The biology and non-chemical control of Black bent (*Agrostis gigantea* Roth.)

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Black bent
(fiorin, marsh bent grass, red top, running twitch, white bent)
Agrostis gigantea Roth.
(*A. nigra, A. alba, A. stolonifera* ssp. *gigantea*)

Occurrence

Black bent is a native, rhizomatous perennial grass found in grassy places, it is a serious weed of arable land especially on light sandy or gravely soil (Clapham *et al*., 1987; Stace 1997). It is distributed throughout the British Isles but is commonest in the south and east particularly on chalk soils. It prefers moist but well drained soils of low to high pH and light to medium texture. Black bent grows equally well in marshy or dry places and varies much in appearance (Morse & Palmer, 1925). It is thought to prefer lighter soils to common couch (*Elytrigia repens*) and to be less tolerant of tillage (Håkansson, 2003). It occurs in abundance on light semi-acid sands (Mann & Barnes, 1949).

In a survey of weeds in conventional cereals in central southern England in 1982, black bent was found in 10, 9 and 6% of winter wheat, winter barley and spring barley respectively (Chancellor & Froud-Williams, 1984). In a study of seedbanks in some arable soils in the English midlands sampled in 1972-3, black bent was recorded in 41% of the fields sampled in Oxfordshire and 22% of those in Warwickshire but in moderate not large numbers (Roberts & Chancellor, 1986).

Black bent is a carrier of take-all disease of cereals, *Ophiobulus graminis*, the disease being present in the rhizome internodes (Hughes, 1966). There have been suggestions that black bent reduces barley growth allelopathically (Horne, 1953).

In the vegetative state black bent is often confused with common couch. In the literature too there is often confusion over the identification of the weedy rhizomatous grasses. The same common name has been used for several perennial grass species and the Latin names of the different species have changed periodically too.

Biology:

Black bent flowers from June to August and seeds develop rapidly. One third of seeds are viable just 7 days after flowering. In the north of England, the seedheads of black bent senesced and shed most of their seeds several weeks earlier than common couch (Attwood, 1981). A single panicle contains about 1,000 viable seeds.

Mature seeds are non-dormant and germinate readily on moist soils (Williams, 1973). Fresh seed requires light and alternating temperatures for germination but older seed will germinate at constant temperature in the dark. Seed is said to germinate mainly in the autumn (Grime *et al.,* 1988). In field tests, 75% of seed sown on the soil surface in February had germinated within 2 months but only 44% of seed lightly covered (6 mm) with soil had germinated (Williams, 1968; 1973). In a separate test,

36% of seeds sown 25 mm deep in soil emerged but few seedlings emerged from seed buried deeper than 25 mm. The seeds germinated when cultivation brought them to the soil surface. Seed sown in a 75 mm layer of soil in cylinders sunk in the field and stirred periodically emerged mainly from March to October (Roberts, 1986). Over the first three years 12, 10 and 5% of seedlings emerged in years 1 to 3 respectively. Seed sown at different depths in boxes of soil outdoors emerged in the winter when left uncultivated and in spring when cultivated in February (Froud-Williams *et al.*, 1984). In a second experiment surface sown seeds emerged in spring. The optimum depth of emergence was 0-5 mm, the maximum was 10 mm.

Black bent seedlings grew rapidly and initiated rhizomes on reaching the 6-leaf stage when some had 10 tillers (Williams, 1968: 1970). The aerial shoots can root at the nodes (Boyall *et al*, 1981). Seedlings of black bent were much more susceptible to competition from wheat than plants derived from single node, rhizome pieces. However, the faster emergence and rapid initial growth of the wheat seedlings reduced the biomass of even the rhizome derived black grass plants by 77% (Williams, 1973). When the weed and wheat seedlings were grown separately, the later growth of the weed was much faster than that of the cereal mainly due to its greater leaf area (Williams, 1970).

The rhizomes of black bent are found down to 15 cm deep in soil but the fibrous roots penetrate further. The rhizomes only branch occasionally and have distinct scale leaves. Black bent rarely forms stolons. Growth is slow under dry conditions (Cussans, 1970). Shading reduces rhizome development more than top growth (Skuterud, 1984). Plant height is increased at a light intensity of 50 or 25% of full daylight but shoot number is reduced. Shading later in the season, when the initiation of new rhizomes takes place, reduces rhizome production more than early shading. Black bent overwinters as dormant underground buds on the rhizomes and as aerial shoots (Zimdahl, 1993).

Persistence and Spread

Rhizome multiplication is considered to be the main form of reproduction of black bent but seed production is important too. The rhizomes occur mainly in the top 5 cm of soil (Boyall *et al*., 1981). The seeds are not innately dormant and most germinate during the first autumn (Williams, 1978). Seeds germinate most readily on the soil surface and persist longer when incorporated. Seeds appear able to remain viable for up to 5 years buried in soil. However, only 34% of seeds remain viable for longer than 1 year in cultivated soil (Chancellor, 1982).

Seeds ingested by sheep had an enhanced germination capacity following excretion compared with fresh seeds (Özer, 1979). However, after 3 months in a dung heap the germination potential was just 3.3%.

Management

The prevention of seeding and removal of the creeping stems and rhizomes are important in the control of black bent (Morse & Palmer, 1925. Forking out may be practised on a small scale. In the field, roots and stems gathered up during cultivations and harrowing should be burnt. Machinery has been developed with two banks of rigid soil-loosening tines fitted with 30 cm wide wing- or duck-foot shares that tear up the stubble ahead of a pto-driven horizontal rotating shaft fitted with long

curved tines (Anon, 2005). These flick the rhizomes out onto the soil surface where they can be left to desiccate or can be collected up for burning.

Crops of maize, vetches or mustard tend to choke out the weed. In meadows or pasture the flower heads should be cut before seeding. Black bent seems to prefer acid soils and liming may check its development (Thurston, 1976). Liming is said to reduce all species of *Agrostis.*

Black bent will increase under intensive cereals and minimal cultivation (Grime *et al.*, 1988). Spring barley is more competitive than spring wheat or field beans against black bent (Cussans, 1972; 1970). In pot tests with barley, increasing the crop density reduced the biomass of the grass and limited any crop losses (Mann & Barnes, 1949). Perennial grass control in barley stubble should include one or two passes with a rotovator, the second when the weed regrowth has 1-2 leaves (Cussans & Wilson, 1970). The land is then ploughed, cultivated and drilled with spring barley. There is considerable foliar regrowth at the time of ploughing but no appreciable rhizome growth. Shoot counts in spring have shown a reduction of 80 to 90% in black bent, the higher figure following two passes with the rotovator. The treatment does not result in complete eradication and would need to be repeated in subsequent years to maintain control. The treatment works best when conditions at the time of rotovation are good for stimulating bud growth on the rhizome fragments (Elliott *et al.*, 1966).

In perennial ryegrass swards, as the interval between cutting increased to more than 4 weeks black bent rhizomes increased in dry weight (Courtney, 1980). Black bent rhizomes also grew better at lower nitrogen levels because of reduced competition from the ryegrass at lower fertility levels. Cutting at intervals of 2 to 4 weeks is more likely to reduce black bent populations than allowing 8 weeks between cuts. Rhizome growth also depends on the composition of the sward (Courtney, 1972). Tetraploid Italian ryegrass (*Lolium multiflorum*) and rough meadow-grass (*Poa trivialis*) are less competitive than perennial ryegrass (*L. perenne*) or cocksfoot (*Dactylis glomerata*).

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