

CSL PEST RISK ANALYSIS FOR *PHYTOMYZA GYMNOSTOMA*

STAGE 1: PRA INITIATION

1. What is the name of the pest?

Phytomyza gymnostoma Loew Diptera Agromyzidae Allium leaf miner

Notes on taxonomy: This organism was originally described in 1858 from Poland and placed in the Genus *Phytomyza*. Spencer (1976) reclassified it within *Napomyza* although Zlobin (1994) placed it back into *Phytomyza*. Agricultural entomologists were largely unaware of the work by Zlobin and continued to publish papers on the pest throughout the 1990's using the synonym *Napomyza gymnostoma*. Collins and Lole (2005) provide a summary of the history of its taxonomy and explain the arguments used to reinstate the species within *Phytomyza*.

2. What is the reason for the PRA?

There have been several findings of this organism in allotments in the West Midlands. An up-to-date PRA is required to inform Plant Health Policy.

Following the organism being descibed as a pest that was spreading in Europe as a pest of *Allium* crops (Spasic & Mihajlovic, 1997) a PRA was first conducted on this pest in August 1997 (CSL, unpublished). As the organism spread further across Europe the PRA was updated in March 2003 (CSL, unpublished). The PRA was again updated when the pest was found in the West Midlands in December 2003 (see 4.). This PRA updates findings in the West Midlands since then to include results of a PHSI survey of allotments in the West Midlands between December 2006 and March 2007.

3. What is the PRA area?

Phytomyza gymnostoma is widespread across Continental Europe (see 11.) Consequently this PRA considers the UK as the PRA area.

STAGE 2: PEST RISK ASSESSMENT

4. Does the pest occur in the PRA area or does it arrive regularly as a natural migrant?

Yes, *Phytomyza gymnostoma* does occur in the PRA area (Collins & Lole, 2005). *P. gymnostoma* was discovered on leeks growing in a private garden in Wolverhampton in December 2003 although there is anecdotal evidence that the pest may have been present since 2002. This led to a survey of allotments and farms growing *Allium* spp. in the area. Ten allotments were found to have infested leeks (Collins & Lole, 2005). It is important to note that

no outbreaks have been found on commercial *Allium* spp. (Agallou *et al*., 2004).

5. Is there any other reason to suspect that the pest is already established in the PRA area?

Yes. *P. gymnostoma* has been found in the West Midlands each year since it was first discovered in 2003. (See also 11.)

6. What is the pest's status in the Plant Health Directive (Council Directive 2000/29/EC[1]) ?

Phytomyza gymnostoma is not referred to in the EC Plant Health Directive.

7. What is the pest's list status in the European and Mediterranean Plant Protection Organisation (EPPO)? (www.eppo.org)

On EPPO List:	A1 regulated pest list	No	A2 regulated pest list	No	Action list	No	Alert list	See text

Phytomyza gymnostoma was added to the EPPO Alert List by the EPPO Secretariat in April 2005 following reports in the scientific literature that the organism was spreading within the EPPO region and becoming a significant pest of *Allium* crops (EPPO Reporting Service, 2005). At the 38th meeting of the EPPO Panel on Phytosanitary Measures, the Panel members decided that the alert had been given and that no further action was needed, so *P. gymnostoma* was deleted from the Alert List (EPPO Secretariat, 2006)

8. What are the pests' host plants?

Allium spp., especially leeks (*A. porrum*), chives (*A. schoenoprasum*) and garlic (*A. sativum*). Onions (*A. cepa*) are secondary hosts. Although ornamental or wild *Allium* spp. are not reported in the literature as hosts, it can be assumed that *P. gymnostoma* could survive on these species.

9. What hosts are of economic and/or environmental importance in the PRA area?

All reported hosts are of economic importance in the PRA area. Annex 1 shows production statistics for leek and onion crops in the UK from 1995/96. Over the past 10 years, the UK area of onions and leeks has averaged approximately 13,000 ha with an annual value of just under £100 million. Although prices are variable, green (spring) onions have been worth approximately £1,200 /tonne; leeks £800 /tonne and dry bulb onions worth

[1] http://europa.eu.int/eur-lex/en/consleg/pdf/2000/en_2000L0029_do_001.pdf

£80 to 120 /tonne (derived from Defra, Basic Horticultural Statistics, 2006. See Annex 1.).

