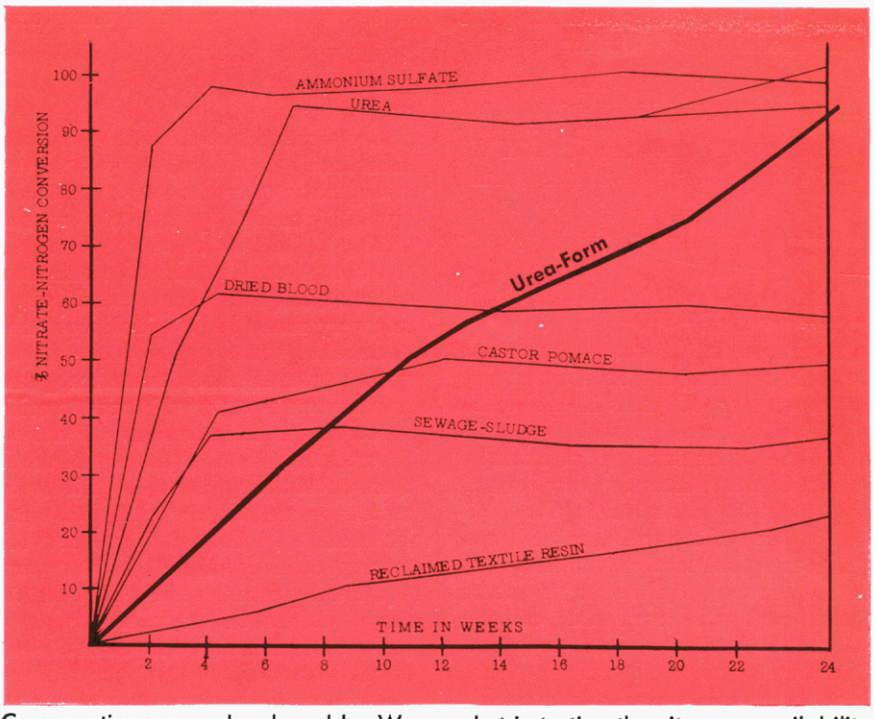


Comparative curves developed by Woonsocket in testing the nitrogen availability of various materials. Company's urea-form is now being marketed as Nitroform

ent upon several soil factors. However, the urea forms have been found generally satisfactory in all soil types. While enzymatic activity is essential to nitrify urea-form materials, it is not essential to have an exceptionally high microbial development in the soil. Only a normal and even a low microbial activity will satisfactorily nitrify urea-form materials.

Allied Announces U-F Solutions

Early last month Allied's Nitrogen Division announced a new urea-formaldehyde solution from which formulators can produce granular-type fertilizers containing the slow release nitrogen. Trade named N-dure, the solution produces complete fertilizer mixtures but requires only standard ammoniation apparatus. A separate spray pipe in the mixer is used to introduce the N-dure into the superphosphate and other dry ingredients. This is done before introduction of the ammoniating medium.

N-dure contains only 12% nitrogen and consequently, in a strict technical sense, does not qualify as a "urea-form." But its mode of action is the same and it is certainly destined to be a factor this season in solid urea-form's market picture.

Feature of the liquid product, say Allied officials, is that it allows manufacturers, for the first time, to make mixtures containing a wide variety of ratios between water soluble and insoluble nitrogen. N-dure is being shipped in insulated steel tank cars from the Nitrogen Division plant at South Point, Ohio.

Basic producers of the urea-forms today include: Du Pont with Uramite; Borden with Borden's 38; Woonsocket Color & Chemical with Nitroform; and Swift in Golden Vigoro.

Du Pont announced Uramite in June of last year. But development had been under way since 1938. Pilot scale production was used for exhaustive field tests in all regions of the country. New plant facilities were constructed at Belle, W. Va., to produce it.

Borden's 38 is being sold in 50- and 25-pound bags, 5- and 1-pound cans and even a 2.5-ounce shaker. Company spokesmen say cost of nitrogen is no more than cost organic fertilizers containing only 3 to 7% nitrogen.

