THE SOLUTION METHOD
of Applying
AMMONIUM NITRATE

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THE VALUE OF NITROGEN FERTILIZERS

Commercial fertilizers have a value only because of the plant food they carry. Materials on the market vary greatly in the amount of plant food they contain. Under Oregon law, each bag of fertilizer must bear a label showing the per cent of available plant food carried — nitrogen (N), phosphorus (P₂O₅), and potash (K₂O).

Nitrogen can be purchased as a "simple," a nitrogen fertilizer carrying only nitrogen, or as a "complete," a fertilizer carrying two or more plant foods such as a 16-20-0 or a 3-10-10. The series of numbers designating a fertilizer analysis has a definite meaning. The first number is always the percentage of available nitrogen, the second, the percentage of available phosphorus, and the third, the percentage of available potash. For determining the value or rate of use of any fertilizer only the available plant food should be considered. Unavailable plant food has little or no value.

The following table compares some common carriers of nitrogen. The comparison is fair only when nitrogen alone is needed. With the "completes," the phosphorus or phosphorus and potash must be taken into consideration when soil and crop requires either or both.

<table>
<thead>
<tr>
<th>Material</th>
<th>Per cent</th>
<th>Pounds nitrogen in each ton</th>
<th>Rate of application to apply 40 pounds actual nitrogen per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonium nitrate</td>
<td>35</td>
<td>700</td>
<td>114</td>
</tr>
<tr>
<td>Ammonium sulphate</td>
<td>20</td>
<td>400</td>
<td>200</td>
</tr>
<tr>
<td>Sodium nitrate</td>
<td>16</td>
<td>320</td>
<td>250</td>
</tr>
<tr>
<td>Ammonium phosphate, 16-20-0</td>
<td>16</td>
<td>320</td>
<td>250</td>
</tr>
<tr>
<td>Ammonium phosphate, 11-48-0</td>
<td>11</td>
<td>220</td>
<td>363</td>
</tr>
<tr>
<td>Victory garden, 6-10-4</td>
<td>6</td>
<td>120</td>
<td>666</td>
</tr>
<tr>
<td>&quot;Complete&quot; fertilizer, 3-10-10</td>
<td>3</td>
<td>60</td>
<td>1,336</td>
</tr>
</tbody>
</table>
The Solution Method of Applying Ammonium Nitrate

by

ARTHUR S. KING
GERALD T. NEWCOMB
O. V. CHENOWETH*

Fertilizers changed by the war

War has changed the commercial fertilizer industry. Nitrogen is a necessary ingredient in making war explosives, and synthetic nitrogen-producing plants have diverted most of their production for munition purposes. A great volume of production is needed to meet any possible wartime demand. In order to meet this demand, plants producing synthetic nitrogen are kept in full production constantly. At times more nitrogen is made than can be immediately utilized for making explosives, releasing a surplus for agricultural purposes.

A year ago the military demand for nitrogen was so great that there was a distinct shortage for farm use, but production has been increased to a point where now more than a normal supply may be available. Oregon farmers in 1944 are assured of a much greater supply of nitrogen than was available in 1943, with one reservation: the War Production Board requires that a large percentage of the nitrogen released for agricultural purposes be in the form of ammonium nitrate, and Oregon farmers must take their share of ammonium nitrate before other nitrogen materials will be made available. These regulations are made because most factories can change quickly from the production of ammonium nitrate for agricultural purposes to the production of nitrogen-carrying materials for military purposes. Ammonium nitrate is a new material to Oregon farmers and to the Oregon fertilizer industry. It will require different methods of handling and use than the ammonium sulphate, sodium nitrate, and ammonium phosphates ordinarily used here, but it should prove as effective as these other materials.

What ammonium nitrate is

Ammonium nitrate is a concentrated fertilizer containing 32 to 35 per cent nitrogen. Chemically it is an ideal fertilizer with half

of its nitrogen in the nitrate form, the same as supplied by sodium nitrate, and half in the ammonia form, which is the same as supplied by ammonium sulphate. The nitrate form is readily available, while the ammonia form is held in the soil for later use. Ammonium nitrate is nearly a neutral fertilizer. It will not leave a harmful residue on alkali soils. On acid soils it will not build up as much acidity as ammonium sulphate or ammonium phosphate (16-20).

