

Applying Nitrogen Through Continuously Moving Sprinkler Systems

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By

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Sprinkler irrigation is an excellent way of fertilizing agricultural crops. With fixed sprinkler systems, high concentrations of fertilizer can be applied in a short time and washed off the leaves so that no leaf burn results. However, when self-propelled irrigation systems such as the center-pivot, self-propelled laterals, or other single or multiple sprinkler systems are used, fertilizer must be fed into the sprinkler system continuously to obtain maximum uniformity of fertilization. There is no opportunity to wash the fertilizer from the plant leaves. Therefore, a study was conducted to determine the nitrogen-fertilizer concentrations that can be applied without damage to plants.

Russet Burbank potatoes, sugar beets, and Lemhi wheat were grown in the greenhouse at Kimberly and were fertilized with ammonium nitrate or a mixture of ammonium nitrate and urea similar to commercial nitrogen solutions. The concentrations in solution were varied from low to high in an effort to determine the concentrations that could be applied through the sprinkler system without damaging the plant leaves.

POTATOES

Russet Burbank potatoes were planted in pots in the greenhouse. A sprinkler system was set up to irrigate and fertilize the potato plants. Ammonium nitrate fertilizer dissolved in water

at concentrations to apply 11.4 to 170 lbs. fertilizer (3.9 to 57 lbs. nitrogen) in 0.5 acre inch of water was sprayed on the plants once each week for four weeks, beginning when the plants were about 10 inches tall. The plants all received distilled water between fertilizer treatments as needed. No visible damage could be detected; the potatoes responded to the fertilizer and grew very well.

A mixture of ammonium nitrate and urea similar to the commercial nitrogen solutions was then applied at concentrations to supply 22.7 to 227 lbs. Uran (7.3 to 73 lbs. nitrogen) in 0.5 acre inch of water at weekly intervals for 3 weeks. Again the potatoes responded to the nitrogen fertilization and no signs of damage were detected.

In order to determine at what fertilizer concentration damage could be expected, ammonium nitrate concentrations to apply 567, 1134, 1701, 2268, and 2835 lbs. fertilizer (190, 380, 570, 760 and 950 lbs. nitrogen) in 0.5 acre inch of water were applied. All of these fertilizer treatments damaged the potato leaves but did not seriously injure the plants. It was anticipated that the high concentrations would kill the potato plants, but this was not the case. Concentrations of nitrogen fertilizers used for defoliating potatoes are about 10 times greater than the highest rate above. Low volume sprays are generally used that contain about 2 lbs. ammonium nitrate per gallon of water for defoliation.

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SUGAR BEETS

Sugar beets were planted in pots in the greenhouse March 11, 1968, in Portneuf silt loam soil. On April 9, when the beets were about 4 inches tall, sprinkler fertilization was started and continued at weekly intervals for five weeks. Ammonium nitrate fertilizer at concentrations to apply 23 to 230 lbs. fertilizer (7.7 to 77 lbs. nitrogen) in 0.5 inch of water was sprayed on the beets each time. The beets responded to the nitrogen and grew very well with no symptoms of fertilizer injury.

WHEAT

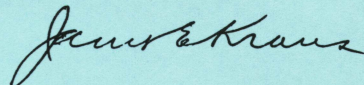
Wheat was planted in greenhouse pots at the same time as the beets and upon emergence thinned to ten plants per pot. The wheat plants were sprinkled with ammonium nitrate fertilizer solution at the same rate and frequency as the beets, starting March 25 when the wheat was about 9 inches tall. No damage symptoms were observed with any of the nitrogen treatments. The wheat grew rapidly and responded to the increased N at the higher rates. Heading and maturity came about one week earlier for the highest nitrogen rate compared with the lowest rate.

SUMMARY

Use of sprinkler systems to fertilize field crops is increasing. Information is needed on the concentration of fertilizer nitrogen that can be applied to crops without damage in cases where it cannot be washed off. These observations, while they were made in the greenhouse and could be somewhat different under field conditions, indicate that there should be no damage to sugar beets, potatoes, or wheat plants from fertilizing with ammonium nitrate or ammonium nitrate and urea mixtures at almost any economical rate a farmer may wish to apply. One application of 190 lbs. N per acre in 0.5 acre inch of water slightly "burned" potato leaves while 950 lbs. N per acre damaged them slightly more. Three weekly applications of 57 lbs. N per acre in 0.5 acre inch of water did not damage potato leaves. Five weekly applications of 73 lbs. N per acre in 0.5 acre inch of water did not damage sugar beets or wheat plants.

The advantage of sprinkler fertilization is that it supplies the nitrogen when needed and can be used to fertilize frequently to avoid problems of quality deterioration associated with large nitrogen applications.

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