



Supplement of

Impact of crop type on the greenhouse gas (GHG) emissions of a rewetted cultivated peatland

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Table S1: Management of the experimental plots with forage, set-aside or willow treatments in 2018-2023

| Year | Forage | Set-aside* | Willow |
|------|--|--|--------------------|
| 2018 | 2018/6/27 sowing + fertilisation (100 kg N + 13 kg P/ha) with <i>Poa trivialis</i> and <i>Festuca pratensis</i> seeds (50%/50%) | 2018/9/6 Planting of bog whortleberry | 2018/6/14 Planting |
| 2019 | 2019/5/15 fertilisation (100 kg N/ha) and spot sowing (15kg/ha) with seed mix of <i>Phleum pratense</i> , <i>Festuca pratensis</i> , <i>Lolium multiflorum</i> and <i>Poa pratensis</i> . 2019/5/22 herbicide Ariane S 2 l/ha 2019/6/7 harvest 2019/7/11 harvest 2019/9/2 harvest | 2019/5/7: fertilisation (16 kg N/ha) 2019/7/31: fertilisation (8 kg N/ha) | |
| 2020 | 2020/5/8 fertilisation (100 kg N/ha) 2020/6/16 harvest + fertilisation (100 kg N/ha) 2020/8/19 harvest 2020/9/1 last cut, biomass left on the field | 2020/5/27: fertilisation (16 kg N/ha) | |
| 2021 | 2021/5/12 fertilisation (80 kg N/ha) 2021/6/9 harvest + 2021/6/11 fertilisation (80 kg N/ha) 2021/7/12 harvest and 2021/7/28 fertilisation (40 kg N/ha) 2021/8/30 harvest | | 2021/2/22: harvest |
| 2022 | 2022/5/16 fertilisation (80 kg N/ha) 2022/5/31 Spot sowing (15kg/ha) with seed mix of <i>Phleum pratense</i> , <i>Festuca pratensis</i> , <i>Lolium multiflorum</i> and <i>Poa pratensis</i> . 2022/6/16 harvest 2022/7/28 harvest and 2022/8/1 fertilisation (40 kg N/ha) 2022/9/20 harvest | | |
| 2023 | | | 2023/2/28: harvest |

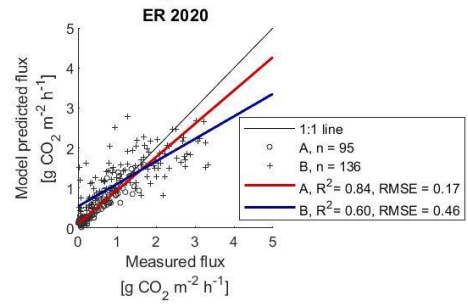
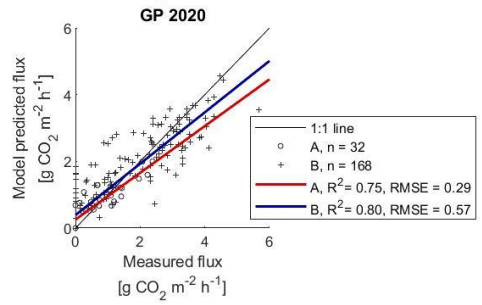
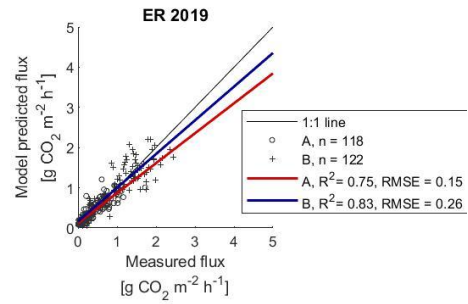
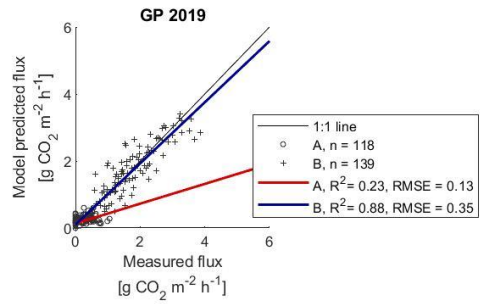
*Planted for bog whortleberry in the first year but turned to set-aside later.