Ammonium nitrate has some drawbacks. The chemists refer to it as a highly deliquescent material, which in plain English means that it absorbs moisture from the air so that it becomes wet and sticky very soon after the bags are opened. This material without the addition of conditioning agents will set up in solid blocks or “tombstones.” It is practically impossible to handle the unconditioned material with ordinary fertilizer equipment.

Improved material available

Granulated ammonium nitrate is now available commercially. This has been conditioned with lime, diatomaceous earth, or other materials that reduce the rate of caking. This improved material can be handled in the same manner as other nitrogen fertilizers as long as the bags have not been broken and the material has not been subject to moist storage conditions. With more experience, manufacturers undoubtedly will improve the product further, and material that will flow like clover seed from a horn seeder under all weather conditions may be a future possibility.

A word of caution

Ammonium nitrate has a justifiable reputation of being highly explosive, but the material released for agricultural purposes through the addition of other materials is comparatively safe, probably no more dangerous than sodium nitrate. To be on the safe side, when stored on the farm, it should not be stored close to artificial heat. It should not be stored in the same building with dynamite and caps, and it should never be mixed with organic material. Grinding may create a serious fire hazard.

Use in solution suggested

Possible difficulties from the use of ammonium nitrate in mechanical fertilizer distributors can be avoided by making applications in the solution form. In fact, the solution method has so many advantages it could easily replace other methods of spreading soluble fertilizers such as calcium nitrate, ammonium sulphate, sodium nitrate, urea, and muriate of potash.
Applying Ammonium Nitrate

Application of fertilizers in solution has several advantages as compared to other methods:

1. The equipment costs only a fraction of the cost of other broadcast or side-dressing equipment. It can be assembled on the farm with readily available materials.

2. Uniform applications are possible. The rate can be determined easily beforehand. The rate will be the same regardless of the roughness of the field, the condition of the fertilizer, or the weather. The adjustment of most mechanical spreaders is, at best, a rough guess and changes are necessary to meet variations in the amount of moisture in the air and the condition of different sacks of fertilizer.

3. Highly concentrated fertilizers can be applied at any desired rate while a uniform application of less than 100 pounds per acre is impractical with many broadcasting machines.

4. Results are quicker than with broadcast applications of solid material. The fertilizer is already in solution and can be immediately taken up by the plant.

5. There is little or no burning when a solution of ammonium nitrate is applied as a top dressing to grass or mixtures of grass and clover. Material in the solid form applied when the leaves are moist may burn severely. Solution applied under pressure enough to form a mist may burn severely.

The only disadvantage from the use of solution is the extra labor and trouble of supplying water to make the solution. This is not as difficult as it sounds since concentrated solutions requiring only a small amount of water can be used. The extra work in making solutions will be no more than that required to break up the cakes and lumps often found in nitrogen fertilizer.

Equipment for broadcasting solutions

Equipment for broadcasting solutions of ammonium nitrate and other soluble fertilizers can be mounted on any truck, pick-up, tractor, trailer, or wagon.

The equipment is assembled from a 55-gallon oil drum or other container, a \( \frac{3}{4} \)-inch gate valve with discharge threaded for a hose connection, a piece of \( \frac{3}{4} \)-inch hose fitted with female connections on both ends, and a boom made of 1\( \frac{1}{2} \)-inch pipe. This boom is plugged or capped at each end, and a “T,” fitted with \( \frac{3}{4} \)-inch male hose connection, is inserted midway between the two ends. Holes are drilled in a straight line along one side of this pipe. The size of these holes will be either 1/16, 3/32, or 7/64 inch and the spacing will be either 6, 9, or 12 inches, depending on the desired rate of application.
The boom can be of any length, depending on the crop to be fertilized and how fast the ground is to be covered. For top dressing pastures or perennial grasses, a 12-foot boom will give good results.

There will be less trouble from corrosion with the use of the new plastic hose fittings than from the conventional brass fittings. Other valves could be substituted for the gate valve, but if a globe valve or ordinary faucet is used it should be oversize to permit free flowing. If a quarter-turn, half-turn, or cut-off valve is obtained, a simple cut-off could be arranged permitting operation from the driver’s seat.