10. If the pest needs a vector, is it present in the PRA area?
No vector is required. This is a free-living organism.

11. What is the pest's present geographical distribution?
Phytomyza gymnostoma is a European species having first been described from Poland. It is now fairly widespread in Europe (Table 1).

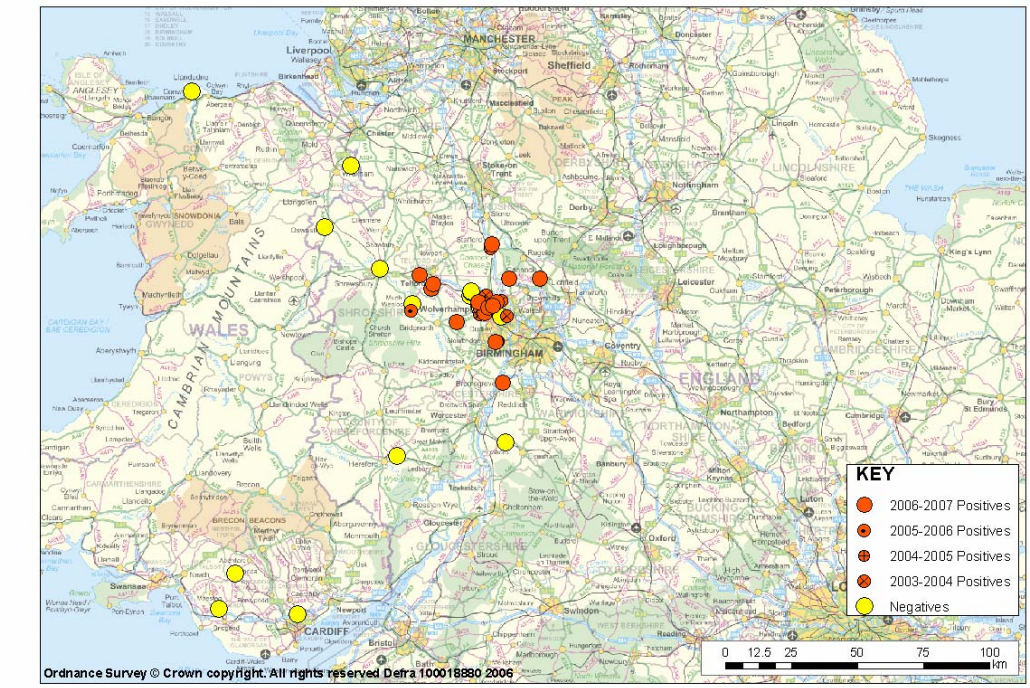
Table 1: Distribution of *Phytomyza gymnostoma*

North America:	No records – presumed to be absent.
Central America:	No records – presumed to be absent.
South America:	No records – presumed to be absent.
Europe:	Croatia, Czech Republic, Denmark, France, Germany, Hungary, Italy, Poland, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, UK, Ukraine.
Africa:	No records – presumed to be absent.
Asia:	Turkey, Turkmenistan
Oceania:	No records – presumed to be absent.

Sources: CAB International 2005.

The map below illustrates the locations of *P. gymnostoma* surveys in England & Wales since 2003 and shows where *P. gymnostoma* was found.

Map 1: *Phytomyza gymnostoma* survey results 2003-2007



Annex 2 shows the distribution on commercial leek growers in England in 2003.

12. How likely is the pest to enter the PRA area[2]?

very Unlikely		Unlikely		Moderate likelihood		Likely		very Likely	✓

Phytomyza gymnostoma has already been confirmed in several different locations in the West Midlands (Map 1). It is very likely that *P. gymnostoma* will enter other regions of the UK by spreading from sites in the West Midlands.

The original pathway into the UK has not been identified. The eggs, larvae and pupae of this pest inhabit the stem and bulbs of hosts, so could have been carried on infested bulbs imported into the UK. However, there is no record of *P. gymnostoma* being intercepted by PHSI during import inspections since records began (Dom Collins, pers. comm.).

13. How likely is the pest to establish outdoors in the PRA area?

very Unlikely		Unlikely		Moderate likelihood		Likely		very Likely	✓

Phytomyza gymnostoma has been present in the West Midlands at least since 2003, and perhaps for some time before that. This strongly suggests that *P. gymnostoma* is able to survive in the UK climate, or at least in the climate of the West Midlands. It may well also find conditions in other parts of the country suitable.