Table S2: Fitted model parameters (\pm SE) for the estimation of gross photosynthesis (GP) and ecosystem respiration (ER). A_{\max} is asymptotic maximum ($\text{g CO}_2 \text{ m}^{-2} \text{ h}^{-1}$), k is half-saturation value ($\mu\text{mol photon m}^{-2} \text{ s}^{-1}$) n is average number of observations in individual model. $R0_s$ and $R0_p$ are soil respiration and plant respiration at the reference temperature at 10°C , E_s is ecosystem sensitivity, $b(\text{WTD})$ is coefficient for water table level. Each combination of treatment and year contains results from four plots except forage in 2021, in which one plot was discarded due to poor model performance.

| | Year | Treatment | A_{\max} | k | n | R^2 | | | |
|----|-------------|------------------|------------------------------|-----------------------|-----------------------|-------------------------|--|--|--|
| GP | 2019 | Set-aside | 1.6 (0.3) | 370 (130) | 30 | 0.30 (0.12) | | | |
| | | Forage | 5.3 (0.5) | 870 (180) | 35 | 0.88 (0.002) | | | |
| | 2020 | Set-aside | 4.3e11 | 1.0e14 | 8 | 0.75 (0.06) | | | |
| | | Forage | 7.2 (1.6) | 970 (340) | 42 | 0.80 (0.02) | | | |
| | 2021 | Set-aside | 7.5 (2.4) | 2000 (820) | 45 | 0.65 (0.08) | | | |
| | | Forage | 3.5 (0.2) | 280 (70) | 45 | 0.58 (0.08) | | | |
| | 2022 | Set-aside | 5.4 (0.6) | 400 (100) | 72 | 0.87 (0.04) | | | |
| | | Forage | 5.2 (0.4) | 380 (46) | 70 | 0.91 (0.02) | | | |

| | Year | Treatment | $R0_s$ | $R0_p$ | E_s | $b(\text{WTD})$ | b p-value | n | R^2 |
|----|-------------|------------------|--------------------------|--------------------------|-------------------------|-----------------------------------|-------------------------------|-----------------------|-------------------------|
| ER | 2019 | Set-aside | 0.31 (0.14) | 0.28 (0.21) | 780 (380) | -0.06 (0.09) | 0.45 (0.17) | 30 | 0.74 (0.07) |
| | | Forage | 0.41 (0.06) | 0.42 (0.08) | 360 (30) | -0.09 (0.09) | 0.80 (0.09) | 31 | 0.81 (0.01) |
| | 2020 | Set-aside | 0.29 (0.04) | 1.36 (0.43) | 210 (50) | 0.01 (0.19) | 0.45 (0.09) | 24 | 0.84 (0.04) |
| | | Forage | -0.07 (0.10) | 0.83 (0.09) | 740 (500) | -1.2 (0.2) | 0.28 (0.15) | 34 | 0.56 (0.04) |
| | 2021 | Set-aside | 0.20 (0.06) | 0.51 (0.02) | 450 (130) | -0.44 (0.21) | 0.44 (0.19) | 31 | 0.67 (0.01) |
| | | Forage | 0.26 (0.13) | 0.46 (0.12) | 670 (180) | -0.65 (0.11) | 0.13 (0.07) | 31 | 0.68 (0.06) |
| | 2022 | Set-aside | 0.21 (0.02) | 0.86 (0.09) | 690 (20) | -0.45 (0.14) | 0.43 (0.17) | 41 | 0.82 (0.02) |
| | | Forage | 0.13 (0.09) | 0.67 (0.12) | 360 (160) | -0.82 (0.28) | 0.35 (0.13) | 40 | 0.74 (0.02) |

*Due to poor growth on the set-aside plots in 2019 and 2020, only a few GP measurements were made in 2020.



