Is This the New Frontier?

By tradition, irrigation was for the West—for semi-arid plateaus and fertile valleys where spring comes cool and green, then fades and burns beneath the summer sun.

And that's just another tradition that farmers have broken to smithereens. As long ago as 1900, irrigation was being used large-scale by Louisiana rice growers. As time went on, farmers here and there began to pump from streams and ponds and wells until, in recent years, thousands have turned to sprinkling systems—east, north, southeast, and everywhere between.

Where there's irrigation, there's the need to level and smooth the land. One engineer summed up the trend this way: Land leveling moves east—to the Corn Belt and the Mississippi delta, to the Carolinas, to New Jersey, and Virginia.

Here then, indeed, is a new frontier—in the extension of irrigation, in the conditioning of land for better use of irrigation water, and in the adaptation of farm equipment to new tasks.

Irrigation engineers offer this word of warning. The newcomers to irrigation, if they are wise, may well consider this one big lesson from the experience of old-timers in the business: Irrigation is wonderful, but it's no miracle. It costs money, and it has its problems—every farmer must learn how best to adapt it to his farm, how to live with it successfully, what equipment is necessary, when to apply water, when not to, and how much.

To the men who are diligent and patient enough to find the answers to such questions, irrigation does offer tremendous possibilities. History proves that.

John Deere • Moline, Illinois
The Agrarian

Volume XV The Clemson Agricultural College Number 4

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THE COVER: The cover shows a liquid nitrogen solution being applied by the dribble method to a pasture. The article on page 3 indicates that this method of nitrogen application is becoming increasingly popular among farmers of this area.

AGRARAN PHILOSOPHY
By Elbridge J. Wright, Jr. Co-Editor

We, the members of this year’s staff of the Agrarian, feel that we have completed a successful year of publication. There have been times when we felt discouraged, but the pleasure we received from seeing a completed issue more than boosted our morale back to a satisfactory level.

In our next year’s editor, Carol Brown, we feel that we have selected a capable person who will lead this magazine on to greater accomplishments. We also feel that the entire new staff is the kind of staff that any editor needs to successfully publish a good magazine. To you, the new staff, we extend our sincere best wishes that you may make this magazine one of which we can all be proud.

The Agrarian has this year tried to convey to its readers the important developments in the ever enlarging field of agriculture. We have attempted in all ways possible to give to you some of the information that is being collected here at Clemson and other sources in the hope that we may be of service to the farmer and other agricultural workers. We realize the importance of the farmer and his connection to our national economy, and because of this we will continue to publish this magazine as a means by which we may aid the farmer in any way that we can. It has been, and will continue to be the policy of this magazine to endeavor to promote the agricultural interests of the state of South Carolina and of the South.

Last but not least I would like to express on behalf of the staff our appreciation to the students and faculty members who have worked untiringly to assist us in publishing this magazine. Without the cooperation given us by these persons, we could not have reached our goal.

THE AGRARIAN—published in November, January, March and May by the undergraduate students in the School of Agriculture and the Department of Vocational Agricultural Education of the School of Education, and sponsored by the South Carolina chapter of Alpha Zeta. Opinions expressed in this magazine do not necessarily reflect the policy of the School of Agriculture or Clemson College.

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THE AGRARIAN
Liquid Nitrogen Solutions

By O. R. Bishop, Ag. Chemistry ’57

Even though the use of liquid nitrogen solutions is not new, the widespread and popular use of them is relatively new, especially in South Carolina. Anhydrous ammonia was known to be a good source of nitrogen for crops back in 1934 in California, where it was added to irrigation water. World War II consumed most of the ammonia from 1940-1945 and extensive research did not begin until after the war was over. Since then, much information has been gathered, but there is still much to learn.

