

Ramsons can deliver taste and antibacterial effect in food preservation: From nature to cultivation



By Martin Jensen¹, Flemming Hansen², Kai Grevsen¹
Department of Food Science, Aarhus University¹, Danish Technological Institute, DMRI²

Ramsons (*Allium ursinum*) contain sulphur compounds that display strong antibacterial activity against *Listeria*, *Salmonella* and *E. coli*. Onion bulbs and flowers have a higher concentration of allicin than leaves and stems and display higher inhibitory activity. Grinded onion bulbs have shown strong antibacterial effects in meat test models and may potentially be used as an alternative to preserve organic meat products. Cultivation methods are investigated.



In the Danish Organic RDD project BerryMeat, a large number of herbs and berries were screened for their ability to inhibit bacterial growth of *Listeria monocytogenes*, *Salmonella typhimurium* and *E. coli*.

Ramsons showed strong inhibitory activity against all three bacteria. Test of different parts of the plant showed stronger bacteriostatic activity against *Listeria* and stronger bactericidal activity against *Salmonella* by onion bulbs and flowers compared to leaves and stems. This matched a high

her concentration of allicin, the main sulphur compound produced in ramsons, in onion bulbs and flowers.

Alliin is easily degraded by the alliinase enzyme to allicin and a number of sulphur containing derivatives that also exert antibacterial activity. Four different formulations of onion bulbs were tested for their content of allicin and their antibacterial effect after preparation: freeze-dried/grinded, oven-dried/grinded, fresh/grinded and fresh/grinded/pasteurized at 92 °C. When corrected for similar dry-matter content all four for-

mulations showed high antibacterial activity in a "broth inhibition test" both shortly after preparation and after 1 and 1,5 years of storage at -20°C.

The content of allicin expressed as alliin eqv. following an enzymatic full conversion were highest in the freeze dried product, followed by oven-dried product, whereas the fresh/grinded had lower content and the fresh pasteurized product had the least allicin content. When corrected for lower dry-matter in the wet products the concentration was 7 mg/g DM in the fresh/

grinded product, but down to 3 mg/g DM in the fresh pasteurized product. Allicin therefore may be lost partly during pasteurization. Addition of 8 % ramson bulb product into a "broth inhibition test" gave higher inhibitory activity than 4 % and thus, showed a dose-response effect.

Hermetic sealed freeze-dried powder, stored at -20, +5, 20 and 40 °C for 4 weeks did not reduce the content of allicin, regardless of temperature indicating that a freeze dried powder stored hermetically seems to be a robust product. A

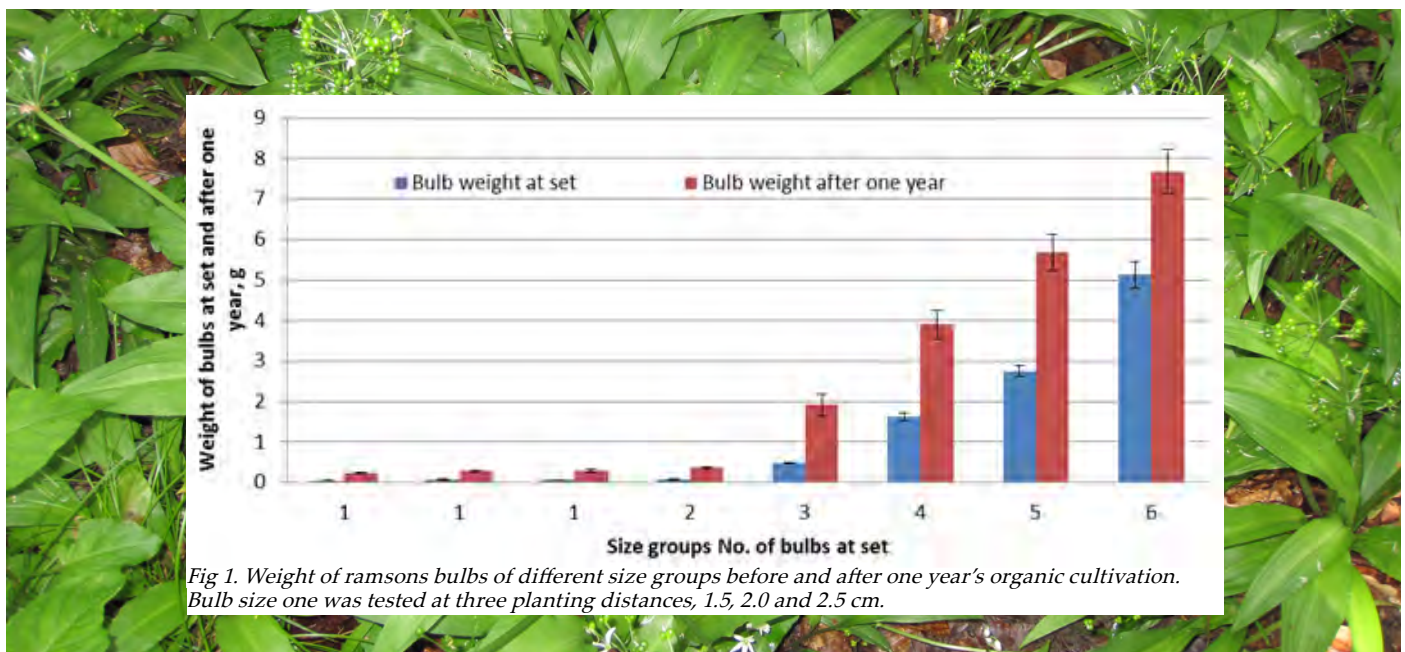
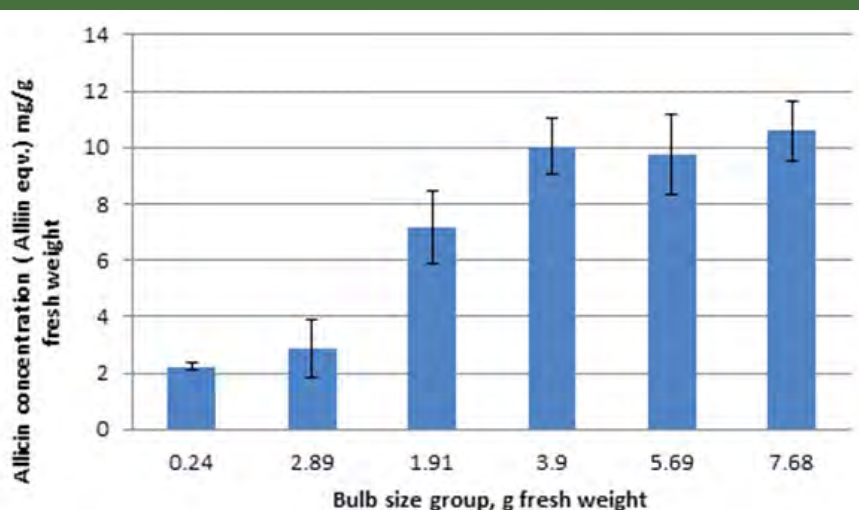