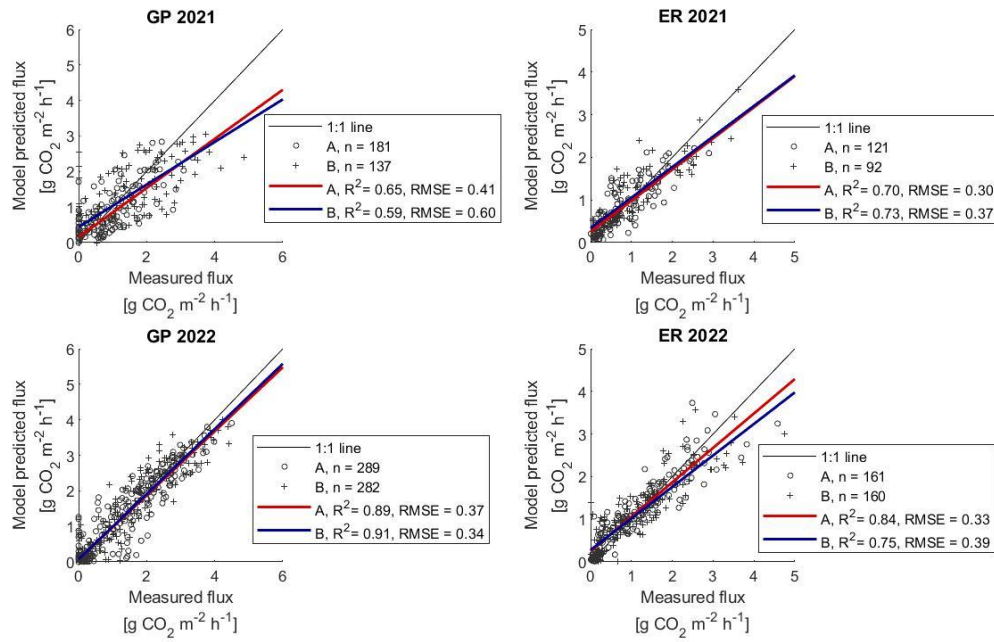


Figure S1: Comparisons between the measured and the model predicted values ($\text{g CO}_2 \text{ m}^{-2} \text{ h}^{-1}$) of gross photosynthesis (GP) and ecosystem respiration (ER) for the set-aside (A) and grass (B) treatments in 2018-2022. Outliers are excluded. Black lines represent the 1:1 line and the red and blue lines linear regression between the measured and modelled values.

Table S3: Fitted model parameters (\pm SE) for the bare soil respiration. R_{0s} is soil respiration at the reference temperature at 10 °C, E_s is ecosystem sensitivity, $b(\text{WTD})$ is coefficient for water table level. Each combination of treatment and year contains results from four plots. n is the number of measurements used in the model.

| Year | Treatment | R_{0s} | E_s | $b(\text{WTD})$ | n | R^2 |
|-------------|------------------|----------------------------|-------------------------|-----------------------------------|-----------------------|-------------------------|
| 2019 | Willow | 0.68 (0.14) | 460 (80) | -0.02 (0.19) | 22 | 0.76 (0.03) |
| | Set-aside | 0.28 (0.10) | 1000 (400) | -0.24 (0.07) | 18 | 0.68 (0.03) |
| | Forage | 0.55 (0.12) | 400 (30) | -0.16 (0.07) | 18 | 0.71 (0.05) |
| 2020 | Willow | 0.45 (0.05) | 310 (20) | -0.11 (0.07) | 22 | 0.70 (0.06) |
| | Set-aside | 0.43 (0.11) | 300 (30) | -0.11 (0.20) | 23 | 0.45 (0.03) |
| | Forage | 0.43 (0.10) | 310 (60) | -0.05 (0.14) | 24 | 0.53 (0.08) |
| 2021 | Willow | 0.22 (0.10) | 970 (360) | -0.36 (0.07) | 19 | 0.51 (0.10) |
| | Set-aside | 0.18 (0.06) | 690 (110) | -0.72 (0.16) | 18 | 0.80 (0.03) |
| | Forage | 0.17 (0.09) | 1500 (600) | -0.33 (0.12) | 17 | 0.68 (0.08) |
| 2022 | Willow | 0.07 (0.07) | 470 (140) | -1.48 (0.44) | 19 | 0.72 (0.02) |
| | Set-aside | 0.06 (0.01) | 610 (140) | -1.96 (0.18) | 23 | 0.49 (0.06) |
| | Forage | 0.00 (0.02) | 830 (880) | -1.55 (0.12) | 21 | 0.44 (0.08) |