Woonsocket Color & Chemical is offering urea-form both to the fertilizer trade for use in specialty mixes and to retail and consumer trade. The inclusion of the urea-form in mixed fertilizer goods will actually be quite a boom to this industry since it will now be possible to turn out extremely safe high analysis products, says a Woonsocket executive.

Swift's fertilizer product, Golden Vigoro, containing urea-form has been on the market for over a year. In the Swift process the urea-formaldehyde reaction is understood to take place right in the mixture.

The urea-forms are still too costly for widespread application. However, informed opinion is that with further progress in manufacturing techniques and with anticipated higher volume of sales the unit price of nitrogen from urea-form will be greatly reduced.

In California alone for just the turf and ornamentals market one experiment station official estimates an annual requirement of some 1000 tons of the urea-forms.

One producer confidently predicts that once the unit price of nitrogen from urea-form reaches a competitive position with natural organic nitrogen, the urea-forms will take over the vast majority of the market. This market could approach the staggering annual figure of 420,000 tons of nitrogen.

Some sources are classing development of the urea-forms as one of the greatest advances in fertilizer manufacture since the development of superphosphate. While this may be open to debate, there is no doubt that the urea-forms are potentially important to the fertilizer industry.

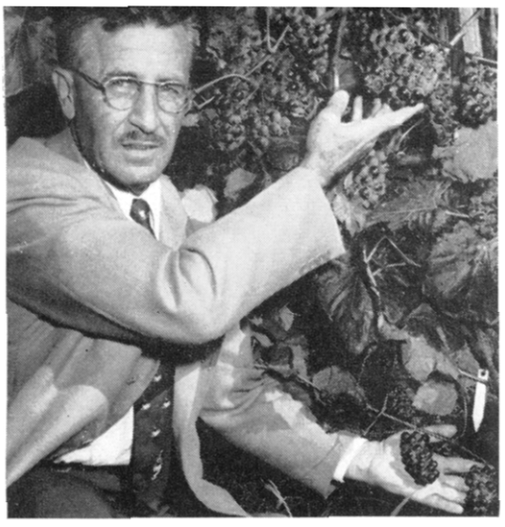
Colchicine in Agriculture

Drug provides potentially valuable tool for breeding crops with unusually large fruit, flowers, and seeds

Colchicine, a drug known for at least 35 centuries and used originally in the treatment of rheumatism and gout, is finding increasing application today in experimental plant breeding. Of special interest to growers, colchicine, an alkaloid derived from the crocus-like plant *Colchicum autumnale*, may profoundly alter the biological makeup of plants. In some cases, the result may be larger fruit, larger flowers, larger leaves, larger seeds. Fruit, for example, may possibly be produced in increased yield, with better flavor, greater nutritional value, greater disease resistance. By the action of colchicine, sterile hybrids may in some cases be made fertile.

Although colchicine can possibly produce changes of this type, the results thus far have fallen short of original expectations. Some early writers, confident in colchicine's ability to work biological miracles, were freely predicting that the drug would create an agricultural revolution. This, obviously, has not been the case.

In many instances, the disadvantages in using colchicine in plant breeding far outweigh the advantages



Haig Derman, USDA colchicine researcher, shows the bigger size grape on Loretto vine resulting from doubling of chromosome number

—at least for the present. New plant varieties obtained by colchicine treatment may be different from conventional varieties, but not necessarily better. Treated plants may have much lower fertility than normal crops, may be much more difficult to grow, or may grow much more slowly. The quality of treated fruit and vegetables may be impaired. Furthermore, because of the special techniques required in the breeding and growing of colchicine-treated plants, the cost of production may be appreciably higher.

Basic Changes

The fundamental property of colchicine is its ability in many cases to double the number of chromosomes in plant cells—provided the drug is applied in the right concentration and at the proper stage of cell development. Normal cells of most plants contain in their nucleus two identical sets of chromosomes. Before these normal so-called diploid cells divide, the chromosomes split lengthwise and each half migrates to opposite ends of the cell. The cell then splits in two, with each new cell containing the same number of chromosomes as the original.

On the other hand, when a dividing cell is treated with colchicine, the chromosomes, after splitting in two in the usual way, do not migrate to opposite ends of the cell, and the cell itself does not divide. As a result, the number of chromosomes is doubled, forming the new tetraploid variety. All cells subsequently produced from this tetraploid also contain twice the usual number of chromosomes.