Elsewhere in Europe, *P. gymnostoma* has two generations per year. Adults emerge in the spring from pupae that overwintered within host plants. Females lay eggs at the bases of host plant stems. The larvae of the first (spring) generation develop in garlic and onion stems and bulbs. First generation pupae diapause during the summer before adults emerge and lay eggs in leeks or other *Allium* species in the autumn for the second generation. Pupae of the second generation overwinter in host plants, before adults emerge the next spring to lay eggs on hosts such as onions and garlic. In Austria, in 1997, the peaks of fly emergence occurred in late April and mid September (Kahrer, 1999).

At a constant temperature of 20°C, egg to adult development takes 73 days at photoperiods of between 6 and 10 hours with a lower threshold temperature for development between 3.2 and 5.1°C (Kahrer, 1999). Using these data, it is estimated that egg to adult development requires around 1,090 degree days (DD) above 5.1°C or 1,225 DD above 3.2°C to complete development. The UK climate does provide sufficient thermal energy to ensure the complete development of two generations per 12 month period.

[2] Pest entry includes an assessment of the likelihood of transfer to a suitable host (ISPM No. 11, FAO, Rome)

In the UK, onions are usually sown from seed or planted from sets in the spring and harvested in the autumn. Unless some of these bulbs are reused this crop will not provide a year round host for *P. gymnostoma*[3]. However, onions are occasionally planted in August for harvest the next summer (June/July) (P. Reed, pers. comm.). This crop would be vulnerable to *P. gymnostoma* attack. Leeks remain in the ground through winter and would also be vulnerable. Thus, by alternating between leeks, onions or other *Allium* spp., hosts are available all year round to sustain *P. gymnostoma.*

14. How likely is the pest to establish in protected environments in the PRA area?

very Unlikely		Unlikely	✓	Moderate likelihood		Likely		very Likely	

Phytomyza gymnostoma is recorded on *Allium* field crops. However, if any *Allium* is grown in protection there is a chance that *P. gymnostoma* could establish on such crops.

15. How quickly could the pest spread within the PRA area?

very Slowly		Slowly		Moderate pace	✓	Quickly		very Quickly	

P. gymnostoma has been in the UK since at least 2003 during which time it appears to have spread within the West Midlands. *P. gymnostoma* has only been found in private gardens and allotments. It has not yet been found at a commercial *Allium* site.

Phtyomyza gymnostoma was first described from Poland in 1858 (Loew, 1858). Other early records are from Spain (1905), the Netherlands (De Meijere, 1924), Germany (1933) and Austria (1935) (Soos, 1984). Following the first report of it causing economic damage to a crop of leeks in Hungary in 1988 (Darvas *et al*., 1988) *P. gymnostoma* appeared to spread within Europe. However, the apparent spread may actually be due to an increased awareness of the pest since it now causes significant damage to *Allium* crops. In 2001, *P. gymnostoma* was reported close to the Dutch border (Goffau, 2001) and Dutch Plant Health Authorities survey for the pest in *Allium* crops. No data about the presence of this pest in Dutch *Allium* is yet available (Lamers, pers. comm., 07/08/2006).

16. What is the pest's potential to cause economic and/or environmental damage in the PRA area?

very Small		Small		Medium	✓	Large		very Large	

[3] Not all *Allium* in allotments will necessarily be harvested, so could provide year round hosts.

Until the late twentieth century *P. gymnostoma* was not regarded as an organism of economic importance, and was not included in the monograph *Agromyzidae of Economic Importance* (Spencer, 1973).

However, since it was first recorded causing significant damage in a crop of leeks in Hungary in 1988, (Darvas *et al*., 1988) it has also been reported causing damage in the Slovak Republic (Vlockva, 1995); Serbia (Spasic & Mihajlovic, 1997), Slovenia, where it is the most important pest on leeks and onions (Seljak, 1998), Austria (Kahrer, 1999), Poland (Szwejda, 1999), Germany (Billen, 1999; Schrameyer, 2001), Turkey (Civelek *et al.*, 2000); northern Italy, where severe damage has been seen at organic farms (Zandigiacomo & Dalla-Monta, 2002; Talotti *et al*., 2004), France (Bouchery & Martinez, 2004), and the UK (Collins & Lole, 2005).

