Séance d'ouverture de la VIIIe Assemblée générale du CIEC. De gauche à droite en 1er rang: SLACK (USA), SCHMITT (Allemagne), BOTTINI (Italie), Interprête, BARANOV (URSS), MORALES (Espagne), BRACONNIER (France), LIEVENS (Belgique)

in making nitrogen solutions, the manufacturing of the latter usually is carried out in the same plant in which the ammonia is made. For direct application, the ammonia usually is shipped to bulk distribution centers, thus providing supplementary storage for the producer during the part of the year when fertilizer demand is low and providing a readily available supply to the distributor during the season of high demand. The distribution facility may be financed by either the producer or by a distributing company.

Aqua ammonia is made by dissolving anhydrous ammonia in water, with cooling to remove the large amount of heat evolved. Much of the aqua ammonia used is made in small plants and the product is distributed in a relatively small area. Numerous «converters» — package-type equipment for combining ammonia and water and cooling the mixture — have been installed in the past few years. The usual ammonia concentration in the product is 25 % (20.5 % N). Distribution is generally direct from the producer to the farmer; the relatively low nitrogen content of the product is a deterrent to the practice of transporting the product for considerable distances and distributing through dealers.

Some aqua ammonia is made at plants where the anhydrous ammonia is produced, although the practice is not prevalent because of the high shipping cost. Concentrations up to 26 % N may be used in such cases to reduce the cost of shipping. There is some demand for such a product by producers or distributors who do not have converters.

Aqua ammonia has advantages over anhydrous ammonia in regard to cost of storage and application equipment and hazard involved in handling. Moreover, it is claimed that application is faster because of the less rigorous application requirements. However, the cost of preparation and increased cost of transport have worked against growth in usage, as indicated in Figure 1. The rate of growth has not been as high as for other types of nitrogen liquids.

Pressure-type nitrogen solutions are made by adding anhydrous ammonia to an aqueous solution of ammonium nitrate and/or urea. Most plants that make anhydrous ammonia have facilities also for making ammonium nitrate or urea, or both. Thus, solutions of these materials are available for use in making liquid fertilizers. The nitrogen contents of pressure-type solutions available on the market range from 20.6 to 49.5 % and the free ammonia contents range from 4 to 43 % **(1)**. The remainder of the nitrogen is supplied as either ammonium nitrate or urea or both. Use of urea in conjunction with ammonium nitrate is desirable since the resulting crystallization temperature is lower — for the same nitrogen content — than if ammonium nitrate or urea is used alone. The solutions require only a small proportion of water because of the high solvent effect of ammonia on ammonium nitrate and urea; the water content of many of the solutions is only 10 to 20 %.

The pressure-type solutions have the same advantage over anhydrous ammonia as does aqua ammonia — less hazard and lower cost of handling equipment. Most of the solutions are more concentrated than aqua ammonia, and therefore provide more nitrogen for the same handling expense. However, as discussed later, the pressure-type solutions are the most corrosive of the nitrogen liquids.

Although use of aqua ammonia and pressure-type solutions avoids some of the handling difficulties encountered with anhydrous ammonia, the ammonia vapor pressure is still a problem. The solutions must be injected under the soil rather than sprayed on the surface, and storage tanks capable of resisting the pressure must be used. Because of this, there has been some trend to nonpressure solutions, which can be stored in standard nonpressure tanks, can be sprayed on the surface of the soil, and are less corrosive than the pressure type.

Nonpressure solutions are aqueous solutions of ammonium nitrate or urea, or both. They are quite similar to the pressure type except that they contain no free ammonia. The most used type is a mixture of ammonium nitrate and urea, with the proportion between the two adjusted to give the highest solubility. The highest feasible concentration (for 0 ° C. as the upper limit of crystallization temperature) is 32 % N. Solutions containing 30 and 28 % N are made also in order to provide a lower crystallization temperature and thereby avoid trouble with crystal formation in winter weather.

Other nonpressure solutions contain only ammonium nitrate or urea. They are lower in concentration than the urea-ammonium nitrate type, ranging from 8.5 to 24.5 %. About 20 % is the maximum for a 0 ° C. crystallization temperature. The solutions of higher concentration crystallize at higher tem-