The reasons that nitrogen solutions have come into such demand is the realization by the farmer that;

1—Labor and labor costs are low. The compound, as it is manufactured at the factory, is a liquid, the same liquid sold to the farmer. Dry nitrogen compound are crystallized from solution, dried and sacked. This is the big difference in cost of handling between the liquid and dry nitrogen fertilizer. After the dry compound is sacked, it has to be transported to the storing or shipping area and stacked in piles. All this takes labor, which is eliminated in the handling of liquids, because they are pumped through pipes and stored in tanks.

2—The solutions are easy to handle and apply. Since the tractor is used more for the application of liquid and dry fertilizer, a comparison can be made as to the actual labor involved in loading. The loaded truck has to be very close to the tractor when loading dry fertilizer to permit the laborer to pour the contents of each sack into the hopper. With the liquid solution, a hose connected to a tank is handed to the operator of the tractor and he fills the tank, the work of transferring being done by gravity, pump, or air pressure. A load of dry compound on the tractor only lasts about 5-15 minutes, while a load of liquid will last several hours. A much speedier job is done with the liquids, because the dry nitrogen applicator will usually handle about two rows, in a row crop, while the liquid applicator with booms, can cover a much larger area in one round. For real ease and simplicity of application, the addition of the liquid to an irrigation system is unique. A homemade rig consists of a 55 gallon drum of solution connected by a hose to the outlet side of an irrigation pump. More will be said about irrigation later.

As shown in the table, the nitrogen solutions may be divided into three general groups: the high pressure, low pressure and non-pressure. Anhydrous ammonia, which is a compressed gas, is the only solution in the high pressure group. When in a liquid state in a closed container, high pressure is developed. (211 psi at 104°F.) The non-pressure group contains nitrogen solutions which develop no pressure in a closed container. They are dissolved in water, similar to table salt in water, which does not create pressure. The low pressure group is a mixture of a non-pressure solution and free ammonia. This free ammonia exerts the pressure, as does the pure ammonia in the anhydrous.

There are advantages and disadvantages to each group. The anhydrous (which means no water) ammonia is costly to handle because of the expensive high pressure equipment necessary, but is the cheapest source of nitrogen because it contains more nitrogen per gallon. The non-pressure is safest to handle for two reasons. 1) The high pressure equipment is eliminated and 2) the caustic action of free ammonia is not as great. The ammonia in the non-pressure is not free, that is, it will not evaporate from the solution. Anhydrous and the low-pressure group will both lose ammonia to the atmosphere. The non-pressure group and low pressure group will salt out at moderately low temperatures, with a few exceptions in the low-pressure, but anhydrous will never salt-out at normal freezing temperatures. For example, the Soda solution has the highest salting out temperature (58°F) of all solutions while anhydrous has one of the lowest (—108°F.) The low-pressure group is more or less, a happy medium of the three and is good for general application, but for specific jobs, the high and non-pressure groups are used. The specific advantage of anhydrous is the low cost and high content of nitrogen, while the specific advantage of the non-pressure is the safer handling and flexibility of application.

The chemical composition of the solutions should be mentioned here.

(continued on page 4)

