Reprinted from: Trends in new crops and new uses. 2002. J. Janick
and A. Whipkey (eds.). ASHS Press, Alexandria, VA.

Cultivating Ramps: Wild Leeks of Appalachia

Jeanine M. Davis and Jacqulyn Greenfield

INTRODUCTION

Ramps, (*Allium tricoccum* or *Allium tricoccum* var. *burdickii*, Alliaceae) also known as wild leeks, are native to the Appalachian mountain region in eastern North America (Fig. 1). Ramps can be found growing in patches in rich, moist, deciduous forests as far north as Canada, west to Missouri and Minnesota, and south to North Carolina and Tennessee. As one of the first plants to emerge in the spring, ramps were traditionally consumed as the seasons first "greens." They were considered a tonic because they provided necessary vitamins and minerals following long winter months without access to fresh fruits and vegetables. Ramps are pleasant to eat and taste like spring onions with a strong garlic-like aroma. They are often prepared by frying in butter or animal fat with sliced potatoes or scrambled eggs. They are also used as an ingredient in other dishes such as soup, pancakes, and hamburgers. They can also be pickled or dried for use later in the year.

Traditions evolved around the annual gathering and preparation of ramps and in many communities in the Southern Appalachian region annual spring ramps festivals are held. These festivals are major tourist attractions and are actively promoted by the communities in which they are held (Fig. 2). The large volumes of ramps consumed at these festivals are gathered from wild populations in public and private forests (Fig. 3). In recent years, celebrity chefs have been promoting ramps as a gourmet food item and "white-table cloth" restaurants have begun serving ramps. This has created a rising demand for large supplies of ramps. As a result, native populations of ramps are dwindling. In response to the increased harvests, and in light of studies showing a ramp population needs many years to recover from a single harvest (Rock 1996), the Smoky Mountain National Park, in North Carolina and Tennessee, banned the harvesting of ramps in 2002. There is no indication that the demand for ramps will decrease. In fact, the medical community has also shown an interest in ramps especially since Whanger et al. (2000) showed that selenium enriched ramps reduced cancer in rats.



Fig. 2. Waynesville, North Carolina ramps festival.



Fig. 1. Ramp plant with bulb and flower bud.



Fig. 3. Ramps being sold in Richwood, West Virginia.

Ramps are a spring ephemeral of deciduous forests in eastern North America. They can be found in cool, shady areas with damp, rich soil high in organic matter. New leaves emerge from the perennial bulb in early spring, usually late March or early April, before the tree canopy develops. By late May, the ramp leaves begin to die back and a flower stalk emerges. Thus, the annual photosynthetic phase is limited to a few weeks between when the plants emerge and the tree canopy closes. The flower blooms in June and the seeds mature atop a leafless stalk. Eventually the seeds fall to the ground to germinate near the mother plant.

In an effort to conserve native populations and meet the rising demand for ramps, we are developing cultivation practices for ramps. Harvesting ramps from easily accessible, concentrated plantings would not only benefit festival participants, chefs, and consumers, but also create a new marketable product for the commercial grower. A series of studies were initiated in a collaboration with the Department of Horticultural Science at North Carolina State University and the North Carolina Department of Agriculture and Consumer Services, Plant Industry Division. Funding is provided by the Golden Leaf Foundation. This paper describes two of our current studies on ramps.

SEED GERMINATION STUDIES

Spring versus fall seeding is being studied at the Mountain Horticultural Crops Research Station in Fletcher, North Carolina. Ramp seeds collected in fall of 1998 in Madison County, North Carolina (Fig. 4) were sown in fall 1999 and spring 2000 at five sites: an open field, a mixed deciduous forest, under four polypropylene shade cloth structures providing 30%, 47%, 63%, and 80% shade, and under a wood lath structure providing an average of 63% shade (Fig. 5). The experimental design at each site is a randomized complete block with four replications. Each plot is 323 cm^2 and contains 50 seeds planted 2.54 cm × 2.54 cm apart. The plots are kept mulched with approximately 5 cm of leaf litter and irrigated when necessary. Data are being collected on germination, plant growth, and survival.

There was no germination of any of the seeds sown in fall 1999 until March 2001. This was not unexpected. C. Baskin (pers. commun.), reported that ramp seeds have a dormant, under-developed embryo. The seed requires a warm, moist period to break root dormancy and a subsequent cold period to break shoot dormancy. Some years there is enough warm weather after sowing in late summer or early fall to break root dormancy. The following winter cold breaks shoot dormancy and the plants emerge in spring. If there is not an adequate warm period after sowing, the seed will not germinate until the second spring.

There were dramatic differences in emergence and plant stand over time depending on when seeds were sown and where. Total emergence was significantly greater for the fall sown seeds (43%) compared to the spring sown seeds (35%). In the shade treatments, the highest emergence rates occurred in the forest and under the 30% shade structure (Table 1). The poorest germination occurred in the open field setting. There were no interactions between when seeds were sown and where.

Location also affected the length of time the seedlings lived. This could have an effect on the size of the plant the following year. Seedlings lived the longest in the forest setting and under the wood lath structure



Fig. 4. Ramp seeds still on seed heads.



Fig. 5. Shade structures for germination studies at the reseach station, Fletcher, North Carolina.

