The biology and non-chemical control of Volunteer Potato (*Solanum tuberosum*)

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Potato
***Solanum tuberosum* L.**

Occurrence
Volunteer potatoes may arise from true seeds, tubers and tuber pieces (Askew, 1993). After potato crop harvest there may be as many tubers left in the soil as were planted originally (Anon, 1999). Figures of 370,000 and 460,000 tubers per ha remaining in soil after potato harvest have been quoted (Askew, 1991). Potatoes are also found growing as casuals on tips and waste ground (Stace, 1997). In Scotland, volunteer potatoes were recorded in set-aside in the first year but gave way to other species in later years (Fisher, *et al.*, 1992). Volunteer potatoes are a particular problem in poorly competitive crops such as leeks and onions grown up to 3 years after potatoes (Orson, 1994). Potatoes are also the main volunteer problem in crops grown for processing including peas, beans and carrots. The volunteers reduce yield, hinder harvesting and contaminate the finished product. Both potato berries and stem pieces can contaminate peas and green beans harvested for processing.

Volunteer potatoes act as a 'green bridge' for pests and diseases that cannot persist in the absence of the host (Yarham & Gladders, 1993). Viruses can survive in ground keeper tubers as can potato blight (*Phytophthora infestans).* The presence of volunteer potatoes can lessen the decline of the potato root eelworm (*Heterodera rostochiensis* and *H. pallida*) in soil (Lumkes, 1974). Volunteers can transmit tuber borne bacterial and fungal diseases and are a particular problem where seed potatoes are being grown (Bray, 1976). The foliage and green tubers of potato are poisonous to livestock (Forsyth, 1968).

Biology
Some potato cultivars produce a large numbers of berries and hence many seeds. Each berry may contain 200-300 seeds. Other cultivars produce flowers that abscise before pollination and do not form berries (Askew, 1993).

Volunteer potato seedlings begin to emerge in early May and continue to appear until September (Lawson, 1981; 1983; 1984).

Potato foliage is killed by temperatures of around –3^{o}C which can occur in October or earlier but may be as late as mid-November (Lutman, 1979).

Persistence and Spread
Potato seeds are produced in large quantities by some cultivars including Vanessa, Cara, Desiree, Maris Piper, Maris Peer, Pentland Ivory and many others that form berries after flowering. Once shed, the seeds can remain viable in field soil for at least 7 years (Askew, 1993; Askew 1991). True potato seed also retained a high level of viability after dry storage at 1-3^{o}C for 20-28 years (Towill, 1983).

Potato seedlings that emerge up until June may produce small tubers that remain in the soil as groundkeepers (Lawson, 1981; 1983; 1984).

Management

In areas where winter temperatures are sufficiently low, volunteer potatoes can be controlled provided tubers are kept in the topsoil (Lumkes & Beukema, 1973). After potato harvest, over ten times more tubers can survive following ploughing compared with shallower cultivations (Askew, 1993). Tillage with tines is more likely to leave tubers near the soil surface where they can be killed by exposure to frost (Mills & Cleal, 1996). However, this may not be effective in a mild winter and even a moderately hard winter is unlikely to eradicate the entire ground keeper population. Only tubers on or near the soil surface are likely to be killed, those 5-20 cm deep may well be unaffected (Lutman, 1974). The tubers need prolonged exposure to temperatures of $-2^{o}C$ to be reliably killed (Askew, 1993). The inclusion of an attachment to the potato harvester to crush small tubers that fall through the main web has been used in Holland (Bray, 1976).

Where potatoes have been grown as a cleaning crop prior to planting soft fruit, volunteer potatoes growing from missed tubers are difficult to eliminate in the crop row (Lawson, 1984). Management is best carried out earlier in the rotation. Hand-digging is one way to remove volunteer potatoes in the growing crop.