<table>
<thead>
<tr>
<th>Group</th>
<th>Solution</th>
<th>%N by wt</th>
<th>Lb. N/gal</th>
<th>CaCO₃ eq. to 100 lb. N</th>
<th>Salting out point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-pressure</td>
<td>Uran</td>
<td>32%</td>
<td>3.54</td>
<td>180</td>
<td>32°F.</td>
</tr>
<tr>
<td></td>
<td>Feran</td>
<td>21%</td>
<td>2.25</td>
<td>180</td>
<td>47°F.</td>
</tr>
<tr>
<td></td>
<td>Sudan</td>
<td>20%</td>
<td>2.35</td>
<td>119</td>
<td>58°F.</td>
</tr>
<tr>
<td>Low-pressure</td>
<td>Nitrana-2</td>
<td>41%</td>
<td>3.79</td>
<td>180</td>
<td>21°F.</td>
</tr>
<tr>
<td></td>
<td>Nitrana-3</td>
<td>41%</td>
<td>3.60</td>
<td>180</td>
<td>-25°F.</td>
</tr>
<tr>
<td></td>
<td>Nitrana-4</td>
<td>37%</td>
<td>3.67</td>
<td>180</td>
<td>48°F.</td>
</tr>
<tr>
<td></td>
<td>Urasol-S</td>
<td>33.5%</td>
<td>2.69</td>
<td>180</td>
<td>18°F.</td>
</tr>
<tr>
<td></td>
<td>Urasol-W</td>
<td>33.5%</td>
<td>2.53</td>
<td>180</td>
<td>-31°F.</td>
</tr>
<tr>
<td></td>
<td>Aqua-ammonia</td>
<td>24.7%</td>
<td>1.84</td>
<td>180</td>
<td>-112°F.</td>
</tr>
<tr>
<td>High-pressure</td>
<td>Anhydrous</td>
<td>82.3%</td>
<td>4.24</td>
<td>180</td>
<td>-108°F.</td>
</tr>
</tbody>
</table>

MAY 1956
Pecan Growing in South Carolina

By William S. Roberts, Hort. '56

By far, the most important nut crop grown in South Carolina is the pecan, since the state ranks fifth in the country. The ten counties reporting the largest number of trees were Orangeburg, Greenwood, Aiken, Florence, Lexington, Sumter, Calhoun, Anderson, Hampton, and Clarendon. There are approximately 250,000 trees in production in the state.

In connection with the establishment of a pecan grove the first factor to consider is the variety which is to be planted. To determine this factor there are several factors which enter into the picture. The most important factors are the type of soil and climate in the area in which the grove is to be established, the disease resistance of the selected varieties, and the quality of the nut. There are several varieties which will meet the required specifications in South Carolina. These are Stuart, Farley, Desirable, Elliott, and Curtis.

The next problem which confronts the individual is the problem of setting the trees. The most desirable pecan trees for planting are those 4 to 6 feet high which have a one year old top and a three to four year old bottom or root. Young trees may be transplanted from the middle of December to the end of February. Pecan trees should be planted 50 to 70 feet apart depending upon the fertility of the soil and the length of the growing season. The more fertile the soil, the farther apart the trees should be planted.

As a rule, 8 to 10 years are required to get the trees in to production of a profitable nature. During this period the land around the trees can be inner cropped. The inner crop will allow the land to supply an income to the producer while the trees are coming into production. The grower should be cautious to supply enough fertilizer for the cover crop and the tree.

After the trees have been set out, the question of what fertilizer to apply arises. This depends upon the texture of the soil. These could be listed in the following manner:

4-10-6—for mature trees on heavier soils where winter cover crops are grown.
5-10-5—for young or mature trees under average growing conditions.
5-10-10—for mature trees on lighter soils plus a cover crop.
6-8-6—for young trees on heavier soils.
7-7-7—for young trees on lighter soils.

A general rule is to apply 2 to 3 pounds of fertilizer per tree for each year of its age, or if the age of the tree is not known, apply the same amount for each inch of trunk diameter. The fertilizer should be placed in a circle around the tree starting approximately one foot from the trunk and extending outward at least twice the diameter of the spread of the branches of the tree.

The pecan is troubled by several diseases, insects, and maladies. The most common of these is rosette or dieback caused by zinc deficiency, scab, which attacks the foliage and the husk of the nut, Pecan weevil, which attacks the nut, Hickory shuck worm, which also attacks the nut, the twig girdler, attacking the tree, and the black pecan aphid which attacks the foliage. Pecan trees can also be damaged by sap suckers which bore into the bark in search of insects, and winter injury due to freezing of the bark which causes splitting.

Zinc can be applied to the soil in the form of zinc sulfate, or can be applied in combination with the spray to control scab. Scab is controlled by first, planting non-susceptible varieties, by practicing good sanitation measures, and by spraying. The most satisfactory spray to control scab is Bordeaux mixture of a 6-2-100 concentration. The insects can be controlled by spraying with a DDT spray and a summer oil emulsion. Winter injury to the young trees can be controlled by wrapping the trunks in burlap.