The barrel or reservoir should be mounted on a conveyance at a height of 3½ to 4½ feet above the ground. It should be mounted on its side so that the gate valve is at the bottom of one end. Refilling is much easier if the barrel is equipped with a large bung, which should be on top of the barrel when mounted for use. If this bung is tapped and a 6-inch to 8-inch piece of ¼-inch pipe is inserted for an air intake, splashing will be eliminated. The barrel should be mounted with the end away from the gate valve elevated 3 or 4 inches. It should be rigidly tied to this mounting with straps, rope, or wire. Considerable operating time can be saved if the barrel can be quickly dismounted for complete draining and cleaning.

The boom is mounted at a vertical distance of 30 inches below the bottom of the barrel, placing it so that it will travel a foot to a foot and a half above the ground. The perforations should point so that they discharge horizontally or slightly upward to avoid clogging. The hose from the barrel can be attached at the middle of the boom, or any other location, depending on convenience in mounting for use on any ground. On comparatively level ground the boom can be mounted rigidly to the conveyance. On sloping or hilly land an adjustable pivot mounting will permit leveling the boom for even applications on side hills.

When the equipment is mounted on a pick-up or truck, the boom can be mounted at the rear end of the bed with the barrel mounted directly above. With a pick-up, the boom can rest on the bumper. The driver can watch the operation of the boom through the rear-view mirror. If much material is to be spread, the use of mirrors on both sides of the cab to permit watching both ends of the boom will be justified.

If the equipment is to be mounted on a tractor, either of two mountings is possible. The boom can be mounted at the rear, suspended from the fenders, or from the drawbar with the barrel mounted to one side of the driver’s platform; or, if the tractor will permit mounting the barrel toward the front, the boom can be
mounted either ahead of the front wheels or directly behind, where the operations will be in full view of the driver at all times.

Many alternate mountings could be used. The barrel could be mounted at either a greater or lesser height from the boom. If mounted much closer to the boom there will be a sharp variation in the rate of application, depending on the amount of solution in the barrel. There is some variation at the suggested height, but it is not serious. A greater distance would further reduce the difference. Mountings at other than the suggested height would require calibrating the equipment before use.

![Diagram of broadcasting equipment]

**Preparation of the solution**

Ammonium nitrate is well adapted to application as a solution. It is soluble in water, so highly soluble that 1 pound of ammonium nitrate can be dissolved in only 1 pound of water. Under field conditions, using a commercial ammonium nitrate that has been treated with some conditioning agent, 100 pounds can be easily dissolved in water to make a total volume of 25 gallons. More water can be used if necessary to secure the desired rate of application.

Equipment for making up the solution consists of one or more open-end containers such as 50-gallon oil drums with the head removed, a shovel or a hoe for stirring, and some means of obtaining water. Work will be saved if water is available under pressure, otherwise it will be necessary to pump it by hand or dip it with a bucket. The container should be marked to indicate the 25- and 50-gallon levels. To make up 100 pounds of ammonium nitrate into 25 gallons of solution, place the ammonium nitrate in the container,
add enough water to reach the 25-gallon level, and stir. If water is available under pressure the force from the nozzle will completely dissolve the material without extra stirring. If 50 gallons of solution of the same concentration are to be made up at one time, make up 25 gallons first, then add an additional sack of fertilizer, together with enough water to reach the 50-gallon level.

Stirring is necessary to permit the ammonium nitrate to separate from the particular conditioning agent added by the manufacturer. This material settles to the bottom of the container and has no particular value as a fertilizer. To avoid plugging the holes in the boom, the solution should be strained through a 20-mesh screen as it is transferred to the spreading equipment. Ammonium nitrate does not settle out once it is dissolved.

Any desired dilution can be made up by adding more water. Most field conditions can be served by using two dilutions—100 pounds made up to 25 gallons and 100 pounds made up to 50 gallons. To simplify the following directions on rates of application, the more concentrated solution is referred to as the 100 to 25 solution and the other as the 100 to 50 solution.

**Rate of application**

Table 1 gives variations in amounts of material applied through perforations of different size, different dilutions, different spacing, and rates of travel. This should permit adapting the spreading equipment for any rate of application.

