2019

Germination rates of Carex spp. seed after long-term storage

Jonathan N. Nzombo
University of Northern Iowa

Kate Sinnott
University of Northern Iowa

See next page for additional authors

Authors
Jonathan N. Nzombo, Kate Sinnott, and Laura E. Fischer Walter

Germination rates of *Carex* spp. seed after long-term storage

Jonathan N. Nzombo[1], Kate A. Sinnott[1], and Laura E. Fischer Walter[2]

[1]Department of Biology, [2]Tallgrass Prairie Center

University of Northern Iowa, Cedar Falls, Iowa

INTRODUCTION

The genus *Carex* is a group of ecologically important grass-like species that constitutes up to 25% of the aboveground biomass in tallgrass prairies (Coppedge et al. 1998). In the early 2000s, seed production plots of 18 *Carex* species were established from remnant prairie seed at the Tallgrass Prairie Center in Cedar Falls, IA. Seed harvested was made available for release to the native seed industry for commercial production, with the remainder stored in an on-site seed bank for future use. By measuring the decline in viability of stored seeds, we can better inform the stewardship of foundation seed banks and improve the availability of genetically diverse and regionally adapted *Carex* seed for restorations. In this germination test, the percentage of germinated normal seedlings was used as an indicator of viability.

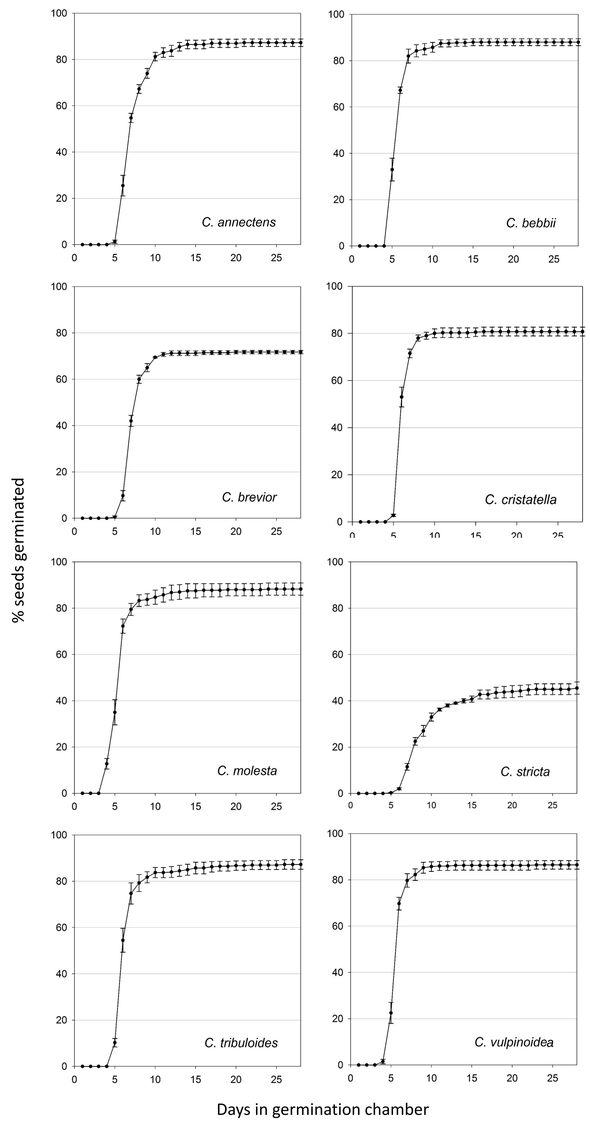
METHODS & MATERIALS

1. Seeds were harvested from seed-increase plots of eight *Carex* species at the Tallgrass Prairie Center from 2007 to 2015 (Table 1).
2. After harvest, seeds were air-dried, cleaned, then stored loose and dry in sealed plastic bags in an on-site seed bank at 4°C and 45% relative humidity.
3. Samples of each species were removed from storage and stratified in damp sand at 4°C for 28-29 days.
4. Four replications of 100 seeds from each species were arranged in grids on moistened blotter paper in germination boxes.
5. The boxes were placed in unsealed plastic bags and then in a growth chamber set to 25/15°C (Budelsky & Galatowitsch 2007) corresponding to a light regime of 12 hours light/12 hours dark (Schütz & Rave 1999).
6. Boxes were checked daily for 28 days. We defined germination as the presence of both a radicle and a coleoptile visible to the naked eye (Schütz & Rave 1999). Germinated seed was removed after being counted. A seed that appeared abnormal (either radicle or coleoptile was visible, but not both) was moved to a separate box and observed the following day. If it met criteria for normal germination, it was added to that day's count.
7. Remaining seeds that had not germinated after 28 days were palpated; dormant seeds had a hard exterior while dead seeds were soft, discolored, or covered in mold.