Fig 1. Weight of ramsons bulbs of different size groups before and after one year's organic cultivation. Bulb size one was tested at three planting distances, 1.5, 2.0 and 2.5 cm.

Fig 2. Concentration of alliin (alliin eqv) depending on bulb size.



test of alliin concentration in ramson bulbs depending on bulb size showed that young small bulbs with average fresh weight of 0.24 g/bulb only had low amount of alliin (2 mg/g), and that the concentration increased with increasing bulb weight up to 3.9 g bulb size (10 mg/g) and then leveled out in larger bulbs up to 8 g size (10 mg/g) (Fig.2). The taste and odor of the bulbs of ramsons is by most people considered much stronger than from leaves and have an overlapping sensory profile with garlic, although some different taste aspects is found.

Supply: collection versus agricultural production

In Denmark and Western Europe, traditionally only the leaves are used for seasoning food, while the bulbs and flowers are also used in Eastern Europe. Until now almost all supply of ramsons, rely on harvesting from natural wild forest populations. Ramsons in nature are growing in fertile beech forests and harvest of leaves is fairly easily done here and allows regeneration from the bulb next year. Harvest of bulbs of ramsons in natural forest would likely both threaten the wild populations over time

and also involve large constraints to retrieve bulbs from the forest soil filled with tree roots. If ramson bulbs and leaves in the future should meet the increasing supply demand of worldwide consumers, a mechanized harvest would be necessary and would require efficient cultivation methods on agricultural land.

Cultivation methods

As a first step in the development of a cultivation method, we investigated the growth of 6 different bulb sizes from approx. 0.1 g to 5 g in order to develop a growth model and to predict how many years a production may take to obtain an acceptable size of the ramson bulb. Resting bulbs of ramson, collected in nature were graded in different sizes and planted in individual depths and distances depending on size in a clay soil in the autumn. They were allowed to grow in one season with 100 kg organic N/ha and with supplemental irrigation and shade applied. Resting bulbs were retrieved in September

and weighed individually and the weight and relative increase of weight were calculated for each size. Small bulbs less than 1 g size increased their fresh weight 3.5 - 4 times after one year, whereas larger bulbs only increased their weight 2.5 - 3.5 times (Fig.1). Large bulbs between 2-5 g showed the largest increase in weight equal to on average of 3 g increase/ bulb - equal to 8,250 kg/ha/year with a bulb square distance of 6 cm (machine tracks not subtracted). In bulbs over 3 g size double bulbs will develop by division with higher percentage the larger the initial bulb size. Setting bulbs of 5 g resulted in 25 % double bulbs. Similarly only large bulbs will flower, and again the larger the bulb, the higher percentage of flowering. 4-5 years cultivation is likely necessary to produce a good sized ramson bulb of 7-9 g from seed. In our experience artificial humid and cold storage at 1°C of resting bulbs, result in sprouting in January - February and longer storage i.e. until spring time, is therefore a challenge.

Ramson seeds studies

Studies with ramson seeds were also undertaken in order to establish a method for breakage of seed dormancy with subsequent field sowing trials. The dormancy is thought to be released by a combined warm and cold stratification. Seeds collected in nature were dried and cleaned in a greenhouse and stored at -5°C. Imbibed seeds were subjected to 1

or 2 months of moist warm stratification at 20°C followed by cold stratification at 4°C until germination. Only very few seeds germinated and it may well be, that the Danish seeds need longer warm stratification than seeds of more southern European origins.

An interesting crop

In conclusion, ramsons is a very interesting crop with unique taste and strong antibacterial activity as a result of the high content of sulphur containing compounds.

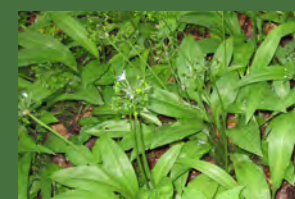
An increasing demand for leaves and bulbs will require the development of an efficient horticultural cultivation method and our first results suggest that such a method can indeed be developed.



A display of bulbs, flowers, stem and leaves. Photo: AU Food Science

More information

Read more about the Organic RDD project Berrymeat at: http://www.icrofs.dk/Sider/Forskning/organic-crdd_berrymeat.html



Organic RDD is financed by the Ministry of Food, Agriculture and Fisheries and coordinated by ICROFS.