

Demonstration of Maleic Hydrazide as a Method to Control Sprouting of Onions during Long-term Cold Storage

Sprout management is critical for successful long-term cold storage of onions. Sprouting increases moisture loss from the bulbs, while also rendering the onions unattractive and unmarketable. While onions are initially dormant for a period after harvest, they will inevitably begin to sprout once sufficient time has passed in cold storage. The fast maturing onion cultivars preferred by growers in Saskatchewan tend to have a short dormancy period once harvested. Storage at very low temperatures (ca. 0°C) will delay the development of sprouts but consistently generating low storage temperatures may be difficult and costly.



Figure 1 . Sprouting onion

Maleic Hydrazide (Royal MH) is a herbicide with plant growth regulator activity. When applied to the foliage of a mature healthy onion plant the MH is absorbed and stops cell division but not cell expansion. By interfering with cell division, the MH controls the sprouting that would otherwise occur during long-term storage of the onion crop. Maleic hydrazide is registered in Canada for use as a sprout inhibitor in onions and potatoes. The efficacy of MH as a sprout inhibitor is known to vary depending on weather conditions and crop growth rate at the time of treatment and the onion cultivar being treated. For these reasons, the efficacy of MH can be somewhat variable.

This project demonstrated the efficacy of foliar-applied maleic hydrazide as a means to control sprouting during cold storage in several widely grown onion cultivars.

Procedures

The project was conducted at the University of Saskatchewan Horticulture Field Research Facility in Saskatoon using four cultivars of yellow onion (Alpine, Norstar, Copra and Fortress) selected for their superior yield and storage potential in trials conducted in Saskatchewan. They were also selected to represent a range in inherent dormancy/sprouting characteristics – with Alpine and Fortress showing fairly long dormancy with minimal sprouting and Copra and Norstar having a shorter dormancy and more tendency to sprout during storage.

The plots were established and maintained using standard cropping practices. Timing of application is very important when using maleic hydrazide. The label recommends application 10-14 days prior to harvest. Ideally the product is applied to “mature” yet healthy plants. Application of MH tends to slow bulb development - therefore if it is applied too early both bulb yields and quality can be compromised. If it is applied too late it is ineffective. The MH (Royal MG-60) was applied on Sept. 10 - at which time cv. Copra was still growing vigorously, cv. Norstar and cv. Fortress had begun to dieback and cv. Alpine was at 100% “tops down” stage of development (Fig. 2). The MH was applied at the label recommended rate of 3.5 L product/acre in the equivalent of 120 L/acre of water. The MH was applied with a CO₂-powered small plot sprayer equipped with 110-02 nozzles operating at 270 KPa pressure. This spray set-up allowed for

excellent coverage of the foliage. The untreated control treatments were sprayed with an equivalent amount of water. A -5°C frost occurred on Sept. 13, otherwise September 2011 was warm and frost free. The MH treatments caused no obvious changes in the appearance of the crop. On September 22 the crop was lifted and topped. The bulbs were allowed to field cure for 2 weeks and then the number and weight of bulbs in each row was determined. A sample of bulbs was collected from each treatment, weighed and evaluated for sprouting. These onions were then transferred to a cold storage (3°C and 50% RH). Weight loss and sprouting were evaluated after 60 and 200 days of cold storage.



Figure 2. Mature onions with “tops down”.

Results

Application of the MH-60 sprout inhibitor had no obvious impact on yields or appearance of the harvested crop.

Cultivar	Sprout Inhibitor	Weight loss (%)		Sprouting (%)	
		60 days	200 days	60 days	200 days
Alpine	+	7	11	1	1
	-	6	13	3	6
Copra	+	8	14	3	3
	-	13	26	12	13
Fortress	+	5	7	3	6
	-	4	7	1	13
Norstar	+	5	8	9	12
	-	6	10	11	23
Average	+	8	10	4	6
	-	8	16	7	14

The onions kept exceptionally well over an extended storage period – irrespective of the sprout inhibition treatments applied. This reflects the fact that;

- the onion cultivars selected for use in this trial had shown exception yield and storage potential in previous trials.
- The refrigerated storages used in the trial consistently produced near-ideal conditions for onion storage. Very few commercial growers can afford refrigerated storages. Storage under less optimal temperature conditions would likely have triggered more or earlier sprouting.
- The record hot, dry conditions that prevailed through the fall of 2011 were near-ideal for enhancing maturity and dormancy of onions. Crops maturing under less ideal conditions would be expected to show more or earlier sprouting.

As expected sprouting increased with time in storage – but not at a consistent rate. Some onions had actually begun to sprout even prior to harvest. These onions were not included in the trial. There was substantial sprouting in some cultivars by 60 days after harvest – but relatively little additional sprouting occurred through to 200 days after harvest. Immature onions are prone to early sprouting – even under ideal storage conditions. Having a small proportion of immature bulbs is almost inevitable in onion crops grown in short season production locations such as Saskatchewan.

The maleic hydrazide treatments reduced the % of onions sprouting by more than 50% on average at both 60 and 200 days after harvest. The maleic hydrazide appeared to be equally effective across the range of cultivars tested. This was an interesting observation – as the cultivars used in this trial had been purposely selected to differ in their degree of maturity at the time of application of the MH-60. These results suggest that the MH-60 can provide effective sprout control over a wide window of crop maturity.

Use of the sprout inhibitor also reduced moisture loss over the 200 day storage period – this would be expected as sprouts are a major source of moisture loss from stored onions. As onions are market by weight, this treatment effect would be of obvious benefit to growers.

In conclusion – foliar application of MH represented an easy to apply, affordable and effective means of controlling sprouting and moisture loss during longterm cold storage of a range of popular onion cultivars.

Support for this project was provided by the ADOPT program of Saskatchewan Agriculture and Food. Additional support from the Saskatchewan Vegetable Growers Association is gratefully acknowledged.