<table>
<thead>
<tr>
<th>Dilution and speed</th>
<th>Hole size</th>
<th>6 inch spacing</th>
<th>9 inch spacing</th>
<th>12 inch spacing</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>1/16</td>
<td>3/32</td>
<td>7/64</td>
<td>1/16</td>
</tr>
<tr>
<td>100 to 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 mph</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>100</td>
<td>175</td>
<td>37.5</td>
</tr>
<tr>
<td>100 to 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 mph</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>50</td>
<td>87</td>
<td>18.7</td>
</tr>
<tr>
<td>100 to 25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 mph</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>200</td>
<td>350</td>
<td>75</td>
</tr>
<tr>
<td>100 to 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 mph</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>100</td>
<td>175</td>
<td>37.5</td>
</tr>
</tbody>
</table>
APPLYING AMMONIUM NITRATE

PROBLEM: Apply 100 pounds of ammonium nitrate per acre with equipment mounted on tractor traveling 4 miles per hour.

ANSWER: In the lower half of the table there are three possibilities:

(1) Use the 100 to 25 dilution. One hundred pounds of ammonium nitrate (32 to 35 pounds actual nitrogen) will be applied by using 1/16-inch holes spaced 6 inches apart;

(2) Use the 100 to 25 dilution and 3/32-inch holes spaced at 12 inches;

(3) Use the 100 to 50 dilution with 3/32-inch holes spaced at 6 inches.

PROBLEM: With available equipment consisting of a boom drilled with 3/32-inch holes spaced 6 inches apart apply 50 pounds of ammonium nitrate (16 to 17 1/2 pounds actual nitrogen) per acre.

ANSWER:

(1) Use the 100 to 50 dilution and drive at speed of 8 mph;

(2) Use the 100 to 50 dilution; plug alternate holes to bring spacing to 12 inches and drive at 4 mph;

(3) Use the 100 to 25 dilution; plug alternate holes and drive at 8 mph.

PROBLEM: With equipment traveling at only 2 mph, to apply rates given in table.

ANSWER:

(1) Find size of holes and spacing for 4 mph and double the distance between holes;

(2) Cut the dilution to one-half suggested for 4 mph and use same hole size and spacing;

(3) Use hole size and spacing listed under 4 mph at one-half of desired rate. (1/16-inch holes spaced 9 inches will give 75 pounds at 4 mph or 150 pounds at 2 mph.)

PROBLEM: Equipment travels at 3 mph.

ANSWER:

(1) Use hole size and spacing for 4 mph at 3/4 of desired rate (1/16 inch spaced at 9 inches will give 75 pounds at 4 mph or 100 pounds at 3 mph);

(2) Add 1/3 more water to any dilution;

(3) Add 1/3 to distance between holes (8 instead of 6).
By using methods as outlined in the above problems, rates can be figured for any speed or dilution. If arithmetic won’t handle the problem, “proportional guessing” will hit fairly close. The rate can always be checked in the field.

The information in this table was based on a vertical distance of 30 inches between the bottom of the barrel and the boom. If a different mounting or different hole sizes are used, any equipment can be quickly calibrated by using the information contained in Table 2.

**Ground covered rapidly**

Equipment mounted on a truck or pick-up will permit covering a lot of ground (40 acres or more) in a day if the fields are not too rough or too soft. With either of these vehicles an extra supply of solution can be carried so extra ground will be covered without delays for refilling. When spreading equipment is pulled by a team or tractor, time can be saved by hauling an extra supply of solution to the field.

Extra equipment to save time will be justified on farms where large acreages are to be fertilized. A small gear pump would save time in transferring solution to the spreading equipment and in using water from sources other than a pressure system. An elevated platform for mixing solutions will permit filling the spreading equipment by gravity.

**Row crops side dressed**

Ammonium nitrate can be applied in the solution form to row crops. The equipment consists of a container or containers mounted on the tractor or cultivator. These containers should be equipped

![Diagram of side dressing equipment.](image-url)
with an adjustable shut-off valve. The solution is led through the valve by means of a rubber hose or plastic tubing so that it is discharged just back of a cultivator shovel located close to the fertilized row. The diagram on page 10 illustrates this set-up.