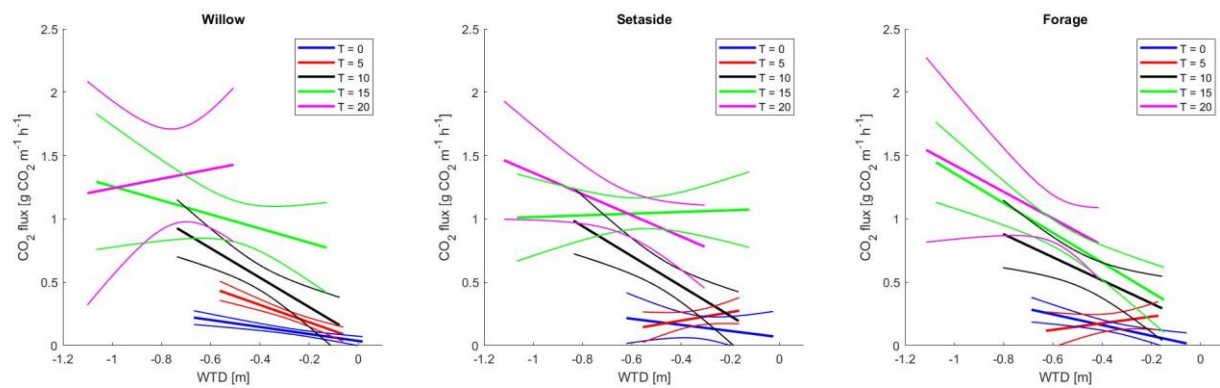


Figure S2: Bare soil respiration (with 95% confidence intervals) in relation to WTD in varying soil temperature conditions.

