

NON-TIMBER FOREST PRODUCTS: RAMPS IN THE WAYNESVILLE, NC WATERSHED

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Abstract

The potential of forest farming was noted as far back as 1929 but the recognition of its importance dates back only 10 to 15 years. The U.S. market for harvested foods and medicinal plants from forests now exceeds \$4 billion annually. Ramps (*Allium tricoccum* Aiton) or wild leeks grow in patches in the rich moist forests of the eastern United States, are harvested during the spring, and are growing in popularity. At issue is the sustainability of the plant populations in face of increased harvesting pressure. In 2010, we began a study in the Waynesville, NC watershed to examine the reproductive biology of ramps and to assess the field survival of their seeds. We tracked flower stalk survival and seed production of individual ramp plants, determined length of time ramp seeds remain viable in the seed bank, and observed the basic germination requirements of seeds. We have determined that seeds will not germinate without some form of stratification and that seeds lost viability if they did not germinate within 20 months in the seed bank. The study is on-going.

INTRODUCTION

There is little information about the flowering cycle and seed development of some understory species. Also lacking are data on how long seeds of certain understory species survive in the field and how long they can be stored at low temperature. This information is not only critical in assessing establishment and survival of a species but also can be used to evaluate potential for establishing artificial germplasm reserves.

Allium tricoccum Aiton (ramps; Figs. 1-4) grow in patches in the rich deciduous forests of eastern North America from Canada south to Tennessee and North Carolina. A member of the Liliaceae family, the plants have broad, smooth leaves that appear in March or April and send up a shoot of white flowers in summer.



Seeds mature in late August or early fall. The plants are harvested during annual spring festivals which are growing in popularity. Since harvesting occurs before seeds mature, individual wild populations may be devastated if harvesters do not nurture individual patches by allowing flowering plants to remain *in situ*.

OBJECTIVES

To determine:

1. flower stalk survival and seed production of individual ramp plants;
2. length of time seeds remain viable in the seed bank
3. the basic germination requirements, i.e. stratification procedures, light requirements, etc. of seeds.

STUDY LOCATION

The field study was installed and seed collections made on the 8400-acre Waynesville Watershed, located in Haywood County, southwest of Waynesville, NC, Lat 35 29' 19" N, Long 82 59' 20" W. The 50-acre man-made reservoir and surrounding watershed are classified by the state of North Carolina as WS-1, the state's most stringent classification, under which development is forbidden. The Watershed is one of the largest tracts of undeveloped, non-federal forest land remaining in western North Carolina. Detailed information on soils and forest cover can be found at:

<http://www.townofwaynesville.org/content/view/374/347/>

METHODS

Flower Stalk Survival and Seed Production

In May 2010, fifty individual ramp plants were flagged on 4 different sites in the watershed. We counted the number of flowers per stalk, the number of seeds developing per stalk, and finally, the number of mature seeds produced by each plant.

Seed Bank Study

Ramp seeds were collected from plants transplanted from western North Carolina (Waynesville Watershed, Franklin, NC and Robbinsville, NC) to raised beds in Blacksburg, VA (Lat 37 16' 29.63 N, Long 80 25 15.40 W, elevation 2024). Seeds were harvested in 2009 and cold-stored prior to field study establishment. Screen mesh bags measuring 7.6 cm x10.2 cm (3"x 4") and sewn with plastic thread were made to enclose the seeds. Each bag contained 100 seeds. Four bags were harvested at each sampling time throughout the year. Bags were buried 1.27 cm (0.5 inch) deep and covered with mineral soil (Fig 5). A wire mesh 'sandwich' enclosed each set of 4 bags (Fig. 6). Sites were flagged to facilitate recovery, with 4 bags anchored to each flag. The flag to harvest on each collection date was randomly determined at the start of the experiment. Seeds that were harvested but had not germinated in the field bags were used to determine the laboratory germination requirements of ramp seeds.



RESULTS AND DISCUSSION

Flower Stalk Survival and Seed Production

Two months after flagging, an average of 37.5% of the flower stalks had aborted or died. Flags were moved to plants with fully formed flower stalks to maintain data collection on 50 plants per site. We were able to collect seeds only once during the fall, and some may have shed before collection. Because of this, we say with qualifications that an average of 10 seeds were produced per plant (Table 1). Like all members of the Liliaceae, each ramp flower can produce three seeds. Of the total potential seed sites, 74% did not form or were aborted, resulting in an average seed yield of 26%. We also counted the number of dominant seeds that were being formed in each ramp flower in August and found that an average of 75% of these seeds survived to maturity when collected in October (Figs. 7-8).

Table 1. Ramp flower and seed production information for 4 sites within the Waynesville Watershed, NC.

Site code	Flower stalk length (mm)	Avg. # flowers per stalk	Total # seed sites (T) ¹	Total # dominant seeds (D) ²	Total # seeds collected (C)	% C/T	% C/D
ST	317.4	11.2	1594	355	337	21.1	94.9
CC	290.7	10.6	1584	574	343	21.7	59.8
SH	256.9	12.5	1762	691	453	39.2	65.6
HH	279.5	17.9	2680	1036	857	32.0	82.7

¹There are typically three seeds (a cluster) formed in each flower. Some of these seed sites, however, were necrotic or missing and were not included in the total.
²Dominant seeds were those in each seed cluster that were developing normally and that could reasonably be expected to form mature, viable seeds. These seeds were counted in August. Seeds were collected in October.

Seed Bank Study

Ramp seeds did not germinate in the field until the collection in August 2011. Then, only roots emerged. We did not observe shoot emergence in the field until May 2012 (Fig. 9). We found no viable, ungerminated seeds in that collection or in the collection after that. All remaining bags will be excavated in Spring 2013 and examined for viable seeds.



Laboratory seed germination proved difficult. Seeds were germinated in clear plastic boxes layered with sand in a growth chamber set at 30°C (Fig. 10).



Alternating light and dark regimes at uniform temperature in the growth chamber proved ineffective, as did a cold stratification treatment. It wasn't until we acquired an incubator and put seeds into it for 24h without light and at a cooler temperature (15°C) that roots emerged (Figs. 11-12). Determining if it was the absence of light or the cooler temperature that affected root emergence will be the subject of another study, when more seeds can be acquired from the study sites. Shoot emergence in the laboratory tests has yet to be achieved.

Fig. 12. Ramp seed laboratory germination flow diagram.