P. gymnostoma is capable of severely infesting almost 100% of a crop. In Serbia around 20 pupae were found per leek stem. All plants were completely destroyed. Even at lower pest densities, the presence of mines on young plants may reduce the quality and marketability of produce (Spasic & Mihajlovic, 1997).

UK garden grown leeks have been so badly infested that they were completely inedible (CSL unpublished data).

17. What is the pest's potential as a vector of plant pathogens?

P. gymnostoma is not recorded as a vector although the feeding damage it causes does allow infection from secondary pests such as bacterial pathogens and pathogenic fungi.

STAGE 3: PEST RISK MANAGEMENT

18. How likely is the pest to continue to be excluded from the PRA area?

	very Likely	Likely	Moderate likelihood	Unlikely	very Unlikely
Outdoors:	☐	☐	☐	☐	✓

P. gymnostoma could be considered as established in the UK. Strong measures that would be difficult to implement would be required to eradicate it from non-commercial urban sites.

As noted in 12. above, the route by which *P. gymnostoma* entered the UK has not been identified. Thus, even if the pest was eradicated from the West Midlands, it could re-enter and establish again unless the pathway can be identified and measures taken to inhibit re-introduction.

	very Likely	Likely	Moderate likelihood	Unlikely	very Unlikely
In protection	☐	✓	☐	☐	☐

Allium vegetables are generally grown out-of-doors and *P. gymnostoma* is not recorded from protected cultivation.

19. How likely are outbreaks to be eradicated?

very Likely		Likely		Moderate likelihood		Unlikely	✓	very Unlikely	

Finds have occurred in allotments and private gardens. This makes eradication very difficult to implement. For example, few insecticides with sufficient efficacy are available to allotment holders.

20. What management options are available for containment and control?

The best methods of controlling *P. gymnostoma* in a private garden or on an allotment would be to use a combination of measures including,

- removal and burning of infested plants. Infested plants should not be composted since eggs, larvae and pupae could continue to develop with adults emerging to disperse and infest available hosts,
- covering *Allium* with fleece in late February. This will inhibit newly emerged female flies from finding a host on which to oviposit,
- delaying planting of *Allium* spp. until after April when the principal peak in adult emergence has passed. Late maturng varieties of onions are available which will help make this possible,
- rotation with non-*Allium* spp.,

There are only a few chemical options for pest management in private gardens and on allotments, i.e. “Home and Garden” products. They are non-systemic sprays with active ingredients based on rotenone and pyrethrins.

In Austria, organic farmers are advised to grow leeks as far away as possible from chives. They are advised also to cover their leek crops with nets as soon as the flies of the autumn generation emerge, and to bury any plant remains containing fly pupae as deep as possible in the soil (Kahrer, 1999). In Poland, delayed planting in the spring reduces damage by *P. gymnostoma* in the autumn (Sionek, 1999).

At a commercial site, professional growers have a broader chemical armoury. Treatments with a systemic insecticide when adults are active and females egg-laying, around March/April and October/November, could be used. In Austria, sprays are advised as long as larvae are found feeding in the upper parts of the leaves (Kahrer, 1999).

21. Further work that would reduce uncertainties

Area of PRA	Uncertainties	Further work that would reduce uncertainty
Taxonomy	Literature is confused using both *Napomyza* and *Phytomyza*	Check literature for future work that continues to use *Napomyza gymnostoma*.
Pathway	Route into UK unknown. Natural spread from West Midlands is possible.	Check with European contacts to uncover (or hypothesize about) the pathway.
Distribution	Pest is spreading. Current distribution within other EU / EPPO states is uncertain.	Contact other EU / EPPO states to ask for information about presence of the pest.
Hosts	Are there wild *Allium* hosts? Are ornamental *Allium* spp. hosts?	Maintain watching brief on emerging literature Conduct host preference trials.
Establishment	West Midlands appears suitable.	Compare climate of West Midlands to the climate of the north west, another major leek growing region.
Spread	Rate of spread	A baseline survey of *Allium* crops followed by a repeat survey to determine spread
Impact	How much damage would be necessary to significantly reduce the value of a leek plant?	Calculate the damage threshold, e.g. number of mines per plant.
Management	Are existing control measures on *Allium* pests effective against *P. gymnostoma*?	Check what measures are currently used. Are they likely to be effective?

