**Supplementary material**

Table S1: Basal herbicide experiment summary of Kruskal-Wallis rank sum tests comparing proportion of active nodes per old man’s beard stem across four treatment groups, at three separate assessments (2020.1yr = 1 year after treatment in autumn 2020; 2020.2yr = 2 years after treatment in autumn 2020; 2022.1yr = 1 year after treatment in autumn 2021).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **year.assessment** | χ² | df | p-val |
|  | 2020.1yr | 62.44 | 3 | <0.001 |
|  | 2020.2yr | 51.44 | 3 | <0.001 |
|  | 2021.1yr | 62.07 | 3 | <0.001 |

Table S2: Basal herbicide experiment generalised linear model summaries (negative binomial (NB) and Poisson) for old man’s beard stem vigour between treatment pairs (Control = untreated stems; Cut = stems severed at 1 metre above ground; Paste = stems severed at 1 metre above ground and treated with 45% glyphosate gel; Ring = stems chemically ringbarked with triclopyr in oil (basal bark method))) at three separate assessments: 1 year after 2020 treatment (2020.1yr), 2 years after 2020 treatment (2020.2yr), and 1 year after 2021 treatment (2021.1yr). Treatment p-values in bold are significant at α=0.001.

|  |  |  |
| --- | --- | --- |
| Cut vs Paste | Control vs Ring | Paste vs Ring |
| 2020.1yr NB model  | 2020.1yr Poisson model  | 2020.1yr NB model  |
|  | EST | SE | Pr (>|z|) |   | EST | SE | Pr (>|z|) |   | EST | SE | Pr (>|z|) |
| Intercept | 1.27 | 0.14 | <0.001 | Intercept | -0.241 | 0.17 | 0.166 | Intercept | 0.42 | 0.21 | 0.048 |
| Paste | -0.85 | 0.22 | **<0.001** | Ring | -19.06 | 1721.06 | 0.991 | Ring | -20.73 | 2837.54 | 0.994 |
| 2020.2yr NB model  | 2020.2yr Poisson model  | 2020.2yr Poisson model  |
|  | EST | SE | Pr (>|z|) |   | EST | SE | Pr (>|z|) | Random effects | VAR | SD |   |
| Intercept | 0.96 | 0.15 | <0.001 | Intercept | 0.25 | 0.14 | 0.065 | Block (intercept) | 0.02 | 0.13 |  |
| Paste | -0.91 | 0.24 | **<0.001** | Ring | -3.65 | 1.01 | **<0.001** | Fixed effects | EST | SE | Pr (>|z|) |
|  |  |  |  |  |  |  |  | Intercept | 0.05 | 0.18 | 0.795 |
|   |   |   |   |   |   |   |   | Ring | -3.45 | 1.01 | **<0.001** |
| 2021.1yr Poisson model  | 2021.1yr Poisson model  | 2021.1yr Poisson model  |
| Random effects | VAR | SD |   | Random effects | VAR | SD |   | Random effects | VAR | SD |   |
| Block(intercept) | 0.23 | 0.48 |  | Block(intercept) | 0.43 | 0.65 |  | Block(intercept) | 0.20 | 0.44 |  |
| Fixed effects | EST | SE | Pr (>|z|) | Fixed effects | EST | SE | Pr (>|z|) | Fixed effects | EST | SE | Pr (>|z|) |
| Intercept | 1.12 | 0.24 | <0.001 | Intercept | 0.02 | 0.38 | 0.957 | Intercept | 0.68 | 0.23 | 0.004 |
| Paste | -0.54 | 0.15 | **<0.001** | Ring | -2.82 | 0.68 | **<0.001** | Ring | -3.40 | 0.60 | **<0.001** |

Table S3: Foliar herbicide experiment two-way Scheirer-Ray-Hare table for dry weight of old man’s beard remaining in plots 8 months post-treatment, between two sites and four treatments. Also, a summary of Kruskal-Wallis rank sum test comparing three treatments (no control treatment). P-values in bold are significant at α=0.05.

|  |  |
| --- | --- |
|  | Scheirer-Ray-Hare test |
|  | Df | Sum Sq | H |  | p-value |
| treatment | 3 | 210 | 11.25 |  | **0.01045** |
| site | 1 | 20.25 | 1.0848 |  | 0.29762 |
| treat:site | 3 | 24.75 | 1.3259 |  | 0.72299 |
| residuals | 8 | 25 |  |  |  |
|  | Kruskal-Wallis rank sum test |
|  | χ² | df | p-val |  |
|  | 2.386 | 2 | 0.303 |  |

Table S4: Foliar herbicide experiment two-way ANOVA table for ground cover density change within an 8-month period, between two sites and four treatments.

|  |
| --- |
|  |
|  | Df | Sum sq | Mean sq | F value | Pr(>F) |
| treatment | 3 | 0.101 | 0.034 | 1.986 | 0.195 |
| site | 1 | 0.003 | 0.003 | 0.147 | 0.711 |
| treatment:site | 3 | 0.131 | 0.044 | 2.564 | 0.128 |
| residuals | 8 | 0.136 | 0.017 |  |  |

Table S5: Foliar herbicide experiment two-way ANOVA table, with Tukey multiple comparisons of means, for average grass height at 8 months post-treatment, between two sites (Kaitoki, Awapuni) and four treatments (Control = untreated; Grazon = triclopyr in oil; Meturon = metsulfuron; Tordon = combination of picloram, aminopyralid, triclopyr). P-values in bold are significant at α=0.05.

|  |
| --- |
|  |
|  | Df | Sum sq | Mean sq | F value | Pr(>F) |
| treatment | 3 | 1.844 | 0.615 | 10.747 | **0.004** |
| site | 1 | 0.563 | 0.563 | 9.836 | **0.014** |
| treatment:site | 3 | 0.031 | 0.01 | 0.182 | 0.906 |
| residuals | 8 | 0.458 | 0.057 |  |  |
| Tukey multiple comparisons of means |
| treatment | diff | lwr | upr | p adj |
| Grazon-Control | 0.188 | -0.354 | 0.729 | 0.695 |
| Meturon-Control | -0.438 | -0.979 | 0.104 | 0.119 |
| Tordon-Control | 0.5 | -0.042 | 1.042 | 0.071 |
| Meturon-Grazon | -0.625 | -1.167 | -0.083 | **0.025** |
| Tordon-Grazon | 0.313 | -0.229 | 0.854 | 0.320 |
| Tordon-Meturon | 0.938 | 0.396 | 1.479 | **0.002** |
| site | diff | lwr | upr | p adj |
| Kaitoki-Awapuni | -.375 | -.651 | -.099 | **.014** |