

FEDERAL STATE BUDGETARY SCIENTIFIC INSTITUTION
“FEDERAL SCIENTIFIC CENTRE FOR BAST CROPS” (FSBSI FSCBC)


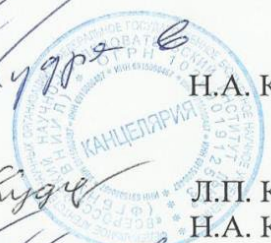
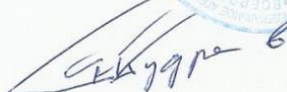
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REPORT

Trials on the use of Ammonium Nitrate fertiliser in combination with the preparation
Saver+ on oil flax

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Торжок 2022

1. Distinct names of tested substances:

Ammonium Nitrate, **Saver+**.

2. Trial Sponsor:

JSC "Scientific Production Association Bioteka".

3. Manufacturers:

Ammonium Nitrate – PJSC "Dorogobuzh",

Saver+ – JSC "Scientific Production Association Bioteka".

4. Purpose of the trials:

To determine the effectiveness of Ammonium Nitrate fertiliser in combination with **Saver+** on oil flax.

5. Active ingredient name:

Ammonium Nitrate – ammonium nitrate (nitric acid ammonium salt).

Concentration:

Ammonium Nitrate contains nitrogen (N) – 35%.

Formulation type:

Granules (Grade B, 1st class, GOST 2-85).

Chemical class:

Ammonium Nitrate – salt of nitric acid.

6. Trial layout:

- Control (no treatment)
- Ammonium Nitrate, application rate – 30 kg/ha, working solution – 300 L/ha.
- Ammonium Nitrate, application rate – 100 kg/ha, working solution – 300 L/ha.
- Ammonium Nitrate, application rate – 30 kg/ha + **Saver+**, application rate – 0.3 L/ha, working solution – 300 L/ha.

Trial plot area – 100 m², accounting plot area – 50 m². Four repetitions.

7. Trial period: April – September 2022.

8. Trial location: 172002, Russian Federation, Tver Region, Torzhok District, Experimental Station of the Bast Crop Research Centre (FSBSI FSCBC).

9. Soil-climatic zone: Zone 1 – podzolic and sod-podzolic soils. Central Federal District.

10. Crop: Oil flax.
Variety: “LM-98”.

11. Brief description of the trial zone:

The central area is the districts of Tver Region. The arable land of the region (around 73%) mainly consists of sod-medium-podzolic soils, with light loamy types prevailing (over 70% of arable land). The humus content in the soils of the Torzhok District ranges from 1.96 to 1.50%.

Phosphorus availability varies little: 66% of arable land has high or very high phosphorus content, 25% medium, and only 9% low. Potassium availability is more varied: 34% of arable land has high or very high content, 35% medium, and 31% low. Slightly acidic soils (pH KCl 5.1–5.5) make up 28% of arable land, while 44% are near neutral.

Climatic conditions in this zone are satisfactory for obtaining a yield of oil flax.

12. Agrochemical characteristics of the trial plot soil:

Sod-podzolic, light loamy, pH (KCl) = 5.3; mobile phosphorus – 204; potassium – 198 mg/kg (soil); humus – 1.6%.

13. Meteorological conditions during the growing season:

Table 1.

The meteorological conditions during the 2022 growing season were satisfactory for the growth and development of oil flax.

On the day of crop spraying, no precipitation or extreme weather events were recorded:

6 June 2022: Air temperature – 17.0°C. Relative humidity – 69%. Wind speed – 3 m/s. Precipitation after treatment: after 1 day – 1.2 mm.

