Effect of Harvest Maturity on Viability of Onion Seed

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Abstract. A study was undertaken to determine the moisture content at which the seed of 'Sweet Spanish' onion (Allium cepa L.) expressed maximum yield and viability but at the same time did not shatter. A harvest maturity curve was developed to provide an estimate for optimum time of harvest. Umbels could be harvested with moisture contents as high as 66% without any adverse effect on seed size or viability. The umbels could be left on the plant until umbel moisture was as low as 52% before shattering commenced. The resulting 14% moisture range, within which harvest may proceed without losses to shattering or immature seed, provides an adequate buffer for harvesting onion seed.

Onion seed yields obtained in the field are often less than the potential yield. Low yields are attributed to poor breeding, diseases, and adverse growing conditions (2, 10–12). These sources of loss are often difficult to control.

Seed shattering prior to or during harvest is another loss in onion seed production. Many seed crops, onion included, shatter when past initial prime maturity. This loss can be easily reduced by harvesting before shattering occurs. However, to have good quality seed and maximum production, it is necessary to have high viability and maximum seed size.

In a survey of seed harvesting operations for grass and small-seeded legumes, Klein and Harmond (9) showed that the optimum time of windrowning for maximum seed yields often precedes the period of highest germination. In some instances, highest germination occurred after some shattering had taken place. Accordingly, the optimum time of harvest is a result of the balance between seed weight, viability, and shatter loss.

Klein and Harmond established that moisture content of the inflorescence correlated well with the time of harvest for obtaining maximum yield and high viability seed. Curves were developed that could be used to predict the correct time for harvest for numerous forage seed crops.

Onion seed is harvested commercially by gathering the umbels either by hand or with a mechanical mower that cuts the stalk several centimeters below the seed head. The seed heads then are placed on tarps to dry before threshing.

No curve is presently available for determining the optimum time for harvesting onion seed. Such a tool could be more useful than the customary method of looking to see when the first-formed seed is nearly ready to shatter (3, 5, 6). At that time, the youngest seed in the umbel will have passed from the milk to the dough stage and thus have ripened. Harvesting at that time often results in large losses due to shattering (8).

The purpose of this research was to provide a general guideline for harvesting onion seed that minimizes losses to seed shatter and immature seed.

All onion umbels and seed used in this experiment were collected from a 0.5-ha hybrid seed field of the type 'Sweet Spanish'. The soil was a coarse-loamy, mixed, nonacid, thermic Typic Xerorthent. The parent lines were arranged in a sequence of 4 rows of females alternating with 2 rows of pollinators. The stock bulbs were planted 15 cm apart on beds spaced at 1 m. The plants were grown with standard cultural practices for onion seed production, including an incorporated preplant application of 185 kg·ha⁻¹ of 16N–8.8P–0K fertilizer, and a post-planting application of Dacthal at a rate of 9 kg·ha⁻¹. Surface irrigations were applied as needed.

Full bloom (90% of the umbels in full anthesis) occurred on day-of-year 198. Three weeks after full bloom, 2 replications of 16 rows of the female line plants were marked to provide a representative sample. Five randomly selected plants were taken from each replication and the umbels harvested. This process was repeated every 2 days for a period of 30 days.

After sampling the umbels in the field, each was cut in half and bulked with the others within the respective replication. Subsamples of both excised seed and intact umbels were taken from each of the replications and dried to constant weight at 60°C for 48 hr. Moisture contents then were determined. The remaining umbel halves to be used for seed quality determinations also were bulked and dried to constant weight in a forced-air oven at 37°C. The subsamples were threshed and cleaned by hand. The seed was tested for viability according to the rules of the Assn. of Official Seed Analysts (1). Four random samples of 100 seeds from each sample date...
measure of seed moisture, which requires excising individual seeds from the florets.

Percentage of seed germination increased from an initial 78% at the start of sampling to a maximum of 95% at the end of the study. The maximum percentage was reached about 31 days after full bloom and then remained constant (Fig. 2). The 100-seed weight increased with time until 35 days after full bloom, after which the value remained constant (Fig. 3).

Seed weight is considered an estimate of vigor, as larger seeds result in more vigorous seedlings (12). A combination of percentage of seed germination and vigor is considered an ideal indicator of viability (4). Thus, the high percentage of seed germination and 100-seed weight at 35 days after full bloom indicates that this time is the earliest that seed harvest can begin without detriment to seed yield and quality. Since appreciable shattering did not occur until 43 days after full bloom (Fig. 4), seed could be harvested between 35 and 43 days after full bloom without any reduction in seed viability or yield loss due to small seed or shattering.

Figure 5 shows the relationship of the measured variables and indicates the optimum moisture range within which onion seed can be harvested. Similar relationships have been shown for other crops (7, 9). The range of 52% to 66% moisture in the umbels corresponds to a time interval of 8 days, during which there would be no adverse effects on seed quality and yield. This moisture level is higher than that found by Globerson et al. (6), who reported dry matter levels should be 60–70% (30–40% moisture).

Since the umbels must be dried on tarps after harvest before the seed can be threshed safely, it is recommended that harvest be delayed as long as possible up to the 52% umbel moisture threshold to facilitate drying. However, with a 14% moisture range within which harvest may proceed, sufficient time is available to plan the harvest without loss of seed yield or quality.

**Literature Cited**