

on the year of growth (meteorological conditions during the vegetation year) and the rate of nitrogen fertilization. Carbon content (min - max) in various was similar – stems (0.39 – 0.47 g kg⁻¹), shives (0.38 – 0.44 g kg⁻¹) and chaff (0.40 – 0.48 g kg⁻¹). Sulphur content (min –max) in linseed production differed – stems (0.56– 1.77 mg kg⁻¹), shives (0.97 – 1.90 mg kg⁻¹) and chaff (0.66 – 1.91 mg kg⁻¹). The gross calorific value (min – max) was observed in the linseed stems (17.75 – 18.79 MJ kg⁻¹) and shives (18.56 – 19.23 MJ kg⁻¹). The carbon yield from one kg nitrogen decreased by nearly 50% if the nitrogen fertilizer norm was increased from N0 to N100.

Water are formed in the process of burning carbohydrates; the energy from the Sun is freed, which is a natural, sustainable battery for the accumulation of the energy of the Sun.

Literature

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MIXTURES OF DIGESTATE AND WOOD ASH – AN EFFECTIVE FERTILIZER IN WINTER OILSEED RAPE CROPS

Winter rapeseed, or oilseed rape, is widely grown in Latvia. Moreover, during the last decade, the average yield of winter rapeseed has increased from 2.5 t ha⁻¹ in

2010 to 3.3 t ha⁻¹ in 2020, and the sown areas have increased from 67.6 thousand ha in 2010 to 127.7 thousand ha in 2020. According to the data of the State Statistics Service of Ukraine, the озимий area of winter rapeseed in Ukraine in 2022 reaches 1.4 million hectares, which is 40% more than the previous year. The average annual yield of rape in Ukraine is 2.67 t ha⁻¹. These figures indicate the stable interest of farmers in the cultivation of winter rapeseed and the improvement of cultivation technologies.

Field trials were set up at the LBTU Study and Research farm "Pēterlauki" in the fall of 2020. For the purposes of the research, a trial of two factors was set up: 1) mixtures of cattle manure (from JSC "Ziedi JP") digestate (D) and wood ash (from LLC "Gren Jelgava") (P) with different proportions of components (A1 – D; A2 – D+P 1:1; A3 – D+P 2:1; A4 – D+P 3:1; A5 – D+P 3:1 + NPK 8-20-30 200 kg ha⁻¹; A6 – D+P 3:1 + N 68.8 kg ha⁻¹; A7 – D+P 4:1); 2) different rates of mixtures used for fertilization (B1 – 5 t ha⁻¹; B2 – 10 t ha⁻¹; B3 – 20 t ha⁻¹).

In the research, the lowest winter rape seed yield of 1.97 t ha⁻¹ was obtained from the plots of the control variant. Significantly higher ($p < 0.05$) average winter rapeseed yields were obtained when the 10 and 20 t ha⁻¹ mixed fertilizer rates were used for fertilization variants. At the lowest fertilizer rate of 5 t ha⁻¹, the variants GD, GD + P 2:1, and GD + P 3:1 + N had a lower yield than the control variant; however, the differences were not significant ($p > 0.05$).

A considerably higher ($p < 0.05$) average seed yield of winter rapeseed was obtained in fertilizer variants GD, GD + P 1:1, GD + P 3:1 + NPK, and GD + P 4:1.

Among all fertilizer variants, the highest average winter rapeseed yields were obtained directly in the variants GD + P 1:1, and GD + P 4:1. Studies have shown that the use of liquid digestate of at least 25.000 L ha⁻¹ as a fertilizer can markedly ($p < 0.05$) increase the yield of winter rapeseed, i.e., the increase in digestate rates increases the rapeseed yield [1].

In the present trial, when only digestate was applied, a significantly higher average winter rapeseed yield was obtained at a fertilizer rate of 10 t ha⁻¹. The obtained data demonstrated that the deficiency of nutrients was not a yield-limiting factor in the particular trial year.

One of the main indicators of winter rapeseed quality is the oil content of rape seeds. The analysis of the results revealed that a significantly higher ($p = 0.07$) average oil content in winter rape seeds was obtained using the 5 t/ha⁻¹ digestate and wood ash mixture rate.

Among the average values of all mixture variants, a considerably higher ($p = 0.001$) oil content was obtained in the variants GD + P 1:1, GD + P 2:1, GD + P 3:1, and GD + P 3:1 + NPK; whereas, a significantly lower ($p = 0.001$) oil content was obtained in the variants where ammonium nitrate was additionally used for fertilization.

Such trend has also been observed in other studies where the increase in N fertilizer rate significantly decreased the oil content of winter rape seeds [2].

Fertilizer variants of wood ash and digestate mixtures did not have a considerable effect ($p=0.334$) on the average oil yield of winter rape seeds. However, when mixture rates were increased to 10 and 20 t ha⁻¹, the amount of oil obtained also notably increased ($p=0.004$).

Correlation analysis proved that the yield of winter rape seeds positively correlated ($r=0.80$) with the amount of oil obtained (t ha⁻¹) in the particular trial.

The use of the wood ash and digestate mixtures significantly ($p<0.05$) increased the yield of winter rape seeds. When the 5 t ha⁻¹ fertilizer rates were used, the yields obtained in all fertilizer variants were not considerably higher ($p>0.05$) than in the control variant; whereas, fertilizer rates of 10 and 20 t ha⁻¹ gave markedly higher ($p<0.05$) winter rape seed yields.

So, significantly higher ($p<0.05$) winter rape seed yields (by 19.6% on average) in the particular trial year were obtained in variants where 10 t ha⁻¹ fertilizer rates were used. In the control variant, the winter rape seed yield was 1.97 t ha⁻¹; whereas, the fertilizer variant GD:P 1:1 at a rate of 20 t ha⁻¹ gave a 2.67 t ha⁻¹ seed yield, which makes the yield increase of 26.3 %.

A higher ($p<0.05$) oil content in winter rape seeds was produced in variants using the 5 t ha⁻¹ fertilizer rate. Among all fertilizer variants, a higher ($p<0.05$) oil content was observed in the variants GD + P 1:1, GD + P 2:1, and GD + P 3:1 + NPK. A higher ($p<0.05$) rape seed volume mass (97.93 kg hL⁻¹) was obtained in the fertilizer variant GD 3: 1 + N, which indicates the deficiency of nitrogen fertilizer required for obtaining a high winter rapeseed volume mass.

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