There are a number of other causes which prevent the normal production of a crop. Such factors as lack of pollination, too close spacing, and drought will affect the yield. The lack of pollination will cause the tree to bear no fruit, and is usually present when the male and female trees do not bloom at the same time. Drought will cause what nuts that are present to be of poor quality and poorly filled. Too close planting of the trees will encourage scab, cause the yield to be less, and also lessen the quality of the nuts which are produced.

When the trees come into bearing, the greater part of the pecan crop is harvested in October. After the crop is harvested care should be exercised in storing since the pecan will absorb odors very easily, and will become rancid if stored at high temperatures. Pecans should be stored at 35 to 40°F. in the summer months, and placed in an unheated dry place for winter storage.

For further information on pecans, order Extension Circular 301 from Clemson College.

LIQUID NITROGEN SOLUTIONS

(continued from page 3)

Anhydrous ammonia, in the high pressure group, is pure ammonia (NH₃). Uran, in the low pressure group, contains 44% ammonium nitrate (NH₄NO₃), 35.4% urea (NH₂).CO, and 20.6% water. The urea will stay in the soil longer before nitrification. Ferron is 60% ammonium nitrate with 40% water. Sodan contains 75.5% ammonium nitrate and 25.5% sodium nitrate (NaNO₃) in 32% water. The sodium may be useful here. Sodium may substitute 1/3 of the potash requirement for crops in a potash deficient soil. These are in the non-pressure group and contain no free ammonia. The Nitrana 2, 3, 4, are solutions of varying quantities of ammonium nitrate, free ammonia and water. The Ursol-S and Ursol-W are solutions (continued on page 10)
Tripl-Range transmission gives 12 overlapping gear speeds from 1½ to 20 MPH . . . full use of engine power with every implement . . . right speed for every PTO machine. Tachometer tells engine speed, shows proper PTO speed. "Tell-Easy" instrument panel also has speed-ometer, true-time hour meter, electrical fuel gauge, ammeter, engine temperature and oil pressure gauges.

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THE AGRARIAN
Dwarfism: Headache of the Beef Industry

By Joseph E. Jackson, A.H. '56

The first record of importation of cattle into this country was in 1493 when Columbus, on his second voyage brought cattle with him to be used as work stock.

The vast grassland area of the Midwest and Western states was ideally suited for the production of cattle. The first cattle raised extensively on the Western rangeland was Longhorns. These were rough cattle that lacked form, type, and quality, but they did have the ability to withstand the adverse weather conditions common to that area. However, these cattle served the purpose while the cattle industry was in its infancy. But, as the cattle industry expanded, competition also increased. Cattlemen soon realized that they would have to have animals that would reach the desired market weight at an early age, and exhibit good gaining qualities in the feed lots if they were to cope with the increased competition.

Thus a new era of breeding principles began. Cattlemen imported foreign cattle and crossed them with the native stock. Through intensive selection, they developed cattle that reached the desired market weight at an early age and also did well in the feed lots. Some new breeds were developed that have gained national recognition. Others of lesser importance have also been developed.

Breeders, through selection, changed the form of the beef cattle from ones that were rough and upstanding to ones that are moderately low-set, compact, and show balance and symmetry from any point of view.

Cattlemen met and conquered the problem of obtaining a thrifty type animal that would be economical and at the same time meet market demands. However, they are now faced with another serious problem — dwarfism. Various kinds of freaks have always been produced in breeding. Freaks are to be expected in cattle the same as in other animals and in human beings.

The incidence of dwarfism seems to be increasing and is beginning to be a serious economical problem to producers. Some people tend to believe that this increase is the result of breeding for lower set and more compact cattle. The larger cattle usually make the largest and most economical gain. If this is true, breeders should select breeding stock that are slightly larger than the more compact ones commonly being used to day.