Presented at the 2019 SER Midwest-Great Lakes Chapter Meeting

RESULTS

Figure 1. Germination rates of eight *Carex* spp.

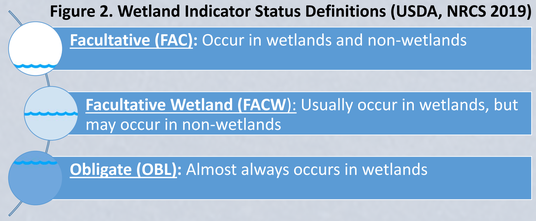


Of the eight species tested, only two (*C. brevior* and *C. stricta)* had germination below 80% (Figure 1). For seven of the species, germination percentages were very similar to the results of TZ tests done between five and nine years ago (Table 1). The viability of *C. stricta*, however, declined by half after 4-6 years of cool-dry storage. *C. stricta* had the highest percentage of dormant seeds, followed by *C. brevior.*

Table 1. Species information

Species	Wetland Indicator Status (Figure 2)	Years seed harvested	Tetrazolium (TZ) Tests		2019 Germination Test	
			Date	Viability (%)	Normal (%)	Dormant (%)
C. brevior	FAC	2010	2010	91	72	15
			2011	78		
			2014	83		
C. molesta	FAC	2010	2010	93	88	5
C. annectens	FACW	2007-2011	2010	84	87	4
C. cristatella	FACW	2011	2013	73-81	81	6
C. vulpinoidea	FACW	2010-2012	2010	86	86	5
			2014	91		
C. bebbii	OBL	2009-2012	2010	88	88	2
			2014	71		
C. stricta	OBL	2013-2015	2013	88-92	45	35
C. tribuloides	OBL	2010-2012	2010	80	87	5
			2013	91		

Figure 2. Wetland Indicator Status Definitions (USDA, NRCS 2019)



CONCLUSIONS

- Cool-dry conditions are suitable for seed storage of all species tested except *C. stricta*. Regeneration of these seeds more frequently than every ten years or exploring other production or storage methods is probably not necessary. Retesting them every two years would be a way to detect when viability begins to decline.
- Obligate wetland status was not a clear predictor of loss of viability under cool-dry storage, contrary to our expectations. Budelsky and Galatowitsch (1999) found that viability and germination of four obligate wetland *Carex* species declined in cool-dry storage. Two of the three obligate wetland species tested (*C. bebbii* and *C. tribuloides*) showed no decline in viability after 7-10 years of storage.
- Follow-up studies of *C. stricta* could help to clarify whether the non-germinated seeds are dead or dormant. *C. stricta* may need different temperatures than we provided in order to break dormancy. Kettenring and Galatowitsch (2007) found that *C. stricta* needed a diurnal temperature regime of 35/30 °C or 5/1 °C to germinate at >50%.
- These germination test methods will be applied to other species to gain a better overall understanding of seed viability in storage. This information will be used to inform decisions on regeneration of seed lots. The ability to maintain viable seed in storage is essential to the availability of diverse species in restorations.

WORKS CITED

Kettenring, K.M. & Galatowitsch, S.M. (2007). Temperature requirements for dormancy break and seed germination vary greatly among 14 wetland Carex species. *Aquatic Botany, 87*(3), 209-220.

Budelsky, R.A. & Galatowitsch, S.M. (1999). Effects of moisture, temperature, and time on seed germination of five wetland *Carices*: Implications for restoration. *Restoration Ecology, 7*(1). 86-97.

Coppedge, B.R., Leslie Jr., D.M., & Shaw, J.H. (1998). Botanical composition of bison diets on tallgrass prairie in Oklahoma. *Journal of Range Management, 51*(4), 381.

Mayfield, Frank. "Carex stricta COMMON TUSSOCK SEDGE" (2008). Retrieved from https://www.flickr.com/photos/gmayfield10/6405964869/

Schütz, W. & Rave, G. (1999). The effect of cold stratification and light on the seed germination of temperate sedges (*Carex*) from various habitats and implications for regenerative strategies. *Plant Ecology, 144*(2), 215-230.

USDA, NRCS. 2019. The PLANTS Database. National Plant Data Team, Greensboro, NC 27401-4901 USA. Retrieved from http://plants.usda.gov