22. Summary / Conclusions

In several countries of mainland Europe *Phytomyza gymnostoma* has become the major pest of *Allium* spp.. It can infest a high proportion (80-100%) of a susceptible crop (Darvas *et al*., 1988). Plants can be completely destroyed or reduced in market value. UK garden-grown leeks have been so badly infested that they were completely inedible (CSL unpublished data).

There is a high likelihood that *P. gymnostoma* will continue to spread in the UK and will eventually reach commerical premises. Economic damage would be expected on *Allium* crops, particularly leek and onion crops from autumn sowings. Measures to prevent the spread of *P. gymnostoma* from the West Midlands, e.g. to the Vale of Evesham, a major leek growing region of England, relatively close by, are likely to be difficult to implement.

REFERENCES

Agallou E, Cannon R, Cheek S, Coolins D, Matthews L. 2004. Allium leaf miner – *Phytomyza gymnostoma*. Plant Pest Notice No. 35, Central Science Laboratory, York. http://www.defra.gov.uk/planth/pestnote/allium-notice.pdf

Billen W. 1999. A new pest of *Allium* spp.: *Napomyza gymnostoma* Loew (Diptera: Agromyzidae). *Mitteilungen der Entomologischen Gesellschaft Basel*. **49**: (1), 37.

Bouchery Y, Martinez M. 2004. A new enemy of *Allium* in France: the leek mining fly *Phytomyza gymnostoma*. *Phytoma*. **574**, 5-7.

CAB International 2005. *Phytomyza gymnostoma*. [Distribution map]. Distribution Maps of Plant Pests. CAB International, Wallingford, UK: 2005. December, Map 674.

Civelek HS, Deeming JC, Onder F. 2000. Some new records for Turkish leafminers (Diptera: Agromyzidae) fauna from Izmir province. *Turkiye Entomoloji Dergisi*. **24**: 1, 17-26.

Collins DW, Lole M. 2005. *Phytomyza gymnostoma* Loew (Diptera: Agromyzidae), a leaf mining pest of leek and onion new to Britain. *Entomologist's Monthly Magazine*. **141**: 1694/96, 131-138.

Darvas B, Szarukan I, Papp L. 1988. *Napomyza gymnostoma* (Loew) (Dipt. Agromyzidae), an agromyzid pest on leek in Hungary. *Novenyvedelem*, **24**, (10), 450-454.

DEFRA 2005 Basic Horticultural Statistics for the United Kingdom, http://statistics.defra.gov.uk/esg/publications/bhs/2005/default.asp

EPPO Reporting Service 2005. *Phytomyza (Napomyza) gymnostoma* is a new pest of *Allium* in Europe: addition to the EPPO Alert List. *EPPO Reporting Service* 2005/064, EPPO Paris.

EPPO Secretariat 2006. Report of the 38th meeting of the EPPO Panel on Phytosanitary Measures, Paris, March 6th – 8th 2006. http://www.eppo.org/MEETINGS/2006_meetings/phytomeasures.htm

Goffau, LJW de 2001. Noxious *Napomyza gymnostoma* close to the Dutch border. In: *Diagnostic Activities Plant Protection Service, Wageningen, Annual Report* 2001.

Kahrer A. 1999. Biology and control of the leek mining fly, *Napomyza gymnostoma*. *Bulletin OILB/SROP*. **22**: 5, 205-211.

Loew H. 1858. Zwanzig neue Dipteren. *Wien ent. Mschr*., **2**:57-62,65-79.

Schrameyer K. 2001. Mining pests of *Allium* vegetable species. *Gemuse (Munchen)*. **37**: 3, 17-20. [In German]

Seljak G. 1998. Mass appearance of *Napomyza gymnostoma* (Loew) in Slovenia. *Research Reports Biotechnical Faculty University of Ljubljana Agricultural Issue. 1998*. No. 71, 29-37. [in German]

Sionek R. 1999. Effect of leek planting dates on damage to plants by spring generation of the leek leaf miner (*Napomyza gymnostoma* Loew). *Progress in Plant Protection*. **39**: 2, 500-502.

Soos A. 1984. (Ed.) *Catalogue of Palaearctic Diptera, Micropezidae - Agromyzidae*. Volume 9, Elsevier, Oxford, 460pp.