When carrier bulls are mated to carrier cows, the offspring will be 1/4 normal, 1/2 carriers, and 1/4 dwarfs. The dwarfs are a loss to the producer since they are uneconomical and will not increase very much

(continued on page 15)
PROFESSOR SENN HONORED

Professor T. L. Senn of the Clemson College horticultural department has received the only 1956 Danforth Teacher Study Grant awarded to a South Carolinian this year. Danforth grants are designed to encourage college teachers to continue graduate work toward the doctorate degree. Professor Senn was one of 62 selected from this year's recommended list of 400 American colleges and university staff members. His was the only scholarship granted in horticulture. A native of Newberry, Senn financed his education at Clemson by working as an undergraduate laboratory assistant. He graduated in horticulture in 1939 and received his master's degree from the University of Maryland in 1950. He has published 12 papers as a result of researches on horticultural products and is the originator of "The Horticultural Collegiate Newsletter," a publication circulated to the horticultural departments of 100 colleges and universities. His Danforth grant studies at the University of Maryland will be in the field of horticultural physiology.

Prof. Senn and his wife are going to the Danforth Teachers Conference to be held at Camp Miniwanca near Shelby, Mich., beginning Monday afternoon, August 20 and continuing through noon Sunday, August 26.

AGRONOMY CLUB GOES ON THREE DAY TOUR

A three-day, three-stop educational tour in two states was completed April 7 by a group of Clemson agronomy students and professors. The three places visited by the group were the Liggett-Myers Tobacco Company in Durham, N. C., the Hopewell Nitrogen Fixation Plant at Hopewell, Va., and the agronomy department of North Carolina State College in Raleigh. Enroute the tour included observations of crops and soils in the Carolinas and Virginia.

The group was accompanied by Dr. C. M. Jones and Dr. G. R. Craddock of the agronomy department at Clemson.
JUDGING TEAM TO MAKE TRIP

Wednesday morning, April 25, two Clemson College judging teams of five men each will leave Clemson to compete in the annual Southeastern Livestock Judging Contest held this year at V.P.I., Blacksburg, Va.

The teams coached by Prof. Dale Handlin have done considerable practice on Wednesday afternoons and Saturday mornings including a trip to Athens, Ga. The team members are L. C. Blanton of Lavares, Fla., J. E. Cox of Loris, A. D. Chamblee of Anderson, R. N. Mathis of Gaffney, R. N. Chastain of Taylors, B. L. Hammond of Edgefield, R. H. Hammond, Jr., of Greenwood, R. G. Johnson of Nichols, T. O. Jones of Younges Island, and J. R. Werts of Ninety-Six.

The teams will compete with eleven other colleges in judging 12 classes of livestock consisting of Angus, Hereford, and Shorthorn breeds of cattle, Yorkshire, Hampshire, and Duroc breeds of hogs, and Southdown breeds of sheep. Reasons will be required from each member on how he placed eight of the classes.

The teams are co-sponsored by the animal husbandry dept., and the Block and Bridle Club.

ALPHA TAU ALPHA INITIATED MEMBERS

Alpha Tau Alpha, National Agricultural Education Fraternity, met March 20 for the purpose of initiating five new members. Those initiated were: John Elliott, Loris, S. C.; Adger Carroll, Westminster; David Buckner, John Island; and Bill Page, Tabor City, N. C.

Prof. B. H. Stribling, advisor for the group, spoke briefly on some proposed objectives for next year. Also, he related some of the highlights of the National Alpha Tau Alpha Convention which he and Monkey Coats attended in Kansas City.

ENTOMOLOGY NEWS

Dr. J. H. Cochran was recently selected for Who's Who in America. Some of his work has been research entomologist E. I. Du Pont De Nemours and Co., associate entomologist of the S. C. Experiment Station, and is now head of the entomology and zoology department here at Clemson College.
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FRED L. ZINK, JR., Manager

LIQUID NITROGEN SOLUTIONS
(continued from page 4)

varying in content of urea, free am-
omia and water. The 30% Aqua-
ammonia is 30% anhydrous or free
ammonia added to water. All the
low pressure solutions will lose their
free ammonia when exposed to the
atmosphere.