Table 2. **Minutes and Seconds Required to Catch 1 Quart of Solution from One Outlet, for Varying Rates of Application and Tractor Speeds. Concentration Is 100 Pounds Ammonium Nitrate in 25 Gallons of Solution**

<table>
<thead>
<tr>
<th>Rate of applying ammonium nitrate</th>
<th>6 inches between outlets</th>
<th>12 inches between outlets</th>
<th>15 inches between outlets</th>
<th>18 inches between outlets</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min- Sec- onds</td>
<td>Min- Sec- onds</td>
<td>Min- Sec- onds</td>
<td>Min- Sec- onds</td>
</tr>
<tr>
<td>50 pounds per acre</td>
<td>2 MPH...</td>
<td>10 00</td>
<td>5 00</td>
<td>3 56</td>
</tr>
<tr>
<td></td>
<td>3 MPH...</td>
<td>7 40</td>
<td>3 45</td>
<td>2 38</td>
</tr>
<tr>
<td></td>
<td>4 MPH...</td>
<td>5 00</td>
<td>2 30</td>
<td>1 58</td>
</tr>
<tr>
<td>75 pounds per acre</td>
<td>2 MPH...</td>
<td>7 40</td>
<td>3 45</td>
<td>2 57</td>
</tr>
<tr>
<td></td>
<td>3 MPH...</td>
<td>5 36</td>
<td>2 48</td>
<td>1 28</td>
</tr>
<tr>
<td></td>
<td>4 MPH...</td>
<td>3 44</td>
<td>1 52</td>
<td>1 58</td>
</tr>
<tr>
<td>100 pounds per acre</td>
<td>2 MPH...</td>
<td>5 00</td>
<td>2 30</td>
<td>1 58</td>
</tr>
<tr>
<td></td>
<td>3 MPH...</td>
<td>3 20</td>
<td>1 40</td>
<td>1 19</td>
</tr>
<tr>
<td></td>
<td>4 MPH...</td>
<td>3 30</td>
<td>1 15</td>
<td>59</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rate of applying ammonium nitrate</th>
<th>21 inches between outlets</th>
<th>24 inches between outlets</th>
<th>30 inches between outlets</th>
<th>36 inches between outlets</th>
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<tr>
<td></td>
<td>Min- Sec- onds</td>
<td>Min- Sec- onds</td>
<td>Min- Sec- onds</td>
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</tr>
<tr>
<td>50 pounds per acre</td>
<td>[2 MPH...</td>
<td>2 48</td>
<td>2 30</td>
<td>1 58</td>
</tr>
<tr>
<td></td>
<td>3 MPH...</td>
<td>2 6</td>
<td>1 52</td>
<td>1 18</td>
</tr>
<tr>
<td></td>
<td>4 MPH...</td>
<td>1 24</td>
<td>1 15</td>
<td>59</td>
</tr>
<tr>
<td>75 pounds per acre</td>
<td>2 MPH...</td>
<td>2 6</td>
<td>1 52</td>
<td>1 28</td>
</tr>
<tr>
<td></td>
<td>3 MPH...</td>
<td>1 34</td>
<td>1 24</td>
<td>1 6</td>
</tr>
<tr>
<td></td>
<td>4 MPH...</td>
<td>1 3</td>
<td>56</td>
<td>44</td>
</tr>
<tr>
<td>100 pounds per acre</td>
<td>2 MPH...</td>
<td>1 24</td>
<td>1 15</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>3 MPH...</td>
<td>1 3</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>4 MPH...</td>
<td>42</td>
<td>37</td>
<td>29</td>
</tr>
</tbody>
</table>

(If concentrations given below are substituted, multiply the time given in the table above by the number indicated below.)

- 100 pounds to 50 gallons—multiply by 2
- 100 pounds to 100 gallons—multiply by 4
- 100 pounds to 75 gallons—multiply by 3
- 100 pounds to 35 gallons—multiply by 1.4
Rates for cultivator attachment

Application can be made to as many rows as desired. It can be made either to one or both sides of the row, depending on the number of tubes used. Available equipment will vary widely, but Table 2 can be used to obtain any rate of application.

The equipment should be assembled and the container filled with solution. The discharge valve can be adjusted to apply the proper rate by checking the time required to fill a quart container. The discharge should be checked having the opening of the tube the same distance below the container as it will be while the machine is operating. The information in Table 2 can also be used to calibrate broadcasting equipment.

