

Effect of CIPC Residue on Seed Emergence & Yield

based on research performed by John Walsh, Associate Principal Scientist, McCain Foods NB
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Recently, there has been an interest in examining whether residual CIPC exposure can affect seed emergence and resultant yields. CIPC is a persistent sprout inhibition product which has been shown to prevent sprouting at small concentrations. The main question from growers has been to find out what even very small residue levels will do on exposed seed, and how can growers prevent exposing their seed to CIPC.

Delayed Emergence and Yield Loss

To assess the effect of residual CIPC on seed performance, the McCain Foods Research Team in New Brunswick dipped two varieties, Russet Burbank and Innovator, in water with different levels of CIPC residue. They found it difficult to get the exact level of CIPC residue intended, but there is a gradual increase in CIPC in the different treatments.

For Russet Burbank, the treatments yielded the following results:

Intended Rate	Actual Rate	Yield (cwt/ac)	Yield Reduction
0 ppm	0 ppm	537	--
0.025 ppm	0.021 ppm	480	10.6%
0.050 ppm	0.128 ppm	487	9.3%
0.100 ppm	0.143 ppm	464	13.6%
0.200 ppm	0.230 ppm	453	15.6%

Delayed emergence was also seen, with every treatment with CIPC having some delay in emergence compared to the control, with the largest delays at the higher rates. There was only 25% emergence in the 0.230 ppm treatment at 27 days after planting, compared to 95% emergence for the 0 ppm control. While emergence rates caught up with time, there was obviously a negative effect on yields.

For Innovator, the treatments yielded the following results:

Intended Rate	Actual Rate	Yield (cwt/ac)	Yield Reduction
0 ppm	0.000 ppm	593	--
0.025 ppm	0.062 ppm	584	1.5%
0.050 ppm	0.153 ppm	547	7.8%
0.100 ppm	0.153 ppm	564	4.9%
0.200 ppm	0.303 ppm	524	11.6%

For the Innovator variety, delayed emergence in the treatments with CIPC residue was even more pronounced. The 0.303 ppm treatment had only 22% emergence at 27 days after planting, compared to 90% emergence for the 0 ppm control. For the treatments with the highest residue levels, emergence rates never completely caught up to the control treatment.

From this research, there is evidence that even very low rates of CIPC residue (as low as 0.025 parts per million) can result in delayed emergence and yield reductions. Therefore, it is important to avoid exposure of seed potatoes to CIPC wherever possible. Results from both varieties were statistically significant in this trial.

As a follow up, the McCain team wanted to assess what levels of CIPC could be detected in grower storages, and what CIPC residue levels would be after storages had been steam cleaned.

Detecting CIPC residue in storages

A number of grower storages used for cutting seed were tested for CIPC residue in New Brunswick. Samples of potatoes were taken at different locations in the bin, with the location recorded as well as whether the seed was cut or whole. These results are shown on the following page:

Client #	Location in Bin	Cut or Whole Seed	CIPC Residue (ppm)
1	Near duct	Cut	0.055
1	Along wall	Cut	Trace
1	Near duct	Cut	0.240
1	Along wall	Cut	0.008
1	Middle of pile	Cut	0.012
2	Back wall	Cut	0.075
2	Centre of pile	Cut	0.072
3	Along wall	Whole	<0.005
4	Along front wall	Whole	<0.005
5	Along back wall	Cut	0.018
5	Above back duct	Cut	0.083
6	Along wall	Cut	0.007
6	Above duct	Cut	0.012
7	Next to wall	Whole	0.054
7	Next to duct	Cut	<0.005
8	Next to wall	Whole	<0.005
9	Next to wall	Whole	0.014
11	Next to wall	Whole	0.012

Six of these samples had residue levels greater than the 0.025 ppm level that showed yield reduction in plot trials. Similar results were found in samples from Maine, with residue levels up to 0.210 ppm found in storages where seed was being cut.

The next step in the research was to assess what effect cleaning of storages had on reducing CIPC residues. A co-operating grower selected a storage that had previously been used for long-term storage and stopped using CIPC in that storage. He then steam-cleaned all the bins in that storage for two years before seed samples were placed in the bin. Samples were placed in this empty storage on September 21st, and no CIPC was detected at that time.

Samples were then tested again on December 14th. At this point, nearly three months later, three out of six samples had detectable levels of CIPC residue, with the highest coming back at 0.011 ppm. This shows us that steam-cleaning will do a lot to reduce the risk of exposure to CIPC, but there is still a chance to have low levels of exposure even after two years of cleaning.

Recommendations:

Based on the two years of research done by the McCain Foods team, they made the following recommendations:

1. Ideally, growers should store, cut and hold seed in a storage that has never been treated with CIPC. That means either an old seed storage or a new structure.
2. A second option would be to designate a storage previously treated with CIPC for short-term storage, never treat it with CIPC again, and steam clean it every year prior to bringing in seed. Don't forget to do the plenum and ducting.
3. A third, much less desirable option would be to designate a portion of the storage for seed cutting, discontinue the application of CIPC in the seed cutting bins, and only gas the other portions of the storage. In this case, each bin would have its own ventilation system, and the ventilation system in the seed cutting bin would be turned off while gassing the other bins.
4. Growers should also steam clean any equipment that was used in CIPC-treated storages before using it for seed cutting, including potato scoops, bin pilers, conveyors, bulk boxes and trucks.

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