These solutions may be diluted
with water by the dealer to lower
the salting out point, especially in
cold weather. This will change the
percent nitrogen per gallon, but the
S. C. law maintains that the percent
nitrogen in all solutions shall be
given. These solutions are checked
by the proper authorities to see that
the percent of nitrogen is correct.

In applying the solutions, the
amount of nitrogen required per
acre has to be known. For example,
the usual application for cotton is
30-60 lbs. of nitrogen per acre. If
the nitrogen of the solution to be
added is 2.25 lbs/gallon (Feran),
multiply 30 lbs. and 2.25 lbs/gallon
and the gallons per acre is then 67.5.
Any of the solutions may be used,
but there is one for nearly every
(continued on page 12)
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Shows life cycle, damage, and control methods. (12 minutes)

COTTON INSECTS AND THEIR CONTROL
Interviews with successful growers, close-ups of common insects. (40 minutes)

CUTWORM CONTROL
Habits, damage done, and recommended controls. (12 minutes)

THE POLLINATION OF ALFALFA
Close-ups of bees, showing importance of protecting these beneficial insects. (25 minutes)

THE SPITTLEBUG AND ITS CONTROL
Interviews with farmers and other authorities on control of this damaging insect. (14 minutes)

DESIGN FOR A LABORATORY
A visit to the Hercules Powder Company's Agricultural Chemicals Laboratory. (14 minutes)

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LIQUID NITROGEN SOLUTIONS

(continued from page 10)

situation. If one in the low-pressure group is added, the solution must be applied at least 2 inches below the surface of the soil. Anhydrous ammonia has to be put at least 4 inches under the surface for best results. The non-pressure solutions may be placed at any depth, but the quickest and easiest way is to apply it on the surface.

With the use of the ammonia solutions, it must be emphasized that liming is a necessity, especially in South Carolina, where the soils have a tendency to become acid anyway. When ammonia is added to the soil, no matter which solution containing it is used, nitrification will take place. Nitrification is the oxidation of ammonia to the nitrate form by soil bacteria. The process of nitrification is acid forming, so liming is necessary for efficient crop growth.

In the chart is given the pounds of CaCO₃ equivalent needed to neutralize a solution containing 100 lbs. of N per acre. For example, a Uran solution is added to the soil to give 100 lbs. N per acre. Converting this to gal./acre gives 354 gals. to be added. Since 100 lbs. of N were added, 180 lbs. of CaCO₃ equivalent must be present to neutralize the acid that will be formed when nitrification occurs. Only the solutions containing ammonia will nitrify.

For application of solutions to pastures, lawns, small grains, and orchards, the non-pressure group is the best. The solution can be applied on the surface, which eliminates the more expensive equipment needed for the other two groups. A quicker application can be attained by use of booms with sprayers or hoses. Application to crops requiring irrigation is easily done by mixing the non-pressure solution with the irrigation water. Two methods of getting the solution into the system are gravity and suction. In the former method, a hose is connected to the drum or tank of solution. The water flowing through the hole will create enough suction to pull the solution from the tank into the system. The irrigation system should not contain any of the metals which will be corroded by ammonia. (copper, brass, bronze, steel and galvanized metal)

The equipment used in the application of solutions are fairly specialized, especially with anhydrous ammonia. Anhydrous ammonia requires a high pressure tank, holding about 150-200 gallons of liquid. From this tank pipes run to the blades, usually chisel or disk. The (continued on page 14)
Today's farmers are looking for new efficiency — engineering that saves crop quality, tractor power and dollars. That's the kind of engineering behind these Allis-Chalmers hay and forage machines.