Since chromosomes carry the all-important genetic factors in plants, this increase in number may have a substantial effect on growth. By use of colchicine, new man-made varieties of plants may be rapidly created that might otherwise take millions of years to be produced by natural means.

Unlike insecticides or herbicides, colchicine is not something the farmer sprays on his crops in the field. Rather, it is a tool in the hands of the plant breeder for use experimentally and possibly also for the production of seeds and plants used by the grower.

Worldwide Investigations

Research on the use of colchicine in plant breeding has been under way for more than 15 years in the U. S., Japan, England, Russia, Belgium, Sweden—in fact, in all major countries of the world. Virtually every agricultural experiment station in the U. S. has at one time or another used colchicine in plant breeding studies.

In Europe, triploid sugar beets, which are hybrids formed by crossing a colchicine-produced tetraploid beet with the conventional diploid variety, are now being grown commercially. These beets reportedly yield 5 to 10% more sugar than ordinary varieties. Thus far, however, triploid sugar beets have gained relatively little headway either in the U. S. or Great Britain. A big problem is that the production of high-yield triploids is a difficult, painstaking, and costly job that may not give sufficiently outstanding results compared to other methods of increasing sugar beet yields.

Japanese researchers report that tetraploid radishes are not only larger than ordinary radishes but are also more resistant to root disease. Tetraploid watercress is said to be more succulent, flavorful, and to have a higher vitamin C content. On the other hand, British scientists say that, despite some advantages, tetraploid watercress is still not sufficiently attractive economically.

Swedish investigators report that tetraploid rye is superior to conventional rye in the production of soft and hard breads. According to Mitchell Farms of Windfall, Ind., which has been distributing tetraploid rye in the U. S. for the last two seasons, this grain offers superior size, vigor, and yield.

In many laboratories, experiments are being carried out on the growth and properties of colchicine-modified corn, wheat, oats, rice, sorghum, flax, cotton, soybeans, tobacco, and oil-bearing seeds. One U. S. experiment station reports that a new polyploid cotton will shortly be released for commercial use. Elsewhere, researchers for many years have been working with colchicine to develop larger, more abundant Chinese tallow nuts in the hope of making this crop more economical in the U. S.

Modified Fruit

A major focus of attention has been colchicine's action on the growing of fruit, such as strawberries, cranberries, apples, peaches, pears, and others. The tetraploid of one variety of apple is almost twice the size of the diploid from which it was developed, although not very much larger than some conventional types of apples. Researchers report that in some cases tetraploid apples have superior resistance to cold.

Considerable interest has been expressed lately in the growing of seedless watermelons from hybrids produced by crossing the tetraploid with an ordinary diploid variety. The resulting seedless triploid, first grown commercially in Japan and later in the U. S., can be produced in greater yield than ordinary watermelons and is reported to be sweeter and to have better texture and storage qualities. However, because of problems involved in breeding seedless watermelons, costs are relatively high. American Seedless Watermelon Seed Corp. of Goshen, Ind., and others are convinced, nevertheless, that seedless watermelons will find widespread markets in the future.

By use of colchicine, scientists at the U. S. Department of Agriculture have created more than 30 different tetraploid varieties of grapes. Tetraploid Loretto grapes are nearly three times as large as ordinary Loretto grapes. This disease resistant variety should be of particular interest in the South, where ordinary grapes are often destroyed by diseases within two or three years. At least five years of additional research may be required, however, before enough is known about these tetraploid grapes to determine whether they can actually be grown commercially.

Much research is currently being done at the Department of Agriculture and elsewhere on the modification of flowers with colchicine. Work is in progress on carnations, snapdragons, lilies, phlox, rhododendrons, marigolds, African violets, and other plants. Colchicine may not only be able to increase the size of the flowers but may also improve their fragrance and intensify their color.

Colchicine today continues to provide the groundwork for extensive, long-term studies of plant breeding and selection. As researchers emphasize, colchicine, a compound on which considerably more research remains to be done, is obviously of value in the breeding of new plants.