The biology and non-chemical control of Cock's-foot (*Dactylis glomerata* L.)

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Cock's-foot

(cocksfoot, orchardgrass)
***Dactylis glomerata* L.**

Occurrence

Cock's-foot is a coarse, densely tufted, non-creeping, perennial grass, native in grassland, open woodland, hedgerows, rough, waste and cultivated ground (Stace, 1997). It is common throughout Britain. Cock's-foot is associated with meadow habitats (Gibson, 1996). It prefers soils of moderate to high fertility and pH 6.0 to 7.0 but will grow at pH 5.5 to 8.0 (Beddows, 1959). It is widespread but sparse on chalk grassland.

In a 3-year set-aside, cock's-foot frequency declined gradually with increasing distance from the field edge (Rew *et al.*, 1992). In a survey of weeds in conventional cereals in central southern England in 1982, cock's-foot was found in less than 1% of winter wheat, and not at all in winter and spring barley (Chancellor & Froud-Williams, 1984). Cock's-foot seed was found in 5% of arable soils in a seedbank survey in Scotland in 1972-1978 (Warwick, 1984). In a survey of seeds in pasture soils in the Netherlands in 1966, while cock's-foot was common in the sward it was not represented in the soil seedbank (Van Altena & Minderhoud, 1972).

A number of ecotypes have been described, some with an erect and others with a spreading growth habit (Beddows, 1959). The taller forms predominate in ungrazed and unmanaged habitats. It is a variable species with over 160 named variants and was formerly included in seed mixtures for hay and pasture. It formed part of the 'fattening pastures' of the Midlands and Kent but was not widely used before the early 19th century. Robust plants are probably of introduced stock. Ornamental variegated and golden yellow forms occur.

With appropriate management it can be a valuable and nutritious grass when in cultivation. It is early and productive and is relatively drought resistant on light soils but can become coarse and tufted with poor management (Elliot, 1943). It grows in midsummer when other grasses burn up. Cock's-foot is a C_3 plant in terms of carbon fixation during photosynthesis (Baskin & Baskin, 1978). It is positively mycotrophic and growth is stimulated by the presence of a mycorrhizal infection (West, 1996).

Biology

Cock's-foot flowers from May to August (Clapham *et al.*, 1987). The main period is in June but sporadic flowering can occur in autumn and winter (Beddows, 1959). Cock's-foot is wind-pollinated. Cross-fertilization is usual but self-pollination is possible in some plants. Weather conditions can determine how long it takes for seeds to ripen. Vivipary or proliferation of the flower heads has been reported. When grown as a seed crop, cock's-foot can produce 10 cwt or more of clean seed per acre but the average is nearer 4 cwt per acre.

Freshly harvested seed may require an after-ripening period of up to 3 months (Beddows, 1959). Seeds germinate better at alternating than at constant temperatures (Harrington, 1923). In Petri dish tests with seed maintained under high or low light intensity or in darkness, seed gave around 80% germination in the light but only 39% in the dark (Grime & Jarvis, 1976). Seed sown in a 75 mm layer of soil in cylinders sunk in the field and stirred periodically, emerged mainly from February to June (Roberts, 1986). Over 30% of seeds emerged in year 1, 16% in year 2 and 3% in year 3 of the study.

A simple seed population dynamics diagram for cock's-foot has been constructed based on data from a study where seed was scattered on plots that had been deep cultivated, surface cultivated or left as a closed sward cut to 7.5 cm (Mortimer, 1976). Seed was found to have only 25% viability and being relatively large did not become readily moved down the soil profile. Invertebrate activity and greater openness at the soil surface increased the chance of seed burial. Less than 4% of the seed produced seedlings and fewer than 4% of these reached maturity. Excluding invertebrates increased the number of seedlings that survived.

Frost causes the leaf tips to die back as does a drying or salt-laden wind (Beddows, 1959). Each shoot is annual rather than biennial and plants survive by producing new tillers from buds at the base of shoots. The leafy shoots survive the winter and new tillers appear between the old shoots as the weather turns mild. Leaf growth is most active in April-May and again in July.

Persistence and Spread

Thompson *et al.* (1993) suggest that based on seed characters, cock's-foot seed is likely to persist for less than 5 years. Only low numbers of viable cock's-foot seeds have been recovered from field soils (Beddows, 1959). Seeds occur mainly in the upper 5 cm of soil. Seed buried in soil persisted for less than 3 years. Seed buried in mineral soil at 13, 26 or 39 cm depth and left undisturbed retained 1, 2 and 11% viability respectively after 4 years but none was viable after 20 years (Lewis, 1973). Seed buried in a peat soil at 26 cm for 1 and 4 years retained 3% viability after 1 year but was not viable after 4 years. Seed remained viable for at least 7 years in dry storage but when buried in soil most had germinated or disappeared in the first year (Rampton & Ching, 1970). Dry-stored seed gave 98% germination after 1 year and 63% after 5 years storage (Kjaer, 1940). The viability of dry-stored seed in the laboratory did not change for 4 years it then declined appreciably but still had 10% viability after 10 years. Seed stored under granary conditions exhibited 77 to 82% viability after 1 year and 2% after 4 years but was the seed was not viable after 20 years.

There is no special mechanism for seed dispersal. Apparently-viable seed has been found in samples of cow manure (Pleasant & Schlather, 1997). However, other studies suggest that the seed is unlikely to survive passage through the digestive tract of grazing animals (Beddows, 1959). Seed ingested by earthworms has been found intact in wormcasts (McRill & Sagar, 1973). Seed has been recovered from irrigation water in the USA (Kelley & Bruns, 1975).

Vegetative spread is limited as cock's-foot does not form rhizomes or stolons (Beddows, 1959). It may form aerial tillers or 'mops' that can root in contact with the soil as can proliferated inflorescences. However, grazing usually prevents this happening. The length of time that cock's-foot survives in a sown sward depends in part on the persistence of the commercial cultivar used (Blackman, 1933).

Management

In roadside verges, increased cutting frequency increased the incidence of cock's-foot (Parr & Way, 1988). However, in pasture it was favoured by undergrazing (Kydd, 1964). Spring and summer grazing when cock's-foot is in active growth encourages the plant to spread but grazing in the autumn, winter and early spring tends to eliminate it (Beddows, 1959). Rabbits graze it. Cock's-foot populations in grassland increased when rabbits were decimated by myxomatosis in the 1950's (Thomas, 1963).

Cock's-foot is eradicated by trampling and is usually absent from gateways and footpaths. It responds positively to manure applications. Ploughing readily controls cock's-foot.

The stubble of a cock's-foot seed crop was often burned after harvest to get rid of the herbage and any pests. A 'swift' burn can stimulate vegetative growth of cock's-foot (Beddows, 1959).

In greenhouse tests, corn gluten meal (CGM) applied as a surface and incorporated treatment to soil has been shown to reduce plant development (Bingaman & Christians, 1995). At rates of 324 and 973 g/m^2, seedling survival was reduced by 56 and 92% respectively. Corn gluten hydrolysate (CGH), a water soluble material derived from CGM, was found to be more active than CGM when applied to the surface of pots of soil sown with cock's foot seed (Liu & Christians, 1997). Wheat gluten meal (WGM) at 1 or 3 $g.dm^{-2}$ dusted over seeds put to germinate on moist paper reduced germination by 95 and 98% respectively (Gough & Carlstrom, 1999).

A number of insects attack the leaves, flowers and seeds of cock's-foot (Beddows, 1959). Ergot, smut and other fungal, bacterial and viral diseases infect the grass.

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