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LIQUID NITROGEN SOLUTIONS
(continued from page 12)

blades slice through the soil at about 6 inches and the pressure in the tank forces the liquid into the soil, the rate regulated by a valve or by a pump. A packer wheel usually follows each blade. The pump on this machine, if used, cost from $100-$200. The whole machine, including pump, costs from $600-700. If a farmer uses the solution on more than 20 acres, it would be profitable to buy one.

For application of non-pressure solution, the equipment usually needed consists of a 200-500 gallon tank, mounted on the tractor or a trailer, with booms containing spray nozzles or holes for dribbling. The booms are usually 40 ft. long extended. The pressure to supply the solution to the nozzles or holes is obtained by gravity, pumps, or compressed air. The gravity flow has the tank above the boom with a valve on the bottom of the tank. The force of gravity forces the solutions through the holes, the size of the holes and speed of the tractor determining the rate of application. The disadvantage of this method is the fluctuation of flow, resulting in a relatively uneven application. The compressed air method, where the air is compressed by a pump attached to a small motor or the power take off, and goes into the tank, forcing the liquid out, is a good method. The rate with this method is also determined by the size of holes and tractor speed. The most popular method of supplying pressure is by pump, because of its ability to give a fast, evenly distributed flow. There are many kinds of pumps that can be used, but the hose pump is probably the best, because of its low cost, simplicity of operation, accurate flow, and non corrosive parts. It is very well adapted to the dribble application of non-pressure solutions. The hoses will last for about 400 hours of operation.

One of the advantages in the use of nitrogen solutions is the speed by which it can be applied. The equipment for applications, especially for the non-pressure group, where the booms can be used, is the reason for this. Up to 300 acres a day can be covered with the use of booms, which also allows faster tractor speed. If the farmer has no special equipment for the application, weed and insecticide sprayers can be used, but only if the solution to be applied is in the non-pressure group and the internal parts are not made of the corrosive metals mentioned before.

The machine should be rinsed thoroughly with water after each use.

Most dealers have their own application equipment and will apply the solution at extra cost. If the farmer has his own equipment, the dealer has trucks equipped with 500 gallon tanks with which he will supply the farmer with the solution.

For storage, the farmer can purchase tanks made of stainless steel, aluminum, or rubber lined steel tanks. The capacity of these tanks is usually around 1,000-2,000 gallons.

The cheapest overall set-up is for the farmer to have his own equipment, both applicator and storage tank. To give an example, one dealer makes these comparisons. He sells a Feran solution diluted to 19% N (to lower the salting out point from 47°F to 33°F) which is delivered and applied for about $10 less per ton than one can buy sodium nitrate, which is delivered but not applied. If the farmer has his own equipment and uses his own truck and labor for hauling, he will save an additional $10 per ton. Added up, this totals about a $20 saving per ton. These figures are only approximate and are not intended to apply to any particular section of the state.

Safety precautions are very important in the use of nitrogen solu-
tions, especially anhydrous ammonia. Free ammonia is toxic to animals even in very small quantities. A 3% concentration, or more, in the atmosphere is toxic. Ammonia, however, gives a clear warning of its presence, even in very small concentrations. A .1 of 1% concentration in the air is unbearable, but not toxic even for exposures up to an hour. Ammonia gas, compressed to a liquid is also dangerous because of the high pressure involved, unless it is handled correctly. Another danger is the boiling point of the liquid ammonia which is \(-28^\circ\text{F}\). If this liquid contacts the skin, it will instantly freeze that area taking the skin off, causing “ammonia burn.” All solutions containing ammonia in any form are corrosive to steel (not stainless steel), iron, brass, bronze, copper, and galvanized metals. Tanks containing the anhydrous ammonia should not be exposed to high temperatures. Tanks containing the anhydrous ammonia will stand pressures built up by normal temperatures, but precautions should be taken to keep tanks from very cold or warm places, and long durations in the direct summer sun. Care should be taken in the non-pressure and low pressure groups to keep their temperature above their salting out point.