Table 1 – Meteorological data for the 2022 growing season

(according to Torzhok weather station)

Month	May			June			July			August	
Dekad	1	2	3	1	2	3	1	2	3	1	2
Air temperature											
Average for the dekad, °C	13.6	14.4	14.9	12.2	16.4	17.2	15.3	20.3	19.9	19.5	16.9
Long-term average, °C	9.9	11.5	12.9	15.3	15.6	16.5	13.7	17.4	17.5	17.2	15.2
Maximum, °C	26.1	25.8	24.8	25.5	26.5	27.3	22.6	27.8	27.3	28.6	27.2
Minimum, °C	1.8	0.9	2.3	0.8	3.6	5.7	9.4	12.4	10.5	7.3	6.0
Precipitation:											
Total for the dekad, mm	14.3	22.1	0.6	12.1	12.4	29.9	37.6	16.7	10.2	7.1	12.5
Long-term average for the dekad, mm	18.3	15.0	15.0	24.2	27.0	25.8	33.6	24.8	30.3	26.4	22.4
Relative humidity:											
Average for the dekad, %	65	72	61	65	60	76	89	70	68	55	61
Minimum, %	32	26	31	36	37	38	54	48	50	43	46

14. Test Methodology:

Field trials were conducted in accordance with “Statistical Methods Applied to Agricultural and Biological Research” (Snedecor, 1961), “Methodology of Field Experiments” (Dospekhov, 1979; 1985), and “Scientific Agronomy Methodology” (Kiryushin, 2004; 2005).

Specifically for testing **Saver+** on oil flax in combination with Ammonium Nitrate fertiliser, we also followed the “Guidelines for Field Experiments with Flax” (Abramov et al., 1956; Dolgov et al., 1969; Dolgov et al., 1978) and “Guidelines for the Registration Trials of Fungicides in Agriculture” (VIZR, 2009).

Each trial plot had an area of 50 m², with an accounting (measured) area of 25 m². The trials were conducted in four replications.

15. Agronomic Measures:

- Preceding crop – spring barley.
- Soil treatment: Primary – autumn ploughing to the depth of the arable layer (8 October 2021, using PN-4-35 plough with T-150 tractor, depth 22 cm); Pre-sowing treatment (1 May 2022, using RVK 5.4 unit with MTZ-80 tractor, along previous tillage, depth 7 cm)
 - No fertilisers were applied before flax sowing.
 - Seeding rate: 7 million seeds per hectare (calculated).
 - Sowing date: 10 May 2022.
 - Sowing equipment: MTZ-82 + SLN-16.
 - Emergence date: 15 May 2022.
 - Crop maintenance: fertiliser application rates (Ammonium Nitrate) during the “Christmas tree” stage of flax growth was implemented per trial layout.

Background plant protection consisted of chemical weeding during the “Christmas tree” stage, done separately from fertiliser and **Saver+** application, using the herbicide mix Harmony (10 g/ha) + Kortes (5 g/ha).

Application method and preparation of working solution:

Crop treatment was carried out using a “Rapid” backpack hydraulic sprayer, according to the trial scheme, with a working solution rate of 300 L/ha.

The working solution of the fertiliser and **Saver+** preparation was prepared immediately before application. To prepare the solution, the required amount of fertiliser and **Saver+** for one treatment was measured out. Then, the sprayer tank was filled approximately halfway with water, the fertiliser and **Saver+** were added, water was topped up to the calculated volume, the solution was thoroughly mixed, and the treatment was carried out.

Harvest Accounting

Harvesting and yield accounting method: manual pulling of flax [with tying into sheaves] from the entire accounting area of each plot, drying of sheaves, individual plot threshing, seed cleaning; full yield measurement with recalculation of the product mass after weighing to 100% purity, 12% seed moisture content and 19% flax straw moisture content.

Harvest date: 14 August 2022.

Trial Results:

The effect of the **Saver+** preparation in combination with Ammonium Nitrate fertiliser on plant stand density is illustrated in Table 2; its effect on the morphological characteristics of oil flax plants is shown in Table 3.

