

Carrots have a high N demand but are also susceptible to excessive crop growth if too much N is available, which reduces the growth and development of the marketable portion of the carrot, the root. Excessive crop growth can also create conditions that are more favorable for diseases. Recent studies have found that using a reduced rate of efficiency N products can reduce crop growth but still increase carrot yield. This increase is likely because efficiency products slow the release of plant available N throughout the growing season to ensure better crop uptake. Unlike urea, which does not slow the release of N and can be lost to the surrounding environment more easily. To demonstrate the effectiveness of using efficiency products on carrots, a trial was conducted near Prince Albert in 2019. Three different efficiency products (Agrotain, SuperU, and ESN) were applied at a rate of 70 kg N/ha and were compared to the industry standard of 100 kg N/ha of urea. A control was also included where no additional N was added. These treatments were replicated 4 times. Drip irrigation was installed, and the carrots were irrigated with Prince Albert city water.

All fertilized treatments had greater above ground growth than the control, and of the fertilized treatments Agrotain had the lowest above ground growth (Table 1). The addition of fertilizer increased total root yield by 20-32 t/ha but was not significant. This insignificance was likely because the control had high residual N and a high amount of MAP was applied to the control to reach P requirements.

Table 1 shows that enhanced efficiency N products when used at lower rates (30% lower) performed similarly to the industry standard. This result implies improved nitrogen use efficiency, which reduces the loss of N to the surrounding environment. ESN and SuperU had the highest carrot root yields.

Table 1. Yield of carrot crop growth and roots with the use of nitrogen efficiency products.

| Treatment | N rate (kg N/ha) | Yield | |
|-----------|---------------------|-----------------------------------|------------|
| | | Above Ground | Root Total |
| | | ----- (t ha ⁻¹) ----- | |
| Control | 0 | 28.7 b | 80.6 |
| Urea | 100 | 50.0 a | 99.3 |
| Agrotain | 70 | 41.8 ab | 98.4 |
| SuperU | 70 | 48.3 a | 109 |
| ESN | 70 | 47.4 a | 112.6 |
| P value | | 0.012 | 0.2188 |

The efficiency products used in the study were approximately 1.3X more expensive than urea, but since rates were lower, total cost per ha was less (Table 2). The adoption of using efficiency products will depend on their cost.

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Table 2. Estimated cost analysis of efficiency products compared to industry standard of urea as of November 2019.

| Treatment | Cost | N Rate | Actual Product rate | Total cost |
|-----------|------|--------|---------------------|------------|
| | \$/t | Kg/ha | Kg/ha | \$/ha |
| Urea | 500 | 100 | 217 | 109 |
| Agrotain | 580 | 70 | 152 | 88 |
| SuperU | 630 | 70 | 152 | 96 |
| ESN | 625 | 70 | 159 | 99 |