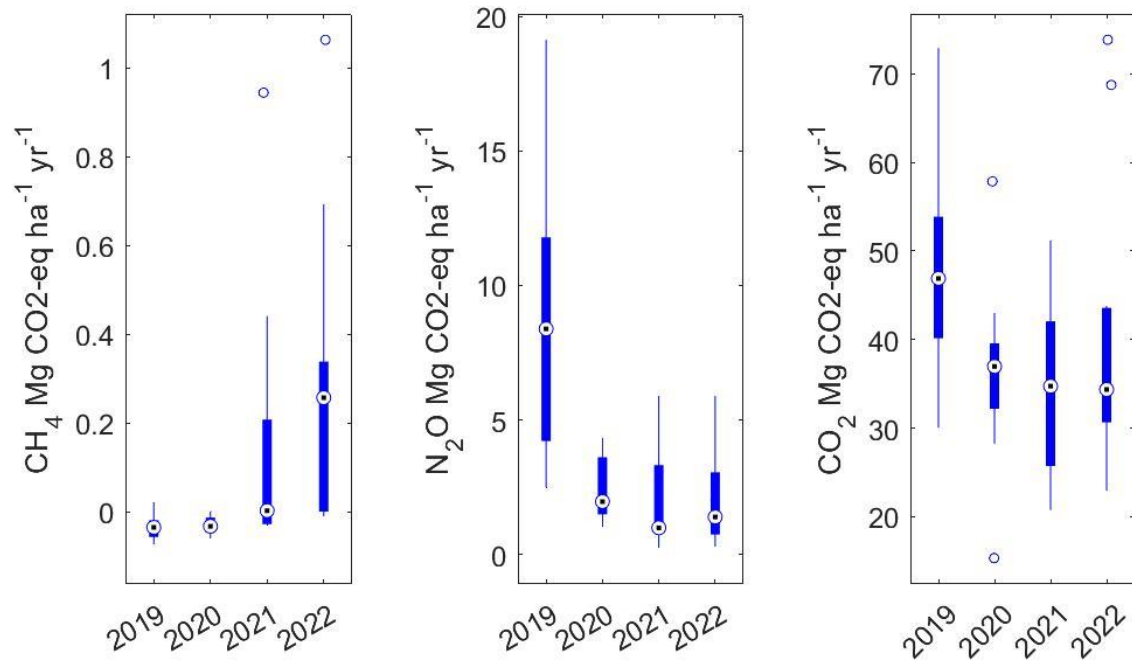


Figure S3: Emissions of CH₄, N₂O and CO₂ in 2019-2022.

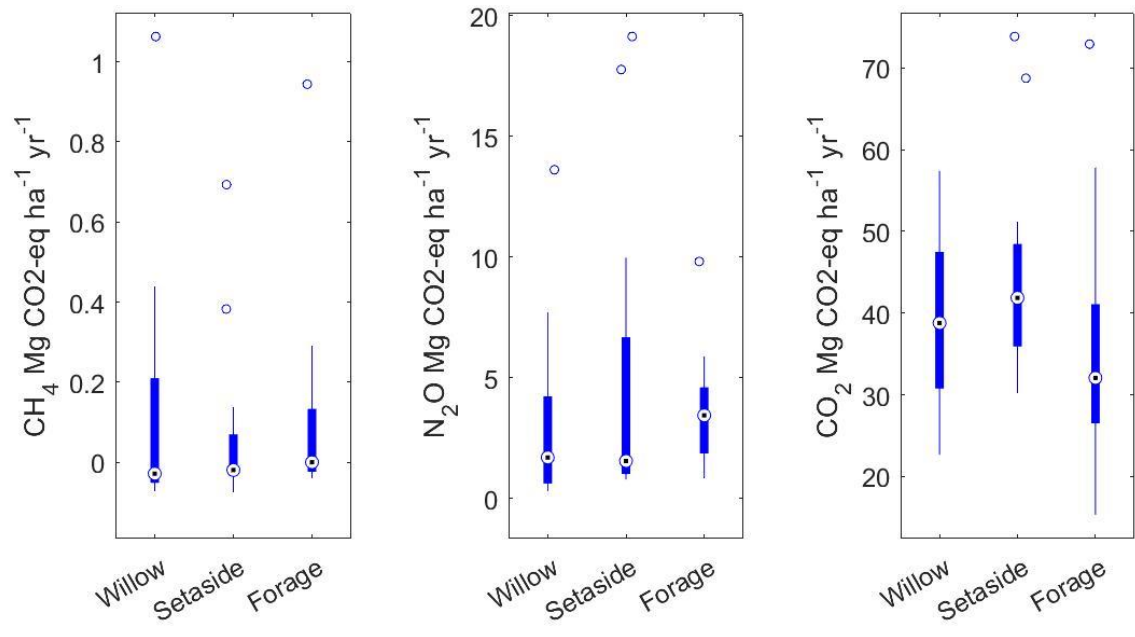


Figure S4: Emissions of CH₄, N₂O and CO₂ in the willow, set-aside and forage treatments.

Table S4: Results of the linear mixed model analysis for the annual estimates of GP, ER, SR, NECB, CH₄ and N₂O.

Crop, year, WTD and all their interactions were denoted as fixed effects in the first model run of each dependent variable. After the first run, the non-significant variables were removed one by one to find the most relevant effects.