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Pendleton Oil Mill  
Pendleton, S. C.  
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Route 1, Oswego, S. C.  
Santee Guano Co. (Greeleyville)  
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Kingstree, S. C.  
Home Guano Co.  
Mullins, S. C.  
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Hartsville, S. C.  
Southern Cities Ice Co.  
Kingstree & Lake City, S. C.

**DWARFISM**

(continued from page 7)  
in weight. If a producer has one thousand breeding cows that are carriers and if they are mated to carrier bulls, there is a possibility that 250 of the offspring will be dwarfs. One can readily see that this represents a terrific loss to the producer.

Dwarfism is a hereditary defect. It is generally agreed by investigators that dwarfism is brought about by a single autosomal recessive gene. The Snorer type dwarf animal is characterized by being short legged, pot bellied, a tendency to stagger as it walks, heavy breathing, and it usually has a protruding tongue and lower jaw, as are illustrated in the pictures accompanying this article. Most of the weaker ones die shortly after birth or somewhere near weaning time. However, ones that are more nearly normal have been kept at experiment stations until they are

(continued on page 16)
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DWARFISM
(continued from page 15)
several years old. The reproductive organs are functional because dwarfs have been mated at experiment stations and they produced young.

Animals that have normal genes as NN . . . An animal that transmits dwarfism is called a “carrier.” It receives a normal gene from one parent and a dwarf gene from the other parent and is designated as Nn. A dwarf as stated previously is the result of the mating of two carriers of the dwarf gene and is designated as nn. Therefore, breeding stock may be either NN or Nn because dwarfs are not used for breeding except for experimental work. The possible matings in a herd are NN x NN, NN x Nn, or Nn x Nn. The NN x NN matings produce NN offspring and all are free of the dwarf gene. The NN x Nn matings produce 1/2 NN and 1/2 Nn offspring. All appear to be normal, however half of them are carriers of the dwarf gene. When these carriers are mated to other carriers, the resulting offspring may appear to be normal or it may be a dwarf. The Nn x Nn mating will produce 1/4 NN, 1/2 Nn, and 1/4 nn. Three fourths of these animals appear normal and one fourth are dwarfs. The problem is distinguishing between the dwarf gene free animals and the carriers. No satisfactory means of doing this has yet been devised. Some work has been done using x-ray methods.

Pedigree and progeny testing are two ways now being used by investigators. L. N. Hazel of Iowa State College writes that a study and pedigree analysis leads to the following conclusions:

1. Both parents are equally responsible when a dwarf is born.
2. Although carriers may vary in the numbers of dwarfs they produce, they are genetically equal. They transmit the dwarf gene in half their reproductive cells except as this varies by chance.
3. The carrier sire used on a herd of clean cows does not produce any dwarfs. He may be recognized as a carrier because of several of his offspring producing dwarfs.
4. The dwarf gene may remain undetected in a herd for a long time. Many carrier cows never produce a dwarf themselves.
5. Dwarf-free animals may be born from matings where both parents are carriers.

Progeny testing is expensive and takes a long time to complete. To prove that a bull is free from the dwarf gene, he has to be bred to cows that are known to be carriers. The only way to be sure that a cow is a carrier is for her to produce a dwarf. The more normal calves that are produced, the greater the chance that the bull is clean. One percent of the carrier bulls can be expected to sire 16 consecutive normal calves when mated to carrier cows, therefore some carrier bulls may escape detection. However, after they have produced eighteen consecutive normal calves when mated to carrier cows, they are considered to be free of the dwarf gene.

Much research is being conducted at experiment stations throughout the United States in an effort to find an accurate way to detect carriers. No one can predict the outcome, but everyone hopes for the best.

Dwarfism is not confined to one or two breeds of cattle, but is found in all breeds, including dairy cattle. More emphasis is placed upon a dwarf-free herd among the registered cattle breeders than previously.

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