AP42 Section:	9.2.1
Background Ch	3
Reference:	9
Title:	C. M. Hansen et al., "A Technique to Determine Volatilization Losses in the Application of Fertilizers Which Contain Free Ammonia," *Michigan Agricultural Experimental Station Quarterly Bulletin*, 39:495-99, 1957.

factors affect plant response to these chemicals. The most desirable effects on vegetative growth, flowering, maturity, and fruit setting occur under the best conditions of temperature, sunlight and mineral nutrition. Top yields of treated crops will probably result only if adequate fertility, especially nitrogen levels, are maintained in the soil. This has been proved with pasture grasses, pineapple and sugarcane.[16]

For many of the flowering and vegetative responses described, repeated treatments may be necessary. For others, a single dosage early in the growth of the plant is sufficient.

Crops can be treated at various stages. As a given plant grows in size (leaf numbers increase), greater quantities are needed for a given result, and greater dosages can be given without injury.

For flowering in some annuals and biennials, several hundred micrograms per plant may be needed. Others respond to 100 or less. On the other hand, only a few micrograms are required to set tomato fruit, increase the weight of celery by 50 percent, and change the growth habits of dwarf peas and bush beans to the tall or poletypes.

Although the safety factor is large, overdoses of gibberellins may injure some crops. The growing tips of treated plants may die back or "top out". This has happened occasionally with lettuce and endive when very rapid seedstalk growth resulted. Use of the chemical on some greenhouse crops may cause excessive growth and result in weakened stems. This has been noticed especially during the winter when sunlight is scarce. In some cases, young leaves have shown marginal burning. With beans, excessive quantities (100 micrograms or more per plant) caused new growth to twist and curl temporarily.

Much laboratory, greenhouse, and field testing is needed before the full power of the gibberellins will be realized. By that time the farmer will be able to buy ample quantities from commercial sources. Because of cost, present uses will probably be with high-value greenhouse, nursery, and garden crops as a fruit setting agent and in seed production.

[16]Imperial Chemical Industries Limited (1955). Op. cit. See also Chardon, C. E. (1956). Gibberellin, a new plant growth promoting substance. Paper read before the Association of Sugar Technologists of Puerto Rico, San Juan, Puerto Rico, December 1, 1956.

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Sect 3 #9

A TECHNIQUE TO DETERMINE VOLATIZATION LOSSES IN THE APPLICATION OF FERTILIZERS WHICH CONTAIN FREE AMMONIA[1]

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FARMERS AND AGRICULTURAL RESEARCH WORKERS have been concerned about the losses of nitrogen when anhydrous ammonia is applied directly to the soil or compounded in a low vapor pressure solution.

A new technique to determine losses of ammonia has been developed which utilizes two 6-volt magnetic (neoprene diaphragm) fuel pumps.[2] The gas trapped in a chamber is forced through a boric acid solution. The ammonia in the boric acid solution can be titrated with standard acid to quantitatively determine nitrogen losses.

EQUIPMENT AND PROCEDURE

The dual pumps move air at the rate of 11½ cubic feet per minute (c.f.m.). They will operate successfully for 24 hours on a fully charged 6-volt battery drawing about 1½ amperes. The design of the applicator foot for direct application of anhydrous ammonia influences the retention of ammonia, as do depth of application and soil physical characteristics.

A hood built around the applicator foot traps any ammonia which escapes from the soil (Fig. 1). Rubber flaps or curtains at the rear end of the applicator foot hood allow soil to flow from the hood without any loss of ammonia to the atmosphere. A known rate of anhydrous ammonia is applied for a given distance.

The hose supplying ammonia to the applicator foot is unclamped at the beginning of the test run and clamped off at the conclusion;

[1]Acknowledgment is made to Nitrogen division, Allied Chemical and Dye Corporation, New York, N. Y., for financial assistance in this project.

[2]Model 500, Auto Pulse Manufacturing Co., Ludington, Michigan.

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the result is a definite rate of application per acre. The pumps (Fig. 2) are started at the beginning of the test run and continued until no further ammonia is picked up by the boric acid solution. Periodic sampling and titration determines the quantity of ammonia picked up by the solution.

