COMPARISON OF CaTs® AND CAN 17 FOR DELIVERY OF CALCIUM TO DRY BULB ONION

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Objective

Compare the effects on onion yield and size profile of same rate of calcium per acre using CaTs® (calcium thiosulfate solution) and CAN 17 (calcium ammonium nitrate solution), product to product, without balancing nitrogen or sulfur between them.

Materials and Methods

Onions were grown in 2020 on a Greenleaf silt loam previously planted to wheat. After the wheat was harvested in 2019, the stubble was shredded, the field was irrigated to sprout unharvested wheat kernels, and then the field was disked. A soil analysis taken in the fall of 2019 showed a pH of 8.2, 3.9% organic matter, 2 ppm nitrogen (N) as nitrate, 1 ppm N as ammonium, 28 ppm phosphorus (P), 661 ppm potassium, 47 ppm sulfur (S), 3086 ppm calcium, 751 ppm magnesium, 173 ppm sodium, 4.3 ppm zinc, 3 ppm manganese (Mn), 1.2 ppm copper, 7 ppm iron, and 0.4 ppm boron (B). Based on the soil analysis, 100 lb N/acre, 44 lb P/acre, 200 lb S/acre, 9 lb Mn/acre, and 2 lb B/acre were broadcast before plowing. After plowing and groundhogging, the field was fumigated with Vapam® at 15 gal/acre and bedded at 22 inches.

Onion seed of cultivar 'Vaquero' (Nunhems, Parma, ID) was planted at 150,000 seeds/acre on March 19, 2020. Seed was planted in double rows spaced 3 inches apart on beds spaced 22 inches apart. Immediately after planting, the field received a narrow band of Lorsban® 15G at 3.7 oz/1000 ft (0.82 lb ai/acre) over the seed rows and the soil surface was cultipacked. Onion emergence started on April 11. On May 13, alleys 4 ft wide were cut between plots, leaving plots 23 ft long.

The field was drip irrigated with drip tape laid at 4-inch depth between two onion beds during planting. The drip tape had emitters spaced 12 inches apart and an emitter flow rate of 0.22 gal/min/100 ft (Toro Aqua-Traxx, Toro Co., El Cajon, CA). The distance between the tape and the center of each double row of onions was 11 inches.

Onions were irrigated automatically to maintain the soil water tension (SWT) at 8-inch depth in the onion root zone below 20 cb. Soil water tension was measured with eight granular matrix sensors (GMS, Watermark soil moisture sensor model 200SS, Irrometer Co. Inc., Riverside, CA) installed at 8-inch depth in the center of the double row of onions. Sensors had been calibrated to SWT. The GMS were connected to the datalogger via multiplexers (AM16/32, Campbell Scientific, Logan, UT). The datalogger (CR1000, Campbell Scientific) read the sensors and recorded the SWT every hour. The datalogger automatically made irrigation decisions every 12 hours. The field was irrigated if the average of the eight sensors was at a SWT of 20 cb or

higher. The irrigations were controlled by the datalogger using a controller (SDM-CD16AC, Campbell Scientific) connected to a solenoid valve. Irrigation durations were 8 hours, 19 minutes, to apply 0.48 inch of water. The water was supplied from a well and pump that maintained a continuous and constant water pressure of 35 psi. The pressure in the drip lines was maintained at 10 psi by a pressure-regulating valve. The automated irrigation system was started on May 7, and irrigations ended on September 1.

Fertility management was based on root tissue and soil analysis. Starting on May 27, root tissue and soil samples were taken every week from field borders and analyzed for nutrients by Western Laboratories Inc., Parma, Idaho. Root tissue was analyzed for nitrate concentration, and soil samples were analyzed for concentrations of nutrients in the soil solution. Nutrients were applied only if both the root tissue and soil solution concentrations were simultaneously below the critical levels. Urea ammonium nitrate solution (URAN) was applied through the drip tape four times from May 28 to June 19, supplying a total of 100 lb N/acre.

The following herbicides were applied: glyphosate at 0.77 lb ai/acre (Roundup® PowerMax at 22 oz/acre) on April 8, sethoxydim at 0.28 lb ai/acre (Poast® at 24 oz/acre) on May 7, and pendimethalin at 0.95 lb ai/acre (Prowl® H_2O at 2 pt/acre) on May 11. For fungal disease control, Luna® Tranquility at 27 oz/acre (fluopyram, pyrimethanil) was applied by ground on June 26.

Insecticides were applied weekly from June 2 to July 14 (Table 1). Insecticides were applied with a CO_2 backpack sprayer using a four-nozzle boom with 11,004 nozzles at 30 psi and 35 gal/acre. Treatments began once thrips counts exceeded four thrips per plant.

Calcium Applications

There were four treatments in this trial: calcium application with CaTs, calcium application with CAN 17, grower standard treatment with no calcium application, and untreated control. All fours treatments received the same recommended N fertilization based on soil and tissue tests. Only the untreated control was not treated with insecticides for thrips control.

