**SUPPLEMENTARY MATERIALS – ДОПОЛНИТЕЛЬНЫЕ МАТЕРИАЛЫ**

**Article title: Eutrophication of arable soil: the comparative effect of mineral and organic fertilizer systems**

**Название статьи: Эвтрофикация пахотной почвы: сравнительное влияние минеральной и органической систем удобрения**

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**Eurasian Soil Science.**

**Почвоведение.**

**Table S1**. Carbon and nitrogen contents in fresh cattle manure used in the long-term microfield experiment

**Таблица S1**. Содержание углерода и азота в свежем навозе крупного рогатого скота, применяемого в длительном микрополевом опыте

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| YearГод | Dry matter, %Сухое вещество, % | Corg, % of dry weightCорг, % на сухую массу  | Ntot, % of dry weightNобщ, % на сухую массу | C/N |
| 1 | 20.4 ± 0.9 | 36.4 ± 1.5 | 1.92 ± 0.14 | 19.0 |
| 2 | 19.8 ± 2.1 | 37.8 ± 1.3 | 1.99 ± 0.06 | 19.0 |
| 3 | 20.6 ± 0.5 | 38.7 ± 1.3 | 2.02 ± 0.04 | 19.2 |
| 4 | 19.1 ± 1.5 | 36.8 ± 2.9 | 2.00 ± 0.04 | 18.4 |
| 5 | 18.8 ± 0.6 | 36.6 ± 2.1 | 1.96 ± 0.10 | 18.7 |
| 6 | 18.5 ± 1.4 | 40.7 ± 0.9 | 1.99 ± 0.11 | 20.5 |
| 7 | 19.3 ± 0.4 | 35.4 ± 0.5 | 1.97 ± 0.02 | 18.0 |
| 8 | 17.9 ± 0.0 | 34.8 ± 0.4 | 1.98 ± 0.05 | 17.6 |
| 9 | 19.5 ± 2.1 | 38.3 ± 1.6 | 1.91 ± 0.09 | 20.1 |

Note: Average P2O5 and K2O contents are 1.50 and 2.00% of dry weight, respectively.

Примечание: Содержание P2O5 и K2O в среднем 1.50 и 2.00% от сухой массы, соответственно.

**Table S2**. Annual (1) and total (2) amounts of mineral and organic fertilizers applied in a 9-year micro-field experiment on the grey forest soil, t/ha

**Таблица S2**. Ежегодное (1) и общее (2) количество минеральных и органических удобрений, применяемых в 9-летнем микрополевом опыте на серой почве, т/га

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| VariantВариант | Mass of mineral fertilizers and manure dry matterМасса минеральных удобрений и сухого вещества навоза | CarbonУглерод | Nitrogen (N)Азот (N) | Phosphorus (P2O5)Фосфор (P2O5) | Potassium (K2O)Калий (K2O) | Total NPKВсего NPK |
| 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| 1. Without fertilizers1. Без удобрений | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2. N1P1K1 | 0.57 | 5.1 | 0 | 0 | 0.09 | 0.81 | 0.08 | 0.68 | 0.10 | 0.90 | 0.27 | 2.39 |
| 3. N2P2K2 | 1.14 | 10.2 | 0 | 0 | 0.18 | 1.62 | 0.15 | 1.35 | 0.20 | 1.80 | 0.53 | 4.77 |
| 4. N3P3K3 | 1.71 | 15.3 | 0 | 0 | 0.27 | 2.43 | 0.23 | 2.03 | 0.30 | 2.70 | 0.80 | 7.16 |
| 5. N4P4K4 | 2.28 | 20.5 | 0 | 0 | 0.36 | 3.24 | 0.30 | 2.70 | 0.40 | 3.60 | 1.06 | 9.54 |
| 6. Manure 25 t/ha6. Навоз 25 т/га | 4.8 | 43.2 | 1.79 | 16.1 | 0.09 | 0.85 | 0.07 | 0.65 | 0.10 | 0.86 | 0.26 | 2.36 |
| 7. Manure 50 t/ha7. Навоз 50 т/га | 9.6 | 86.4 | 3.58 | 32.2 | 0.19 | 1.70 | 0.14 | 1.30 | 0.19 | 1.73 | 0.52 | 4.73 |
| 8. Manure 75 t/ha8. Навоз 75 т/га | 14.4 | 129.6 | 5.37 | 48.3 | 0.28 | 2.56 | 0.22 | 1.94 | 0.29 | 2.59 | 0.79 | 7.09 |
| 9. Manure 100 t/ha9. Навоз 100 т/га | 19.2 | 172.8 | 7.16 | 64.5 | 0.38 | 3.41 | 0.29 | 2.59 | 0.38 | 3.46 | 1.05 | 9.46 |
| 10. Bare fallow10. Чистый пар | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Figure S1**. Changes in organic carbon (Corg) content in the soil during the 9-years application of mineral and organic fertilizers in increasing doses. 1 – Without fertilizers; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Farm-yard manure 25 t/ha; 7 – Farm-yard manure 50 t/ha; 8 – Farm-yard manure 75 t/ha; 9 – Farm-yard manure 100 t/ha; 10 – Bare fallow.