GP

| Solution for Fixed Effects | | | | | | | |
|----------------------------|----------|------|----------|----------------|------|---------|---------|
| Effect | Crop | Year | Estimate | Standard Error | DF | t Value | Pr > t |
| Intercept | | | 3538.15 | 234.01 | 24 | 15.12 | <.0001 |
| Crop | Forage | | -113.98 | 327.42 | 12 | -0.35 | 0.7338 |
| Crop | Setaside | | 0 | . | . | . | . |
| Year | | 2019 | -2996.22 | 328.44 | 20.5 | -9.12 | <.0001 |
| Year | | 2020 | -2229.66 | 328.44 | 20.5 | -6.79 | <.0001 |
| Year | | 2021 | -1213.52 | 328.44 | 20.5 | -3.69 | 0.0014 |
| Year | | 2022 | 0 | . | . | . | . |
| Year*Crop | Forage | 2019 | 2985.6 | 463.04 | 12 | 6.45 | <.0001 |
| Year*Crop | Setaside | 2019 | 0 | . | . | . | . |
| Year*Crop | Forage | 2020 | 3097.27 | 463.04 | 12 | 6.69 | <.0001 |
| Year*Crop | Setaside | 2020 | 0 | . | . | . | . |
| Year*Crop | Forage | 2021 | 1258.83 | 463.04 | 12 | 2.72 | 0.0187 |
| Year*Crop | Setaside | 2021 | 0 | . | . | . | . |
| Year*Crop | Forage | 2022 | 0 | . | . | . | . |
| Year*Crop | Setaside | 2022 | 0 | . | . | . | . |

| Type 3 Tests of Fixed Effects | | | | |
|-------------------------------|--------|--------|---------|--------|
| Effect | Num DF | Den DF | F Value | Pr > F |
| Crop | 1 | 12 | 110.57 | <.0001 |
| Year | 3 | 9 | 14.11 | 0.0009 |
| Year*Crop | 3 | 12 | 20.57 | <.0001 |

ER

| Solution for Fixed Effects | | | | | | | |
|----------------------------|----------|------|----------|----------------|------|---------|---------|
| Effect | Crop | Year | Estimate | Standard Error | DF | t Value | Pr > t |
| Intercept | | | 6037.06 | 422.74 | 23.8 | 14.28 | <.0001 |
| Crop | Forage | | -743.57 | 587.92 | 21 | -1.26 | 0.2198 |
| Crop | Setaside | | 0 | . | . | . | . |
| Year | | 2019 | -3012.09 | 587.92 | 21 | -5.12 | <.0001 |
| Year | | 2020 | -2141.95 | 587.92 | 21 | -3.64 | 0.0015 |
| Year | | 2021 | -1102.23 | 587.92 | 21 | -1.87 | 0.0748 |
| Year | | 2022 | 0 | . | . | . | . |
| Year*Crop | Forage | 2019 | 2993.22 | 831.45 | 21 | 3.6 | 0.0017 |
| Year*Crop | Setaside | 2019 | 0 | . | . | . | . |
| Year*Crop | Forage | 2020 | 3940 | 831.45 | 21 | 4.74 | 0.0001 |
| Year*Crop | Setaside | 2020 | 0 | . | . | . | . |
| Year*Crop | Forage | 2021 | 2192.13 | 831.45 | 21 | 2.64 | 0.0154 |
| Year*Crop | Setaside | 2021 | 0 | . | . | . | . |
| Year*Crop | Forage | 2022 | 0 | . | . | . | . |
| Year*Crop | Setaside | 2022 | 0 | . | . | . | . |

| Type 3 Tests of Fixed Effects | | | | |
|-------------------------------|--------|--------|---------|--------|
| Effect | Num DF | Den DF | F Value | Pr > F |
| Crop | 1 | 21 | 27.37 | <.0001 |
| Year | 3 | 21 | 6.21 | 0.0035 |
| Year*Crop | 3 | 21 | 8.17 | 0.0009 |

NECB (log-transformed values in the model)

| Solution for Fixed Effects | | | | | | |
|----------------------------|----------|----------|----------------|----|---------|---------|
| Effect | Crop | Estimate | Standard Error | DF | t Value | Pr > t |
| Intercept | | 3.401 | 0.02806 | 27 | 121.19 | <.0001 |
| Crop | Forage | 0.1878 | 0.04039 | 27 | 4.65 | <.0001 |
| Crop | Setaside | 0 | . | . | . | . |

| Type 3 Tests of Fixed Effects | | | | |
|-------------------------------|--------|--------|---------|--------|
| Effect | Num DF | Den DF | F Value | Pr > F |
| Crop | 1 | 27 | 21.63 | <.0001 |