When the equipment is mounted on a cultivator, it is possible, by doing a little welding or soldering, or by the "artistic" use of hay wire, to attach the shut-off valve or valves to the cultivator lift so that the discharge is cut off whenever the cultivator is raised.

Ammonium nitrate corrosive

Solutions of ammonium nitrate and other soluble nitrogen fertilizers are extremely corrosive. All equipment should be thoroughly rinsed with clean water immediately after using. It is advisable to rinse the barrel, hose, and boom after each day's operation. The corrosive material is readily soluble and is removed easily with the generous use of water. Ammonium nitrate is equally corrosive when applied as a solid material, and all equipment should be cleaned thoroughly immediately after use.

Used for farm mixes

Ammonium nitrate can be used to supply the nitrogen in mixed materials. Many northwestern manufacturers are now making a full line of complete fertilizers using ammonium nitrate as a source of nitrogen. It can be used satisfactorily for home mixing, providing it is not stored too long before use. It can be mixed in almost any proportion, either with superphosphate or treble phosphate.

If stored for any length of time, these home-mixed materials will gather moisture and eventually become badly caked. Home mixers should avoid the use of sulphur or any organic material since there may be some danger from fire or explosion.

Ideal for use with irrigation equipment

Because of its high rate of solubility, ammonium nitrate is an ideal material for applying through sprinkler irrigation equipment.
The application of nitrogen fertilizers through irrigation equipment has become a quite common practice wherever this equipment is available. In the long run, ammonium nitrate should give better results than either sodium nitrate or ammonium sulphate. It will penetrate deeper into the soil than ammonium sulphate and there will not be the possibility of leaching that there is with sodium nitrate. In making applications through sprinkler equipment the proper amount can be computed by basing the application on the area covered by the sprinkler on any one setting. After this fertilizer treatment, it is recommended that about one-half to one inch of water be applied, although care should be used to avoid applying too much water, which would result in the loss of some of the fertilizer through leaching.

Equipment simple and effective

Equipment for applying ammonium nitrate and many other fertilizers through sprinkler equipment is simple and inexpensive. The fertilizer is placed in an open barrel or other container near the pump; water is supplied in this barrel from the discharge side of the pump through a hose or a short length of pipe. The solution is drawn from the barrel into the sprinkler system by another hose or pipe that is connected to the suction side of the pump. Both the connections on the discharge and the connection on the suction are equipped with valves to permit easy adjustment. As the fertilizer is applied, a flow of water is turned into the barrel from the discharge side. The valve on the suction side is opened and the two are adjusted until the water entering the barrel is equal to that being
drained out. Because of the large amount of water and because of the complete agitation as the material passes through the pump, fertilizers only partly soluble can be applied by this method. At each new setting the amount of fertilizer required for the new area is placed in the barrel. In a few minutes all the fertilizer will be drawn into the irrigation water and then the valves should be closed.

**Ammonium nitrate an effective nitrogen carrier**

Ammonium nitrate can be used to replace any commercial sources of nitrogen now in use on Oregon farms. It is an excellent material for supplying the nitrogen for vegetable crops, berries, fruit, potatoes; in fact, it can be used on all crops that are using nitrogen ordinarily supplied in the form of commercial fertilizer, either as a mixture or as a straight nitrogen material.

As compared with ammonium sulphate or ammonium phosphate (16-20) the amount of nitrogen as ammonium nitrate should be reduced, because the nitrogen carried in the nitrate form (50 per cent) can be lost by leaching or over-irrigation. The application of a full season's supply of nitrogen at one time may result in some loss. This loss can be avoided, however, by making two or more applications during the season. Losses from leaching will not be as heavy, on the other hand, as when sodium or calcium nitrate is used, and if there is any advantage in doing so, rates can be increased in comparison with these two materials.

In some areas orchards are grown under irrigation with permanent cover crops. Where this practice is followed, heavy applications of nitrogen are used, with some material applied in the fall and some in the spring or summer. When ammonium nitrate is used for the fall application, the amount of nitrogen applied should be reduced one-third as compared to the nitrogen ordinarily applied as ammonium sulphate, to reduce the possibility of loss by leaching during the winter months.