At the same time, a second applicator foot is fed an equal amount of anhydrous ammonia. At a predetermined spot in the test run, a shroud (in the form of an inverted V) having an opening of 2¾ inches by 24 inches is placed over the slit in the soil made by the second applicator foot. The pumps on the second unit (Fig. 3) are started and continued until no further ammonia is picked up by the solution.

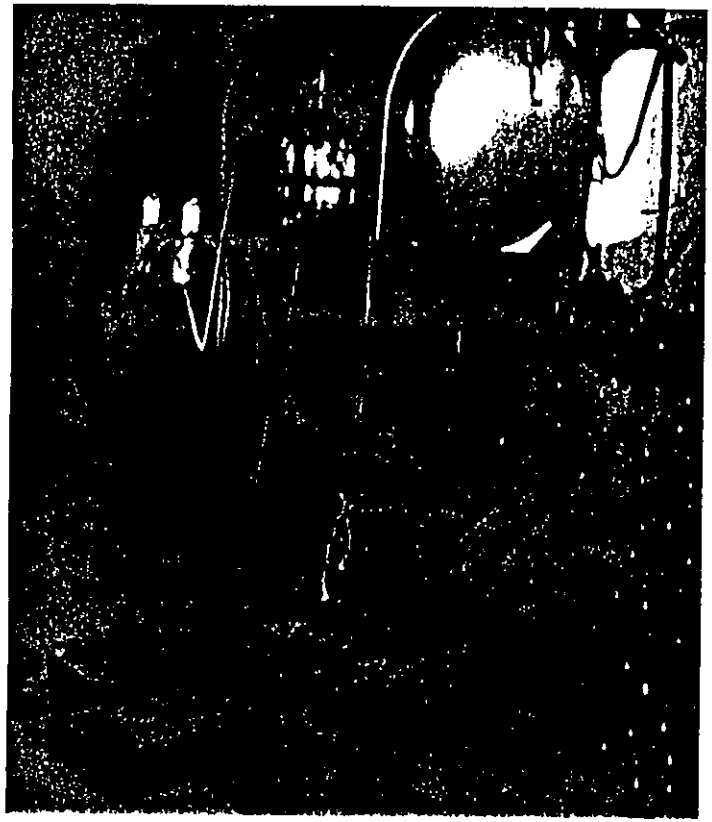

Fig. 1. The hood around the applicator foot traps the gas which is pumped through a boric acid solution.

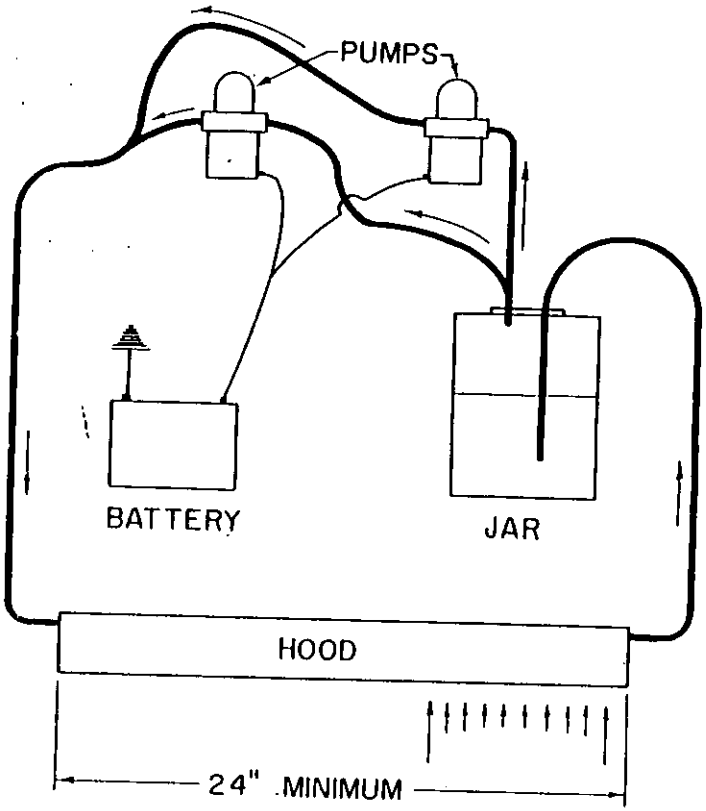

Fig. 2. Schematic drawing of system.