Soil respiration (log-transformed values in the model)

| Solution for Fixed Effects | | | | | | | | | |
|----------------------------|----------|----------|----------------|------|---------|---------|-------|----------|----------|
| Effect | Crop | Estimate | Standard Error | DF | t Value | Pr > t | Alpha | Lower | Upper |
| Intercept | | 3.4466 | 0.08436 | 18 | 40.86 | <.0001 | 0.05 | 3.2693 | 3.6238 |
| Annual_mean_WTD | | -0.00344 | 0.001894 | 14.9 | -1.82 | 0.0893 | 0.05 | -0.00748 | 0.000597 |
| Crop | Forage | -0.06875 | 0.04153 | 30.1 | -1.66 | 0.1083 | 0.05 | -0.1536 | 0.01606 |
| Crop | Setaside | 0.04869 | 0.04147 | 30 | 1.17 | 0.2496 | 0.05 | -0.03601 | 0.1334 |
| Crop | Willow | 0 | . | . | . | . | . | . | . |

| Type 3 Tests of Fixed Effects | | | | |
|-------------------------------|--------|--------|---------|--------|
| Effect | Num DF | Den DF | F Value | Pr > F |
| Annual_mean_WTD | 1 | 42.2 | 3.96 | 0.053 |
| Crop | 2 | 41.2 | 3.71 | 0.033 |

| Differences of Least Squares Means | | | | | | | | | |
|------------------------------------|----------|----------|----------|----------------|------|---------|---------|--------------|--------|
| Effect | Crop | _Crop | Estimate | Standard Error | DF | t Value | Pr > t | Adjustment | Adj P |
| Crop | Forage | Setaside | -0.1175 | 0.04335 | 41.2 | -2.71 | 0.0097 | Tukey-Kramer | 0.0258 |
| Crop | Forage | Willow | -0.06882 | 0.04333 | 41.2 | -1.59 | 0.1198 | Tukey-Kramer | 0.262 |
| Crop | Setaside | Willow | 0.0487 | 0.04328 | 41.2 | 1.13 | 0.267 | Tukey-Kramer | 0.5042 |

Solution for Fixed Effects

| Effect | Year | Estimate | Standard Error | DF | t Value | Pr > t | Alpha | Lower | Upper |
|----------------------|------|----------|----------------|------|---------|---------|-------|---------|--------------|
| Intercept | | 5.4783 | 1.0157 | 32.5 | 5.39 | <.0001 | 0.05 | 3.4107 | 7.546 |
| Annual_mean_WTD | | 0.1412 | 0.0348 | 32.7 | 4.06 | 0.0003 | 0.05 | 0.07036 | 0.212 |
| Annual_mean_WTD*Year | 2019 | -0.1293 | 0.04522 | 36.3 | -2.86 | 0.007 | 0.05 | -0.221 | - 0.03759 |
| Annual_mean_WTD*Year | 2020 | -0.1354 | 0.0356 | 35.4 | -3.8 | 0.0005 | 0.05 | -0.2077 | - 0.06318 |
| Annual_mean_WTD*Year | 2021 | -0.04065 | 0.04316 | 34.7 | -0.94 | 0.3528 | 0.05 | -0.1283 | 0.04699 |
| Annual_mean_WTD*Year | 2022 | 0 | . | . | . | . | . | . | . |
| Year | 2019 | -4.9641 | 2.0972 | 36.7 | -2.37 | 0.0233 | 0.05 | -9.2144 | -0.7137 |
| Year | 2020 | -5.3558 | 1.1703 | 35 | -4.58 | <.0001 | 0.05 | -7.7317 | -2.9799 |
| Year | 2021 | -1.0263 | 1.5186 | 35.5 | -0.68 | 0.5035 | 0.05 | -4.1078 | 2.0552 |
| Year | 2022 | 0 | . | . | . | . | . | . | . |