CaTs was applied at 10 gal/acre. CAN 17 was applied at 5.4 gal/acre. The two treatments delivered the same amount of calcium. CaTs and CAN 17 treatments were applied two times through the drip-irrigation system, June 25 and July 9. CaTs and CAN 17 were mixed into 60-gallon nurse tanks, and water ran for 1 hour before fertilizer injections began. A pump ran each injection at 10 gal/hour. Injections ran for 6 hours and were followed by 1 hour of water to clear the lines and push the entire fertilizer load to the onion rows.

Data Collection

Onions from the middle two double rows in each plot were lifted on September 9. They were topped by hand, bagged on September 19, and placed in storage on September 24. The onions from each plot were graded on October 8, 9, 12, and 13. During grading, bulbs were separated according to quality: bulbs without blemishes (No. 1s), split bulbs (No. 2s), neck rot (bulbs infected with the fungus *Botrytis allii* in the neck or side), plate rot (bulbs infected with the fungus *Fusarium oxysporum*), bacterial rots, and black mold (bulbs infected with the fungus *Aspergillus niger*). The No. 1 bulbs were graded according to diameter: small (<2¼ inches), medium (2¼–3 inches), jumbo (3–4 inches), colossal (4–4¼ inches), and super colossal (>4¼ inches). Marketable yield consisted of No.1 bulbs in the medium or larger size classes (larger than 2¼ inches).

After the initial grading, marketable bulbs were rebagged and placed into storage. These bulbs were graded on February 8 and 9, 2021. Bulbs were graded as in the initial grading. Bulb counts

per 50 lb of super colossal onions were determined for each plot by weighing and counting all super colossal bulbs during grading. Marketable yield consisted of No.1 bulbs in the medium or larger size classes (larger than 2¼ inches).

Results and Conclusions

Treatment with CaTs or CAN 17 did not significantly increase yields at the initial grading the month after harvest. The total marketable yield for the CAN 17 treatment was approximately 5.5% lower than for the CaTs treatment (Figure 1). Initial marketable yields were 1.3% lower than the grower standard for the CaTs treatment and 6.8% lower than the grower standard for the CAN 17 treatment.

After approximately 4 months of storage, size profiles for the four treatments changed from the initial profiles (Figure 2). The changes were not statistically significant; however, the CAN 17 treatment had the least change, whereas the control and grower standard treatments, which did not receive calcium treatments, showed the greatest amounts of change. Total marketable yield shrank by 16% in the control and by 6.8% in the grower standard. After the winter storage, the CaTs treatment marketable yield shrank by only 2.2% and was 3.5% higher than the grower standard. The CAN 17 marketable yield after storage was 5.4% higher than the grower standard treatment and approximately 2% higher than the yield for the CaTs treatment.

Table 1. Insecticide treatment programs in the CaTs and CAN 17 trial, Malheur Experiment Station, Oregon State University, Ontario, OR, 2020. The untreated control received no insecticides. The grower standard, CaTs, and CAN 17 treatments received the same seven weekly insecticide applications.

Fertilizer Treatments	Insecticides	Rate	Units/acre	Application date code
Control	Untreated control			
Grower Standard, CaTs. CAN 17	Movento HL	2.5	fl oz	June 2, June 9
	Agri-Mek	3.5	fl oz	June 16, June 23
	Radiant	8	fl oz	June 30, July 7
	Lannate LV	3	pt	July 14