RESULTS

Fig. 4 presents the data obtained using the above equipment. These curves show ammonia losses from a low pressure solution applied on the soil surface and again at a depth of 2 inches. Using this equipment we found that the large differences in ammonia losses are due to placement.

When the material was applied to the soil surface, the rate of loss was greatest immediately after application and decreased at a slower rate as time passed. The loss-rate curve was almost logarithmic in nature. Losses were still observed after 6 hours. Loss of ammonia

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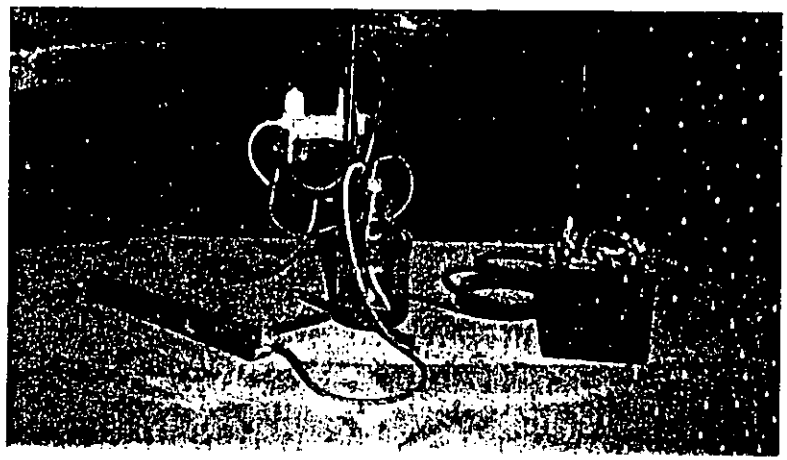

Fig. 3. To recover any lost ammonia, the inverted "V" trough is placed over the slit made by the applicator foot or the applied solution.

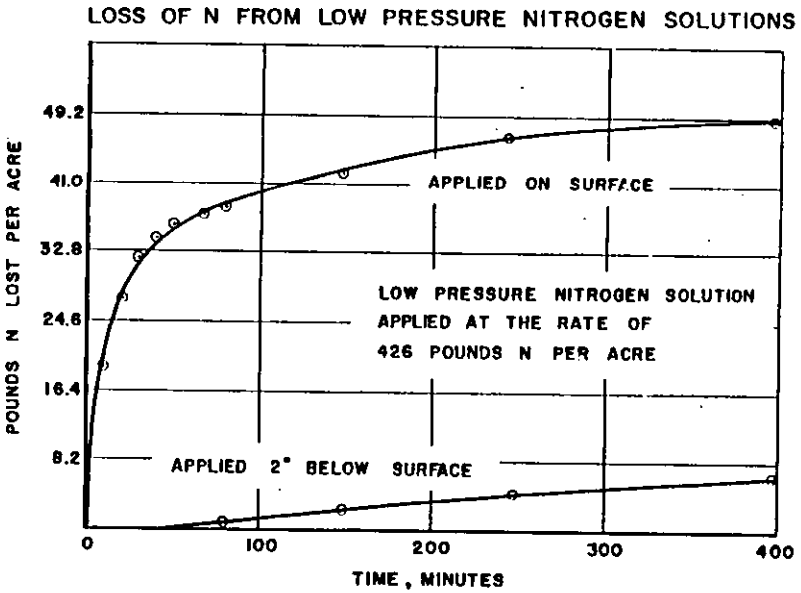

Fig. 4. Curves of data obtained during test run.

from the surface application amounted to 27 percent of the total volatile ammonia in the solution. Ammonia loss from placement at 2 inches was about 4 percent after 6 hours.

SUMMARY

The data indicates that this equipment is well suited to the study of ammonia losses in the field. The data show heavy ammonia losses from surface application of nitrogen solutions containing free ammonia. Results suggest that application depths should be greater than 2 inches.