The biology and non-chemical control of Annual Meadow-grass (*Poa annua* L.)

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Annual Meadow-grass

(annual bluegrass, cause-way grass, Suffolk grass)
***Poa annua* L.**

Occurrence

A native grass, generally annual, that is common throughout the UK. It is a troublesome and ubiquitous weed on arable land, grassland in gardens and on trackways; (Clapham, *et al*., 1987). The plant is also very sensitive to air pollution (Wells, 1974a). Annual meadow grass is recorded to 3900 ft in Britain (Salisbury, 1961). It does not thrive on acid soils and those low in phosphate. In early studies in Bedfordshire Hertfordshire and Norfolk it occurred on all types of soil but chiefly on loam and sandy loam, rarely on chalk (Brenchley, 1911;1913) and was common under fruit tree plantations. The plant is relatively small but is often in sufficient quantities to smother out seedling crops.

In grassland it is regarded as a weed because of its persistence, low growth habit and low productivity. In a survey of grassland weeds, annual meadow grass was found in small quantities in a high proportion of fields, particularly on disturbed ground around gateways and drinking troughs (Peel & Hopkins, 1980). It was present in young swards where establishment had been poor, in swards where Italian ryegrass was dying out after 3-4 years and in older swards damaged by poaching. Another survey showed that annual meadow grass was one of the main weeds occurring in young swards accounting for up to 20% of the composition (Wells, 1974a). In established pastures ingress follows intensive grazing.

Annual meadow grass is a very adaptable species and many ecotypes have been recognised (Wells, 1974a). As a general rule it is self pollinating but it has been suggested that up to 15% outcrossing could occur. Many named varieties and sub-species are recognised and there have been several attempts to describe the taxonomy of the species. There are indications that genotypic as well as phenotypic differences exist. Morphologically distinct races differ in speed of germination, growth habit and life span. Both annual and perennial forms have been reported. Perennial forms have procumbent rooting stems (Stace, 1997).

Biology

Flowering begins in early spring and continues throughout the season. Flowering is independent of daylength and occurs at any time through the year. Plants are self compatible and seed set is high (Ellis, 1974). Up to 15% outcrossing occurs in natural populations. Seed is produced abundantly from April to September and beyond. However, temperatures above 25 ^{0}C are said to hinder anther development and prevent seed production. Seed numbers per plant averaged 2,050 and the 1000 seed weight was 0.200 g (Stevens, 1957). Annual plants die after flowering and the area is colonised by new seedlings. Several generations may be produced in a year. Annual meadow grass can be found in fruit throughout the year (Salisbury, 1962). Annual

forms have erect growth while perennial ecotypes form a mass of tillers, some of which grow horizontally rooting at the nodes (Wells, 1974a). Perennial forms continue tillering prior to overwintering.

Annual meadow grass normally germinates in late summer or early autumn from seed produced a month or so earlier. Germination occurs over a wide range of constant and alternating temperatures in the light. A proportion of freshly collected seeds exhibit dormancy. A tendency towards dormancy is associated with seed of annual forms. In laboratory tests, stored seed germinated at over 90% in constant or alternating temperatures with and without light (Wagenvoort & Van Opstal, 1979). However, large differences have been found in the germinability and mean germination time of seed from different populations of annual meadow grass (Naylor & Abdalla, 1982). A germination value for one population may not be representative of other populations.

Seed sown in pans of field soil showed no periodicity of emergence. Most seeds germinated immediately but odd seedlings continued to emerge over the next 2 years (Brenchley & Warington, 1930). With seeds mixed in 7.5 cm layers of soil in cylinders in the field and stirred 3 times per year, the main period of emergence was March to October. Emergence was greatest in year 2 (17%) with 8% (yr 1) and 11% (yr 3). Field emergence from plots cultivated at monthly, 3 monthly or yearly intervals or not at all, extended from February to November with a small peak in March & a larger one in Aug-Oct (Chancellor, 1964). Seed sown in a 7.5 cm layer of soil in cylinders sunk in the field and stirred periodically, emerged intermittently from February to November (Roberts, 1964). In a sandy loam soil, field seedlings emerged from the top 20 mm of soil with the majority emerging from the top 10 mm and up to 88% in the top 5 mm (Unpublished information).

Annual meadow grass seed sown at intervals germinated at most times of year, although number and rate of emergence was affected by weather conditions (Wells, 1974b). Seeds took around 20 days to achieve 50% emergence when moisture was adequate but dry conditions delayed emergence in the summer months. Plants that developed earlier in the year generally grew large and produced more tillers than those emerging later. Plants that emerged from August to December overwintered and began to tiller in spring. These plants flowered May-June. Spring emerging seedlings flowered July –September. Plants that became established in summer began flowering at an earlier growth stage and had smaller panicles. Two ecotypes were identified, one had an average longevity of 13 months the other lived 19 months.

Persistence and Spread

Poa annua seed can form a major proportion of the seeds in the soil weed seedbank (Wells, 1974a). The seed can remain viable in soil for at least 4 years. Seed losses are greater in cultivated soil. Seedbank decline was studied in a succession of autumn-sown crops (winter wheat & winter OSR) in fields ploughed annually and seed return prevented (Lawson *et al*., 1993). Time to 99% decline was calculated at 4.3 years with a mean decline per year of 55%.

Annual meadow grass seeds were ingested by earthworms and around 25% have been recovered intact and viable in worm casts (McKrill & Sagar, 1974). While not an effective method of dispersal, seeds brought to the soil surface in worm casts may

find conditions more favourable for germination. Seed was shown to be ingested by earthworms and 28% of seed was recovered in wormcasts. In the field over 100 seeds were found in 100g of wormcast soil. Annual meadow grass will also colonise molehills before being replace by perennial grasses.

Viable seeds have been found in cattle dung (Mt Pleasant & Schlather, 1994) but viability is lost after a period of storage (Wells, 1974a). Seed has been found in cattle and horse droppings (Salisbury, 1961). In samples of cultivated grass seed tested for purity in 1967 by the Official Seed Testing Station, Cambridge, annual meadow grass seed was a frequent contaminant in seeds of Danish and Irish origin (Tonkin, 1968). It was also found in clover seed samples.

Management

Control is by surface tillage to encourage germination followed by harrowing to kill the emerged seedlings (Long, 1938). In root crops hoeing keeps the weed in check.

In experiments over 9 years using different primary cultivations in a vegetable crop rotation it was noticed that the different regimes had a pronounced effect on seed numbers of annual meadow grass (Roberts, 1965). At the end of the experiment, seed numbers were 7, 11 and 23 million per acre respectively for deep ploughed (14-16 ins), shallow ploughed (6-7 ins) and rotary cultivations (6-7 ins). Competition from the BL weeds prevented seed development by the grass (Leguizamon & Roberts, 1982). In an experiment to determine seedbank changes under a mixed stand of weeds, seed numbers of annual meadow grass in soil decreased from 4,200 to 1150 /m^2 despite some seed shedding by plants that emerged following cultivation in April.

In experiments to determine economic threshold populations for annual meadow grass in wheat it was observed that development of the weed was suppressed by a vigorous wheat canopy and competition from broadleaved weeds (Woolley & Sherrott, 1993). The calculated economic threshold for chemical control was 714 plants per m^2 but this was likely to be different for non-chemical control and also be modified by climatic conditions.

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