Table 2 – Dependence of oil flax plant stand density on the application of **Saver+** in combination

Variant	Field germination, %	Plant stand density, plants/m ²		% of plants that died during the growing season
		At the flax seedling stage	Before harvest	
1. Control (no treatment)	63.2	514	360	30.0
2. Ammonium nitrate, application rate – 30 kg/ha, working solution – 300 L/ha			421	18.1
3. Ammonium nitrate, application rate – 100 kg/ha, working solution – 300 L/ha			430	16.3
4. Ammonium nitrate, application rate – 30 kg/ha + Saver+ , application rate – 0.3 L/ha, working solution – 300 L/ha			439	14.6

Table 3 – Effect of **Saver+** in combination with Ammonium Nitrate fertiliser on the morphological characteristics of oil flax plants (2022)

Variant	Flax plant stem length, cm		Stem diameter, mm	Number of capsules per plant, pcs.	Number of seeds in 100 capsules, pcs.
	Total	Technical			
1. Control (no treatment)	50.1	46.4	1.92	6.3	678
2. Ammonium nitrate, application rate – 30 kg/ha, working solution – 300 L/ha	52.1	48.2	1.93	7.2	684
3. Ammonium nitrate, application rate – 100 kg/ha, working solution – 300 L/ha	52.6	49.1	1.95	7.3	687
4. Ammonium nitrate, application rate – 30 kg/ha + Saver+ , application rate – 0.3 L/ha, working solution – 300 L/ha	53.0	50.3	1.96	7.5	692

Visual comparison of oil flax crops at the ripening stage on the plots treated with fertiliser — Ammonium Nitrate (100 kg/ha) and those treated with **Saver+** in combination with fertiliser — Ammonium Nitrate (30 kg/ha) — is illustrated in the figure:



Fig. – Left – Variant No. 4 – treatment of oil flax crops with **Saver+** in combination with fertiliser – Ammonium Nitrate (30 kg/ha)

Right – Variant No. 3 – treatment of oil flax with fertiliser – Ammonium Nitrate (100 kg/ha)

Data on the effect of **Saver+** in combination with Ammonium Nitrate fertiliser on the yield of straw and seeds of oil flax are presented in Table 4.

Table 4 – Effect of **Saver+** in combination with Ammonium Nitrate fertiliser on the yield of straw and seeds of oil flax (2022)

Variant	Yield, centners/ha		Advantage compared to control, in yield, centners/ha	
	Flax straw	Flax seeds	Flax straw	Flax seeds
1. Control (no treatment)	20.5	8.4	-	-
2. Ammonium nitrate, application rate – 30 kg/ha, working solution – 300 L/ha	28.1	10.2	7.6	1.8
3. Ammonium nitrate, application rate – 100 kg/ha, working solution – 300 L/ha	29.1	11.0	8.6	2.6
4. Ammonium nitrate, application rate – 30 kg/ha + Saver+ , application rate – 0.3 L/ha, working solution – 300 L/ha	30.3	11.7	9.8	3.3
LSD 0.5	1.2	0.3	1.2	0.3

The effect of **Saver+** in combination with Ammonium Nitrate fertiliser on flax fibre yield and seed sowing qualities from the 2022 harvest is illustrated in Table 5.

Table 5 – Effect of the agrochemical **Saver+** in combination with Ammonium Nitrate fertiliser on fibre yield and sowing qualities of oil flax seeds from the 2022 harvest

Variant	Fibre yield, %	1000 seed weight, g	Germination energy, %	Germination rate, %
1. Control (no treatment)	23.0	4.6	93.75	94.75
2. Ammonium nitrate, application rate – 30 kg/ha, working solution – 300 L/ha	23.1	4.7	94.00	95.50
3. Ammonium nitrate, application rate – 100 kg/ha, working solution – 300 L/ha	24.0	4.7	94.25	96.00
4. Ammonium nitrate, application rate – 30 kg/ha + Saver+ , application rate – 0.3 L/ha, working solution – 300 L/ha	24.1	4.8	95.00	96.25
LSD 0.5		0.3	1.00	1.25

Seed oil content (%) and oil yield (centners/ha) depending on the application of **Saver+** in combination with Ammonium Nitrate fertiliser are illustrated in Table 6.