A strong competitive wheat crop can help to suppress the growth of volunteers in the year following potatoes (Anon, 1999, Askew, 1993). Winter wheat reduces volunteer potato populations more than spring barley (Lawson & Wiseman, 1978). Drilling a cereal crop helps to reduce tuber survival and delays emergence compared with a bare soil (Lutman, 1974). Autumn sown cereals that have developed a dense leaf canopy by the end of April retard the emergence and growth of the potatoes (Aarts & Sijtsma, 1978). Soil temperature beneath the crop canopy is up to $6^{o}C$ lower and this delays potato emergence. In both winter cereals and perennial ryegrass the emerged potatoes are small and often die-back prematurely due to poor growth or disease. Only 1 or 2 small daughter tubers are formed. Suppression is less in spring cereals but is greater in spring barley than spring wheat. In maize and sugar beet, crop growth has no effect on the volunteer potatoes and the tuber yield is the same as potatoes growing alone. Volunteer potato populations left unchecked can increase 2- to 4-fold even in a relatively competitive crop (Askew, 1991).

In cereal crops, volunteer potatoes emerge from late-April to late-July depending on the prevailing soil conditions and the vigour of the crop (Lutman, 1979). Many continue to grow after cereal harvest. Potato plants defoliated in June grew better after cereal harvest than undamaged plants but few of the potatoes defoliated in July recovered and regrew. Potato plants grew better where the cereal crop was irrigated but regrowth after crop harvest was greater where earlier growth had been restricted by dry weather or crop density.

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References

Aarts H F M & Sijtsma R (1978). Influence of crops on volunteer potatoes. *Proceedings of the 1978 British Crop Protection Conference – Weeds*, Brighton, UK, 373-377.

Anon (1999). Rot sets in for volunteer potatoes. *Arable Farming* **26** (8), 61.

Askew M F (1991). The bio-dynamics of volunteer potato populations. *Proceedings of the Brighton Crop Protection Conference – Weeds*, Brighton, UK, 1991.

Askew M F (1993). Volunteer potatoes from tubers and true potato seed. *Aspects of Applied Biology* **35**, *Volunteer crops as weeds*, Cambridge, UK, 9-15.

Bray W E (1976). Planned weed control in the arable crops of eastern England. *Proceedings of the 13th British Crop Protection Conference – Weeds*, Brighton, UK, 865-872.

Fisher N M, Dyson, P W, Winham J, Davies D H K (1992). A botanical survey of set-aside land in Scotland. *BCPC Monograph No.* **50** *Set-aside*, 67-72.

Forsyth A A (1968). British poisonous plants. *MAFF Bulletin No.* **161**, HMSO, London.

Lawson H M (1981). Potato seedlings as weeds: A new slant on the groundkeeper problem. *Proceedings Crop Protection in Northern Britain Conference*, 137-142.

Lawson H M (1983). True potato seeds as arable weeds. *Potato Research* **26**, 237-246.

Lawson H M (1984). Volunteer crops as weeds of soft fruit crops. *Aspects of Applied Biology* **8**, *weed control in fruit crops*, 53-58.

Lawson H M & Wiseman J S (1978). Effects of crop and weed management on field populations of volunteer potato. *Proceedings of the 1978 British Crop Protection Conference – Weeds*, Brighton, UK, 385-392.

Lumkes L M (1974). Research on the control of volunteer potatoes in the Netherlands. *Proceedings of the 12th British Weed Control Conference*, Brighton, UK, 1031-1040.

Lumkes L M & Beukema H P (1973). The effect of cultivation procedure on the liability to freezing of ground-keepers. *Potato Research* **16**. 57-60.

Lutman P J W (1974). Factors affecting the overwintering of volunteer potato tubers and the emergence of sprouts in the spring. *Proceedings of the 12th British Weed Control Conference*, Brighton, UK, 285-292.

Lutman P J W (1979). The control of volunteer potatoes in cereal stubbles. I. Factors affecting potato regrowth. *Annals of Applied Biology* **93,** 41-47.

Mills A R & Cleal R A E (1996). Volunteer potato control in a cereal and sugar beet rotation. *Aspects of Applied Biology* **47**, *Rotations and cropping systems*, 243-250.

Orson J H (1994). Arable crops as weeds. *The Agronomist* **1**, 11-13.

Stace C (1997). *New Flora of the British Isles*. 2nd edition. Cambridge University Press, Cambridge, UK.

Towill L E (1983). Longevity of true seed from tuber-bearing and closely related non-tuber bearing *Solanum* species. *American Potato Journal* **60**, 75-83.

Yarham D J & Gladders P (1993). Effect of volunteer plants on crop diseases. *Aspects of Applied Biology* **35**, *Volunteer crops as weeds*, Cambridge, UK, 75-82.