Type 3 Tests of Fixed Effects

| Effect | Num DF | Den DF | F Value | Pr > F |
|----------------------|--------|--------|---------|--------|
| Annual_mean_WTD | 1 | 9.88 | 8.6 | 0.0152 |
| Annual_mean_WTD*Year | 3 | 35.9 | 5.99 | 0.002 |
| Year | 3 | 36.1 | 7.98 | 0.0003 |

N2O (log-transformed values in the model)

| Solution for Fixed Effects | | | | | | | | | | |
|----------------------------|----------|------|----------|----------------|----|---------|---------|-------|----------|---------|
| Effect | Crop | Year | Estimate | Standard Error | DF | t Value | Pr > t | Alpha | Lower | Upper |
| Intercept | | | -1.0416 | 0.206 | 35 | -5.06 | <.0001 | 0.05 | -1.4598 | -0.6235 |
| Annual_mean_WTD | | | -0.0148 | 0.005762 | 35 | -2.57 | 0.0147 | 0.05 | -0.02649 | -0.0031 |
| Year*Crop | Forage | 2019 | 0.4519 | 0.2473 | 35 | 1.83 | 0.0762 | 0.05 | -0.05015 | 0.9539 |
| Year*Crop | Setaside | 2019 | 0.9257 | 0.2473 | 35 | 3.74 | 0.0007 | 0.05 | 0.4237 | 1.4277 |
| Year*Crop | Willow | 2019 | 0.6223 | 0.2473 | 35 | 2.52 | 0.0166 | 0.05 | 0.1203 | 1.1244 |
| Year*Crop | Forage | 2020 | 0.34 | 0.2071 | 35 | 1.64 | 0.1095 | 0.05 | -0.08035 | 0.7603 |
| Year*Crop | Setaside | 2020 | 0.4185 | 0.2071 | 35 | 2.02 | 0.051 | 0.05 | -0.00184 | 0.8388 |
| Year*Crop | Willow | 2020 | 0.2355 | 0.2071 | 35 | 1.14 | 0.2631 | 0.05 | -0.1848 | 0.6558 |
| Year*Crop | Forage | 2021 | 0.4287 | 0.1995 | 35 | 2.15 | 0.0386 | 0.05 | 0.02372 | 0.8338 |
| Year*Crop | Setaside | 2021 | -0.01528 | 0.2053 | 35 | -0.07 | 0.9411 | 0.05 | -0.432 | 0.4014 |
| Year*Crop | Willow | 2021 | 0.1078 | 0.205 | 35 | 0.53 | 0.6022 | 0.05 | -0.3083 | 0.5239 |
| Year*Crop | Forage | 2022 | 0.7909 | 0.1916 | 35 | 4.13 | 0.0002 | 0.05 | 0.4019 | 1.1799 |
| Year*Crop | Setaside | 2022 | 0.2975 | 0.1913 | 35 | 1.55 | 0.1289 | 0.05 | -0.0909 | 0.686 |
| Year*Crop | Willow | 2022 | 0 | . | . | . | . | . | . | . |
| Crop | Forage | | 0 | . | . | . | . | . | . | . |
| Crop | Setaside | | 0 | . | . | . | . | . | . | . |
| Crop | Willow | | 0 | . | . | . | . | . | . | . |
| Year | | 2019 | 0 | . | . | . | . | . | . | . |
| Year | | 2020 | 0 | . | . | . | . | . | . | . |
| Year | | 2021 | 0 | . | . | . | . | . | . | . |
| Year | | 2022 | 0 | . | . | . | . | . | . | . |

Type 3 Tests of Fixed Effects

| Effect | Num DF | Den DF | F Value | Pr > F |
|-----------------|--------|--------|---------|--------|
| Annual_mean_WTD | 1 | 35 | 6.59 | 0.0147 |
| Year*Crop | 6 | 35 | 3.77 | 0.0053 |
| Crop | 2 | 35 | 3.81 | 0.0319 |
| Year | 3 | 35 | 5 | 0.0054 |