

Screening Short Day Onion Cultivars For Firmness and Related Traits: 2024 Field Results From New Mexico

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Introduction

Onions are a major crop in New Mexico, contributing substantially to the state's economy (Whitcotton et al., 2023). However, short-day onion cultivars, commonly grown in the region, tend to have lower bulb firmness, making them more susceptible to damage during mechanical harvesting (Mullinix et al., 2001; Herold et al., 1998). The need to adopt mechanization is increasing due to rising labor costs and market competition. Identifying firm, marketable cultivars adapted to New Mexico conditions is critical for enabling successful mechanical harvesting.

Objectives and Hypothesis

- Identify short-day onion cultivars with superior bulb firmness to support cultivar selection for mechanical harvesting in New Mexico.
- Determine the relationship between bulb firmness and other traits.
- We hypothesize that cultivars differ in bulb firmness and that specific traits are significantly correlated with firmness.

Materials and Methods

- The field trial was conducted in 2024 at the Fabian Garcia Research Center, NMSU.
- Twenty-eight short-day onion cultivars with varying maturity periods (early, intermediate, and late) were evaluated in a randomized complete block design with three replications.
- Plots were harvest after 80% tops down, and 10 randomly sampled bulbs per plot were used to take the following measurements: subjective firmness rating (1–9), durometer readings (Fig. 2A), bulb weight (g), bulb diameter (cm), number of fleshy scale layers, number of growing points, soluble solids (%), among others.

Results



Figure 1. Firmness (bars), bulb weight (line with dots), and harvest date (right tables) for early- (A) and intermediate-maturing (B) short-day onion cultivars. Cultivars are ordered by bulb weight in the graphs and by harvest date in the tables. Background colors indicate bulb color: green = white, yellow = yellow, purple = red. The number in the right tables refers to the number of days after sowing (DAS).

Smaller bulbs tended to be firmer but may not meet market standards (Fig. 1). Days after sowing (DAS) varied among cultivars within the same maturity group. Firmness was moderately correlated with durometer readings, bulb size, and soluble solids (Table 1).

Table 1. Correlation coefficients between firmness rating and selected traits in early- and intermediate-maturing onion cultivars, including all entries as well as the firmest and least firm cultivars in each group. Sample sizes (N) correspond to the number of observations per group. Asterisks (*) indicate statistically significant correlations.

Measurements	Correlation coefficient with firmness rating					
	Early			Intermediate		
	All Entries (N=360)	Most Firm EMY 72195 (N=30)	Least firm OSYS22-0834 (N=30)	All Entries (N=360)	Most Firm White Ace (N=30)	Least Firm Somerset (N=30)
Durometer	0.49*	0.51*	0.34	0.47*	0.4*	0.52*
Bulb weight [g]	-0.33*	0.3	-0.36*	-0.26*	0.21	-0.01
Bulb diameter [cm]	-0.32*	0.45*	-0.32	-0.25*	0.36*	-0.26
Fleshy scale no.	-0.24*	-0.11	-0.43*	-0.24*	-0.04	-0.02
No. growing pts	0.14*	0.37*	0.23	-0.09	0.04	-0.03
Soluble solids %	0.44*	0.04	0.29	0.37*	-0.26	-0.07

Conclusions

- Firmness varies among cultivars; some show better potential for mechanical harvest.
- Durometer and soluble solids might be useful indicators of firmness.
- Smaller bulbs tend to be firmer but may lack market appeal.
- EMY70043-55, SVNN1049, NUN1213, Betty, Cisne Blanco, and White Ace are strong candidates for mechanical harvesting.

Implications

- Based on harvest date differences, cultivars were rearranged for the second season of data collection in summer 2025.
- Firmness and marketability must be balanced for cultivar selection.
- In 2025, sixteen new cultivars were added, and a compression gauge (Fig. 2B) will be used to improve firmness measurement accuracy.