**Рис. S1.** Изменения содержания органического углерода (Cорг) в почве в течение 9-летнего применения минеральных и органических удобрений в возрастающих дозах. 1 – Без удобрений; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Навоз 25 т/га; 7 – Навоз 50 т/га; 8 – Навоз 75 т/га; 9 – Навоз 100 т/га; 10 – Чистый пар.

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**Figure S2**. Changes in C:N ratio in the soil during the 9-years application of mineral and organic fertilizers in increasing doses. 1 – Without fertilizers; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Farm-yard manure 25 t/ha; 7 – Farm-yard manure 50 t/ha; 8 – Farm-yard manure 75 t/ha; 9 – Farm-yard manure 100 t/ha; 10 – Bare fallow

**Рис. S2.** Изменение соотношения C:N в почве в течение 9-летнего применения минеральных и органических удобрений в возрастающих дозах. 1 – Без удобрений; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Навоз 25 т/га; 7 – Навоз 50 т/га; 8 – Навоз 75 т/га; 9 – Навоз 100 т/га; 10 – Чистый пар.

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**Figure S3**. Changes in total N content in the soil during the 9-years application of mineral and organic fertilizers in increasing doses. 1 – Without fertilizers; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Farm-yard manure 25 t/ha; 7 – Farm-yard manure 50 t/ha; 8 – Farm-yard manure 75 t/ha; 9 – Farm-yard manure 100 t/ha; 10 – Bare fallow

**Рис. S3.** Изменения содержания общего азота (Nобщ) в почве в течение 9-летнего применения минеральных и органических удобрений в возрастающих дозах. 1 – Без удобрений; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Навоз 25 т/га; 7 – Навоз 50 т/га; 8 – Навоз 75 т/га; 9 – Навоз 100 т/га; 10 – Чистый пар.

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**Figure S4**. Changes in N-NO3 content in the soil during the 9-years application of mineral and organic fertilizers in increasing doses. 1 – Without fertilizers; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Farm-yard manure 25 t/ha; 7 – Farm-yard manure 50 t/ha; 8 – Farm-yard manure 75 t/ha; 9 – Farm-yard manure 100 t/ha; 10 – Bare fallow

**Рис. S4.** Изменения содержания N-NO3 в почве в течение 9-летнего применения минеральных и органических удобрений в возрастающих дозах. 1 – Без удобрений; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Навоз 25 т/га; 7 – Навоз 50 т/га; 8 – Навоз 75 т/га; 9 – Навоз 100 т/га; 10 – Чистый пар.

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**Figure S5**. Changes in available P2O5 content in the soil during the 9-years application of mineral and organic fertilizers in increasing doses. 1 – Without fertilizers; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Farm-yard manure 25 t/ha; 7 – Farm-yard manure 50 t/ha; 8 – Farm-yard manure 75 t/ha; 9 – Farm-yard manure 100 t/ha; 10 – Bare fallow

**Рис. S5.** Изменения содержания подвижного P2O5 в почве в течение 9-летнего применения минеральных и органических удобрений в возрастающих дозах. 1 – Без удобрений; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Навоз 25 т/га; 7 – Навоз 50 т/га; 8 – Навоз 75 т/га; 9 – Навоз 100 т/га; 10 – Чистый пар.

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**Figure S6**. Changes in available K2O content in the soil during the 9-years application of mineral and organic fertilizers in increasing doses. 1 – Without fertilizers; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Farm-yard manure 25 t/ha; 7 – Farm-yard manure 50 t/ha; 8 – Farm-yard manure 75 t/ha; 9 – Farm-yard manure 100 t/ha; 10 – Bare fallow

**Рис. S6.** Изменения содержания подвижного K2O в почве в течение 9-летнего применения минеральных и органических удобрений в возрастающих дозах. 1 – Без удобрений; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Навоз 25 т/га; 7 – Навоз 50 т/га; 8 – Навоз 75 т/га; 9 – Навоз 100 т/га; 10 – Чистый пар.

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**Figure S7**. Soil pH changes during the 9-years application of mineral and organic fertilizers in increasing doses. 1 – Without fertilizers; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Farm-yard manure 25 t/ha; 7 – Farm-yard manure 50 t/ha; 8 – Farm-yard manure 75 t/ha; 9 – Farm-yard manure 100 t/ha; 10 – Bare fallow

**Рис. S7.** Изменения pH почвы в течение 9-летнего применения минеральных и органических удобрений в возрастающих дозах. 1 – Без удобрений; 2 – N90P75K100; 3 – N180P150K200; 4 – N270P225K300; 5 – N360P300K400; 6 – Навоз 25 т/га; 7 – Навоз 50 т/га; 8 – Навоз 75 т/га; 9 – Навоз 100 т/га; 10 – Чистый пар.

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