**MORE NITROGEN CAN BE USED WITH PROFIT**

More nitrogen fertilizer can be used to advantage on many Oregon farms. With increased supplies in prospect the following deserve consideration.

**Grasses for seed.** The use of a nitrogen fertilizer on all grasses grown for seed has established itself as a yearly practice on the farms of better seed growers. The yield of perennial grasses, such as the fescues, English ryegrass, orchard grass, etc. (western ryegrass can also be included) can only be maintained by yearly
applications of a nitrogen-carrying fertilizer. These crops will make profitable returns on applications varying from 20 to 60 pounds of actual nitrogen per acre. Either one or two applications are needed. With only one, it is applied at the start of the growing season in late February or early March. With two applications, one is made at this time and the second follows in April. More grass should receive two applications. Some growers make a light application of from 16 to 20 pounds of nitrogen per acre in the fall. This practice should be tried on more farms. It permits the grass to take full advantage of fall moisture.

**Pasture and hay.** Nitrogen fertilizers can be used to increase the yield of perennial grasses or mixtures of grasses and legumes intended for either hay or pasture. Nitrogen applied in early February or March will permit the crop to take advantage of the cool weather to make an additional yield while moisture is still available. Pastures in particular would respond to two applications, one early and the second in April. Good, irrigated pastures may pay returns on three or more applications.

**Flax.** Nitrogen will help the yield of fiber flax, particularly in cool, wet seasons. Applications should be made at seeding time and, to avoid any possible damage to the quality, should be limited to 20 pounds of nitrogen per acre.

**Utilization of straw.** An application of nitrogen to grain straw and stubble is a profitable practice that could be followed on more Oregon farms. The addition of nitrogen to the straw will cause it to rot quickly and will avoid the possibility of decreasing the yield of the succeeding crop. Grain straw plus nitrogen will be the equivalent of an application of barnyard manure. The nitrogen will be retained in the soil for use by the succeeding crops. The organic matter supplied by the straw will help the production of the soil for several years.

**Cover crops.** Double value will be returned from the use of nitrogen on cover crops in orchards, or on other intensively cultivated land such as commercial vegetables. Applications of from 16 to 20 pounds of nitrogen per acre in the fall will increase the fall and early winter growth resulting in better production and increased yield. Another top dressing of from 16 to 20 pounds of nitrogen in February or early March is also a good practice. Nitrogen applications made to cover crops help produce a greater yield of high quality organic matter without extra cost, since most of it is released in the soil for the benefit of the succeeding crop.
Vegetable seed. The production of vegetable seed is a new industry in Oregon. Experiments have shown that successful seed production requires heavy applications of nitrogen fertilizer. Usually the application of a complete fertilizer supplying the necessary phosphorus and potash, together with some nitrogen, is made at seeding time, followed by top dressings of straight nitrogen as the season progresses. Heavy applications often totaling 100 to 150 pounds of actual nitrogen have been profitably used, especially on the crops planted in the late summer and fall and harvested for seed the following season. The heavier applications can be profitably used on irrigated lands, or on land having a good supply of moisture throughout the growing season.

FERTILIZER REGULATIONS

For the duration of the war, there will be regulations governing the sale of nitrogen fertilizers. No one can anticipate when or how much nitrogen-carrying material will be diverted for making explosives. In anticipation of possible shortages, the fertilizer industry is required to operate according to government regulations. Regulations now in force classify crops into two groups according to the national demand. The preferred crops called "A" crops must be given a preference for fertilizer in case of any shortage. The crops specified as "A" crops for the 1944 season are: sugar beets for seed production; dry, snap, and lima beans; cabbage; carrots; onions; dry edible and green peas; potatoes; sweet corn only when grown for processing; hybrid corn for seed only; tomatoes; and all vegetable seed crops.

All other crops, which are termed "B" crops, cannot be supplied material until after the demands for "A" crops are satisfied.

There will be periods when large surpluses of nitrogen-carrying materials, particularly ammonium nitrate, will be available. These should be utilized for agricultural purposes. Growers of both "A" and "B" crops should buy early—and "early" means several months in advance of actual need. Those who wait until seeding time, regardless of whether they are "A" crop or "B" crop growers, might find the market emptied by an unexpected demand for explosives.