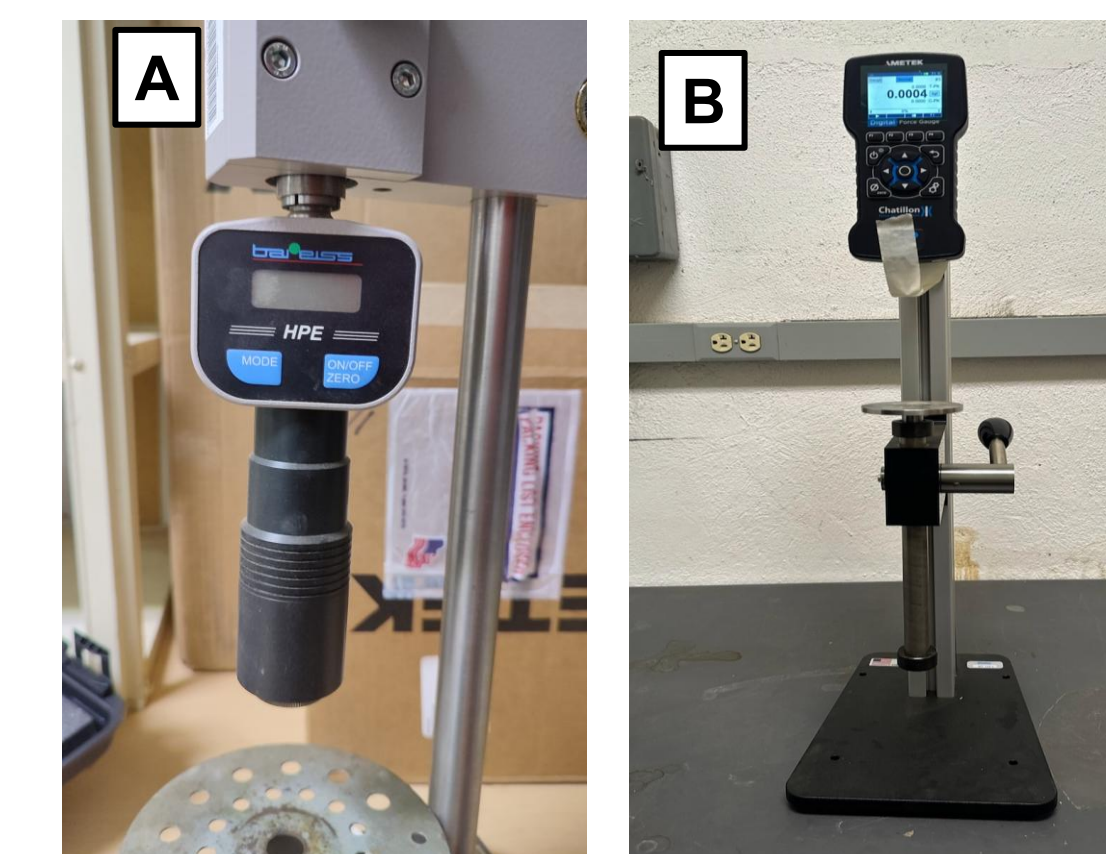


Figure 2. A) Durometer used during data collection in summer 2024. B) Chatillon Force Gauge to be included in the data collection process in summer 2025.

Grant and Citations

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References:

- Herold, B., Oberbarnscheidt, B., & Geyer, M. (1998). Mechanical Load and its Effect on Bulb Onions due to Harvest and Post-harvest Handling. *Journal of Agricultural Engineering Research*, 71(4), 373–383. doi:10.1006/jaer.1998.0336
- Mullinix, Ben G.; Maw, Bryan W.; and Torrance, Reid L. (2001). "DEVELOPMENT OF EXPERIMENTS FOR THE HARVESTING AND STORING OF VIDALIA SWEET ONIONS," Conference on Applied Statistics in Agriculture. <https://doi.org/10.4148/2475-7772.1228>
- Whitcotton, M., Bautista, M., & Gustason, K. (2023). *New Mexico Agricultural Statistics, 2022 Annual Bulletin*. Compiled by the United States Department of Agriculture, National Agricultural Statistics Service, & Mountain Regional Field Office.