Table 6 – Seed oil content (oil percentage in flax seeds) and oil yield in relation to the application of **Saver+** in combination with Ammonium Nitrate fertiliser (2022)

Variant	Seed oil content, %	Oil yield, centners/ha
Control (no treatment)	39.9	3.4
Ammonium nitrate, application rate – 30 kg/ha, working solution – 300 L/ha	40.0	4.1
Ammonium nitrate, application rate – 100 kg/ha, working solution – 300 L/ha	40.1	4.4
Ammonium nitrate, application rate – 30 kg/ha + Saver+ , application rate – 0.3 L/ha, working solution – 300 L/ha	40.3	4.7

Discussion of trial results:

The experiment revealed a pronounced fertilising and growth-stimulating effect from the use of **Saver+** in combination with Ammonium Nitrate fertiliser on oil flax. Spraying vegetative flax plants with **Saver+** in combination with Ammonium Nitrate fertiliser – at 79 plants/m² – increased plant stands density and reduced plant mortality during the growing season by 15.4% (Table 2). The most successful results were obtained specifically from spraying crops with **Saver+** in combination with Ammonium Nitrate fertiliser.

The use of **Saver+** in combination with Ammonium Nitrate fertiliser during crop treatment resulted in an increase in both the total and technical stem length of flax compared to the control (Table 3, Fig.). Following treatment with this preparation, there was a noticeable tendency toward an increase in stem diameter, number of capsules, and number of seeds per capsule compared to the control (Table 3).

Assessment of lodging resistance in oil flax crops showed virtually no lodging across all experimental variants (Fig.).

Treatment of crops with **Saver+** in combination with Ammonium Nitrate fertiliser resulted in flax product yields exceeding those of the control (Variant No. 1 – no treatment), with differences surpassing the LSD_{0.5} threshold (Table 4). The highest yield in the experiment was achieved using **Saver+** (0.3 L/ha) combined with Ammonium Nitrate fertiliser (30 kg/ha), producing 30.3 and 11.7 centners/ha of straw and seed yield respectively (compared to 20.5 and 8.4 centners/ha in the control).

No negative effects were observed, and a positive trend was noted in fibre yield with **Saver+** treatment. The highest recorded value – 24.1% – in the variant treated with both **Saver+** and fertiliser, exceeded the control value of 23.0% (Table 5).

Sowing qualities of flax seeds from the 2022 harvest were higher in the new variants than in the control, although this increase was mostly below the $LSD_{0.5}$ threshold (Table 5).

Seed oil content (%) and oil yield (centners/ha) significantly increased as a result of applying **Saver+** in combination with Ammonium Nitrate fertiliser (Table 6).

Conclusions:

1. Field trials conducted in 2022 demonstrated high biological and economic efficiency from the use of **Saver+** in combination with Ammonium Nitrate fertiliser on oil flax crops during field treatment.
2. Based on the positive results of the field trials, FSBSI FRCFC proposes to approve the use of **Saver+** in combination with Ammonium Nitrate fertiliser on oil flax crops within the Russian Federation under the following application regulations:

Trade name, formulation, concentration, registrant	Application rate	Crop	Purpose	Application method
Saver+ in combination with Ammonium Nitrate fertiliser, 30 kg/ha	0.3 L/ha	Oil flax	To increase yield and quality of seeds and fibre products, and improve flax resistance to diseases	Crop treatment. Working solution consumption – 300 L/ha.

Conclusion on the effectiveness of the product and proposal for its suitability in agricultural production

The application of **Saver+** in combination with Ammonium Nitrate fertiliser on oil flax crops resulted in a statistically significant increase in seed yield and enhanced production of fibre.

The relatively high biological and economic efficiency of **Saver+** used in combination with Ammonium Nitrate fertiliser on oil flax, demonstrated in the trials conducted at the FSBSI FRCFC experimental field, supports the **recommendation for its use in agricultural production** within Zone 1 of sod-podzolic soils in the taiga-forest regions of the Central Federal District of the Russian Federation, in accordance with the developed application guidelines.