(Table 1). Seedling life was shortest in the treatments receiving the most light.

Germination rates obtained here were similar to those reported by Nault and Gagnon (1993) under natural forest conditions in Quebec, Canada (35%–60%). They obtained much higher germination rates (70%–96.4%) when seedlings were sown in large wooden boxes and provided with favorable growth conditions. In this study, the best germination and seedling life were obtained in a natural forest setting. The open field setting was probably too dry and exposed for germination. For the artificial shade structures, the best germination occurred under 30% shade, however, the plants did not have a long life. This indicates that some light is beneficial for germination but too much light may be detrimental for seedling survival.

CALCIUM AND PH STUDIES

In March 2001 a study was established in a mixed deciduous forest at the Mountain Horticultural Crops Research Station to examine the influence of soil pH and soil calcium levels on survival, growth, reproduction, and bulb yields of ramps. The experimental design was a randomized complete block factorial with four pH × four calcium treatments with four replications. The native soil pH is 4.9. The pH levels compared were 4.9, 5.5, 6.0, and 6.5; calcium treatments were 1121, 3363, and 5605 kg Ca/ha. Materials used to create pH and calcium treatments, and keep magnesium balanced between calcium treatments, were gypsum ($CaSO_4$), MgO, and olivine ($MgSiO_3$) (Fig. 6, 7). Individual plots were 1.4 m^2 and each contained 50 bulbs planted on a 15 cm × 15 cm spacing. Plots were kept mulched with 5 cm of leaf litter and irrigated when necessary. Data

Table 1. Ramp seed germination in response to location and seedling life over the 2001 growing season.

Location	Maximum germination (%)	Live seedlings (% of total plants emerged)			
		April 19	May 7	May 14	May 26
Open field	10	88	69	37	0
Shade house					
30% shade	52	88	43	19	1
47% shade	44	47	26	7	1
63% shade	42	93	66	55	11
80% shade	35	89	87	79	10
Lath house	32	92	92	82	21
Forest	57	96	95	77	20
LSD (5%)	7	14	15	17	7
LSD (1%)	10	19	20	23	9



Fig. 6. Preparing research plots for calcium and pH study in forest.



Fig. 7. Ramp bulbs used to plant forest research plots.

were collected on plant emergence, survival, growth, flowering, and decline.

On April 2, there were no differences in plant growth in response to lime or calcium applications. This was probably because all nutrients used by the plants until this time were provided from storage tissues, i.e., the bulbs. On April 18 there was a late freeze that damaged leaves on plants in all plots. This caused some plants to die back earlier than usual, but it was across the entire study. By April 24, there were significant differences within pH and within calcium treatments and these differences were even greater by May 16. For both dates, plant stands decreased as soil pH increased (Table 2). In contrast, plant stands increased as soil calcium levels increased. There were no interactions between soil pH and calcium.

Table 2. Percent stand of ramp bulbs in response to soil pH and calcium, 2001.

	Stand (%)		
Treatments	April 2	April 24	May 16
Soil pH			
4.9	99	77	36
5.5	98	74	31
6.0	99	70	25
6.5	98	66	27
LSD (5%)	NS	8	8
Calcium (kg/ha)			
0	98	63	23
1121	99	70	26
3363	99	75	34
5605	98	78	35
LSD (5%)	NS	8	8
LSD (1%)	NS	11	10

Soil from healthy, native ramps populations in western North Carolina have high calcium levels, often in the 1760–4515 kg/ha range (J. Corbin, unpubl.). Ramps also seem to favor soils with high calcium:magnesium ratios. Our results are consistent with those findings. Native ramp populations are often found in areas with an average soil pH of 5.5. Results of first year growth in this study is contradictory to those findings. In this study, the best plant stands were obtained at pH 4.9.

CONCLUSIONS

Results from the studies described here and other studies we are conducting, along with experiences of the few people growing ramps, indicate that ramps can be cultivated successfully for commercial purposes in a forest setting. Site selection is critical to ensure healthy populations necessary for commercial production. These studies indicate that amending the soil may improve production. Preliminary results suggest that raising calcium levels is beneficial for establishment. Fall planting of seeds resulted in higher germination rates than spring planted seeds and a forest setting provided better seed germination and seedling life than an artificial shade structure or an open field.

REFERENCES

Davis, J.M. and J. Greenfield. 2001. Cultivation of ramps (*Allium tricoccum* and *A. burdickii*). Dept. Hort. Sci., North Carolina State Univ., Hort. Information Leaflet 133.

Davis, J.M. Herbs, Vegetables, Specialty Crops, and Organics. http://ncherb.org.

Nault, A. and D. Gagnon. 1993. Ramet demography of *Allium tricoccum*, a spring ephemeral, perennial forest herb. J. Ecol. 81:101–119.

Rock, J. 1996. The impact of harvesting ramps (*Allium tricoccum* Ait.) in Great Smoky Mountains National Park. National Park Service, Gatlinburg, TN. (unpubl. manuscript).

Whanger, P.D., C. Ip, C.E. Polan, P.C. Uden, and G. Welbaum. 2000. Tumorigensis, metabolism, speciation, bioavailability, and tissue deposition of selenium in selenium-enriched ramps (*Allium tricoccum*). J. Agr. Food Chem. 48:5723–5730.