Perennial weeds: Phenology, Biomass development and Control

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Achieving an effective control of perennial weed species in the Netherlands is becoming increasingly problematic, especially with the decreasing number of chemical control options. The development of alternative, non-chemical control options is therefore increasingly important. The development of these control options do however require a different insight in and knowledge on the biology of these species. Insight in the species life cycle under common Dutch conditions is currently unavailable and required. Dutch farmers were asked to rank the ten most problematic weed species. The resulting list was: *Sonchus arvensis Cirsium arvense, Rorippa sylvestris, Mentha arvensis, Convolvulus sepium, Rumex obtusifolius, Equisetum arvense, Elymus repens, Stachys palustris* and *Persicaria amphibia*.
For each of these species root pieces were collected during the fall of 2008 and planted in two fields in furrows of 5-10 cm deep in the last week of March 2009. The weeds were planted in four blocks, in rows measuring 38 m, of which 8 m was reserved for destructive measurements.
Root pieces were placed 33 cm apart. The extended BBCH (**B**iologische Bundesanstalt für Land-und Forstwirtschaft, **B**undessortenamt, **CH**emical Industry) scale (Hess *et al*., 1997) was used to observe weed development on a weekly basis. For each of the plant species sixteen destructive measurements were taken (four plants per block) every month during the growing season. An area of 0.25 x 0.25 m surrounding the main stem was used as sampling area from which roots and aboveground plant parts were harvested. The destructive measurements consisted of dry weight measurements (4 hours at 70 ºC, followed by a period of 24 hours at 104 ºC) of stems, roots, leaves and flowers and/or seeds. Dry weights were calculated per m^2. Total root length and number of sprouts per root were determined from April to July.
Heat sum calculation started after the burial date, temperature was measured at 5 cm bare soil. The base temperature for each species was based on literature data or, in case no information was available, set at 0 °C. Stem emergence was calculated as a fraction of the total number of stems that emerged per species, per block. A non-linear logistic dose-response regression model was used to fit stem emergence, and the moment the onset of a phenological stage was reached (e.g. eight leaf stage, flowering, vegetative reproduction, senescence) vs. heat sums. Dry matter growth of above-ground, below-ground, stem, leaf and inflorescence dry weight were log-transformed to overcome unequal variances and were plotted versus the heat sum. From the measured above-ground dry weight and below-ground dry weight the instantaneous relative growth rate of above-ground dry weight and the instantaneous relative growth rate of below-ground dry weight were calculated. Following, quadratic polynomials were used to fit the two relative growth rates versus the heat sum. Significant differences in the timing of shoot emergence and other phonological stages were observed between species, varying from 50% shoot emergence of *E. repens* after 228 ^{o}Cd, to 50% shoot emergence of *P. amphibia* after 350 ^{o}Cd. The dry weight growth of both above- and belowground plant parts versus the heat sum were best described by quadratic polynomials. Plants of early emerging species, such as *E. repens* and *Sonchus arvensis* required less day degrees to reach their maximum dry weight than plants of later emerging species such as *Persicaria amphibia* and *Convolvulus sepium*. The resulting data, combined with weather data, offer us valuable information on the timing of the development of these species.

HESS M, BARRALIS G, BLEIHOLDER H, BUHR, L. EGGERS, TH., HACK, H., STAUSS, R. (1997). Use of the extended BBCH scale-general for the descriptions of the growth stages of mono-and dicotyledonous weed species. *Weed Research* **37**, 433.