Spasic R, Mihajlovic LJ. 1997. *Napomyza gymnostoma* Loew - a pest on bulbed vegetables in Serbia and its parasitoids. ANPP Fourth International Conference on Pests in Agriculture, Montpellier, 6-8 January, 1997.

Spencer KA. 1973. Agromyzidae (Diptera) of economic importance. *Series entomologica* 9. Dr. W. Junk B.V., The Hague.

Spencer KA. 1976. The Agromyzidae (Diptera) of Fennoscandia and Denmark. *Fauna entomologica scandinavica*, 5a, b 606pp.

Szwejda J. 1999. Status of entomology research in protection of vegetable crops in Poland. [in Polish] *Progress in Plant Protection*. **39**: 1, 43-51.

Talotti C, Sivilotti P, Coceano PG, Donna ED, Pizza E, Barbina MT, 2004. Trials for control of the leek miner fly. *Informatore Agrario*, **60**(13):83-86.

Vlockva H. 1995. *Napomyza gymnostoma* a pest of onions in the Slovak Republic. *Ochrana Rostlin*, **31**, (1), 63-68.

Zandigiacomo P, Dalla-Monta L. 2002. Occurrence in Northern Italy of the leek mining fly *Napomyza gymnostoma* (Loew) (Diptera, Agromyzidae). *Bullettino di Zoologia Agraria e di Bachicoltura* **34** (2) 2002. 265-268.

Zlobin VV. 1994. Review of mining flies of the genus *Napomyza* Westwood (Diptera: Agromyzidae) V. Phytomyza species currently placed in the Genus *Napomyza* Westwood. *Dipterological Research*, **5**, 289-311.

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ANNEX 1: *Allium* data from DEFRA Basic Horticultural Statistics 2006

http://statistics.defra.gov.uk/esg/publications/bhs/2006/default.asp

1) Area planted (ha)

CROP YEAR	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06		
Onions, Dry Bulb	8,202	9,325	8,845	9,529	9,228	9,058	8,603	8,387	8,480	8,592	8,561		
Onions, Green	2,146	2,455	2,313	2,298	2,549	1,739	1,363	1,318	1,987	1,808	2,069		
Leeks	3,042	2,617	2,477	2,776	2,645	1,978	2,068	1,717	2,010	2,005	1,696	Mean	
	13,390	14,396	13,634	14,603	14,422	12,775	12,034	11,422	12,477	12,404	12,326	13,080	ha

2) Tonnes harvested (000 tonnes)

CALENDAR YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005		
Onions, Dry Bulb	224.7	284.5	335.9	342.0	391.4	392.7	374.9	283.4	373.6	340.9	383.4		
Onions, Green	24.1	28.4	26.2	25.3	26.1	19.0	13.3	11.3	16.4	10.5	21.1		
Leeks	61.5	53.9	45.9	52.3	50.9	44.3	44.3	38.0	35.9	40.2	49.8	Mean	
	310.3	366.8	408.0	419.5	468.4	456.0	432.5	332.7	425.8	391.7	454.3	406	000 tonnes
yield (tonnes /ha)	27	31	38	36	42	43	44	34	44	40	45		
	11	12	11	11	10	11	10	9	8	6	10		
	20	21	19	19	19	22	21	22	18	20	29		

3) Value of Home prodn marketed (£'000)

CALENDAR YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005		
Onions, Dry Bulb	57,605	38,799	48,595	66,173	42,671	34,405	44,691	32,012	43,002	44,090	33,591		
Onions, Green	31,755	32,803	33,094	30,471	29,502	21,387	18,094	14,560	20,784	13,148	26,152		
Leeks	31,844	35,141	22,945	24,306	26,476	25,182	30,507	28,252	30,170	30,686	39,670		
	121,202.6	106,743.7	104,634.9	120,950.6	98,649.0	80,974.1	93,292.1	74,823.6	93,956.1	87,924.2	99,411.8	98,415	£'000
Value per tonne													
Onions, Dry Bulb	256	136	145	194	109	88	119	113	115	129	88	136	£/tonne
Onions, Green	1,318	1,153	1,261	1,204	1,130	1,126	1,360	1,293	1,270	1,252	1,242	1,237	£/tonne
Leeks	517	653	500	465	520	569	689	744	841	763	797	642	£/tonne

Annex 2: Location of leek producers in England 2003