L. syn. V. aizoon L., is produced during the winter growing season utilizing rainfall moisture, and the rice is grown during the summer season under irrigation with the fields kept flooded continuously. The practice has been shown to be a highly effective and inexpensive source of the nitrogen needed by the rice crop.

The oxidation status of a rice soil soon after flooding varies in depth from an oxidizing condition at the soil-water interface to a strongly reducing state at a depth of one or more inches. It is likely that the redox status affects the decompositional pathways of organic matter. The oxidative pathway leading to nitrate production causes nitrogen loss because of subsequent denitrfication to molecular nitrogen and nitrous oxide in the reducing zone of the flooded soil. Hence, the depth of incorporation of leguminous organic matter may influence the subsequent path of chemical change of the nitrogen that it contains. Prior to flooding a field for rice culture conditions may be favorable for aminization, ammonification and nitrification, if soil temperature, moisture, aeration, etc., are appropriate. Hence, loss of effectiveness of the green manure nitrogen is a possibility, if incorporation (plowing-in the crop) precedes flooding of the field for long.

With these concepts of rice-soil behavior in mind, two aspects of vetch crop management, depth and time of incorporation, were studied in field experiments from 1956 to 1959 at the Rice Experiment Station in the Sacramento Valley, California.

Experimental Procedure

The experiments were conducted on Stockton clay, described previously, which is representative of the clay soils in the major rice-growing area of California. Fresh purple vetch top growth used as the source of organic nitrogen was obtained away from the plot area, dried, and analyzed for nitrogen. The nitrogen content (dry basis) was 3.2 ± 1% in 1956, 4.0 ± 3.5% in 1957, 4.4 ± 2% in 1958, and 4.6 ± 2% in 1959. All vetch was applied after being oven dried except in the 1956 experiment when fresh wilted vetch was used. Plots 8 X 8 feet were used and the center 4 X 4 feet harvested for yield. The treatments were replicated six times in a randomized block design. The rice variety, Caloro, was used and the yields of rough rice (paddy) were calculated to 14% moisture content.

In the depth of incorporation experiments vetch was buried at depths of 1, 2, 4, and 6 inches in plots excavated following seedbed preparation. The experiment was repeated in different locations in three succeeding years. In 1956, 30 pounds and in 1957 and 1958, 40 pounds nitrogen per acre were applied in this fashion. An equal amount of nitrogen in the form of ammonium sulfate was applied as a separate treatment. In 1956 and 1957 the ammonium