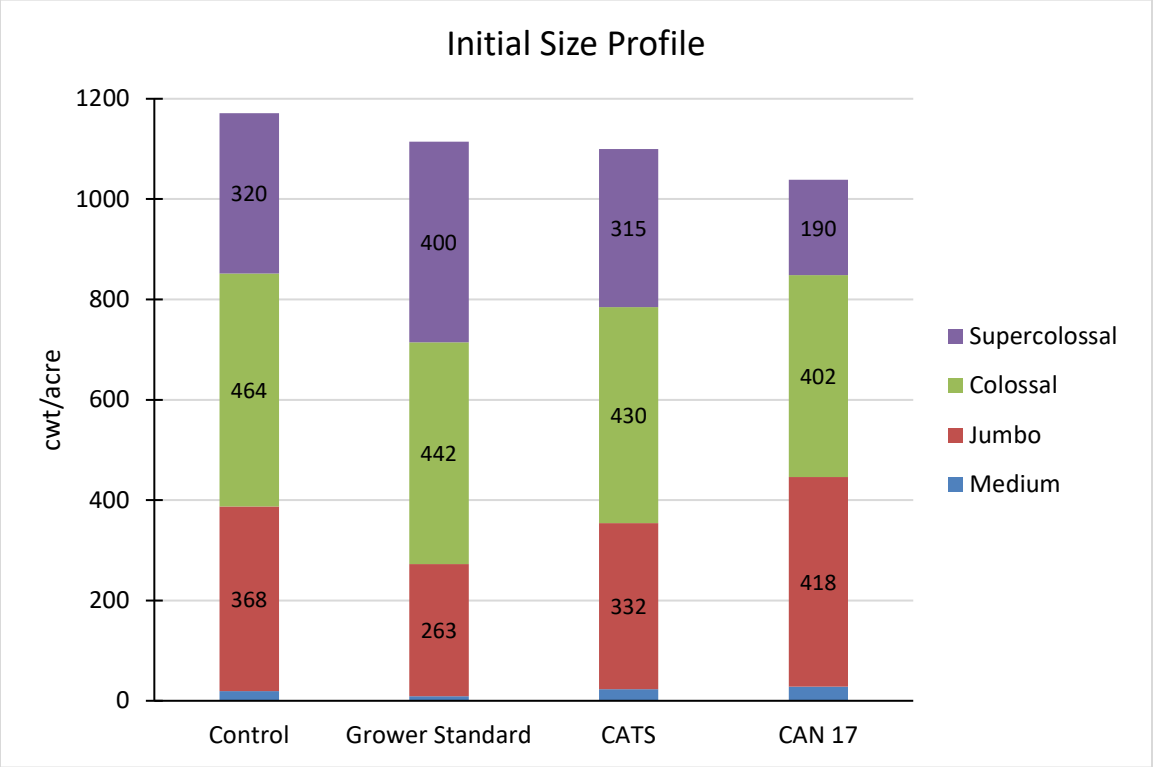

Figure 1. Size profiles of dry bulbs onions after harvest when treated after bulb initiation with CaTs® or CAN 17 fertilizers, Malheur Experiment Station, Oregon State University, Ontario, OR, 2020. The bars show hundredweight per acre (cwt/acre) for each size class.

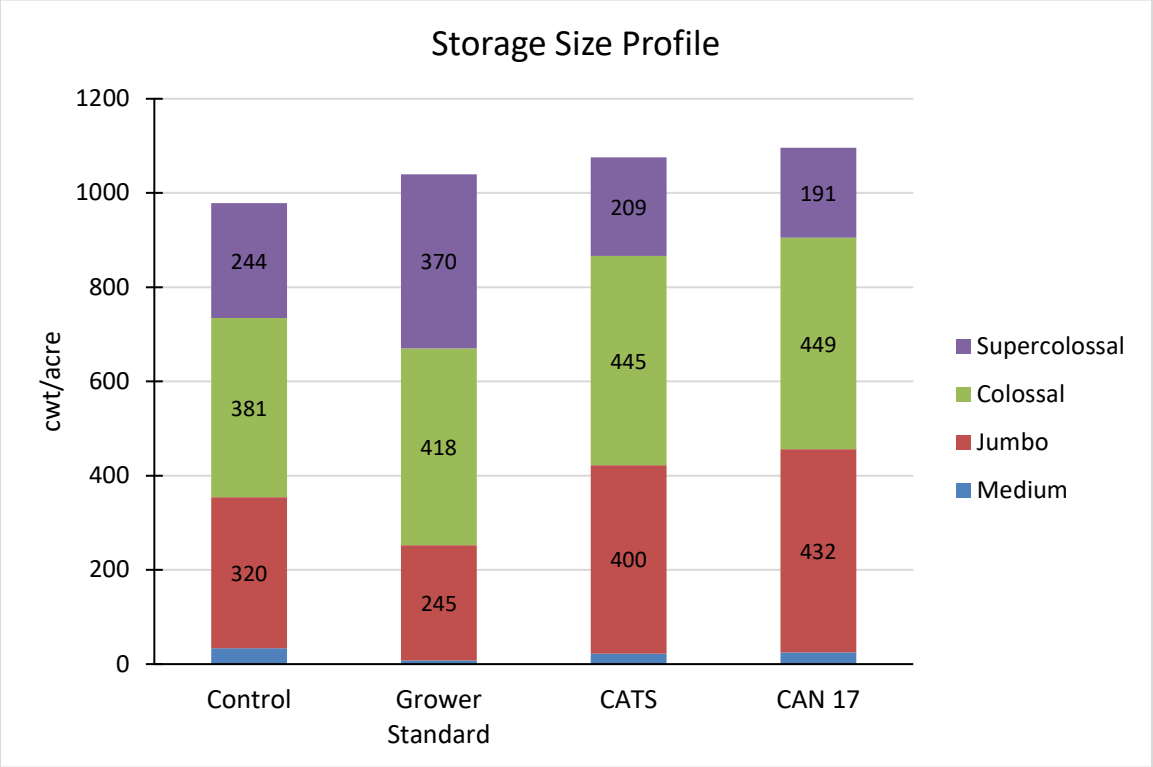

Figure 2. Size profiles for dry bulbs onions after four months of storage when treated after bulb initiation with CaTs® or CAN 17 fertilizers, Malheur Experiment Station, Oregon State University, Ontario, OR, 2020. The bars show hundredweight per acre (cwt/acre) for each size class.