Latvia University of Agriculture
Institute of Agriculture

Report

Detection of the Organic Fertilizer OrganiQ Efficiency for Spring Wheat and Potatoes

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1. Circumstances and methodology of the trial

The trials of the field were established in Skrīveri, in the Institute of Agriculture of the Latvia University of Agriculture (LUA). Within the trial were cultivated the sorts: spring wheat "Robijs" and potatoes "Agria".

The sort "Robijs" (2007), created in the Stende Research Centre of the Agro-Resource and Economic Institute, is a moderately intensive type sort, which is suitable for the production of food and feed grain. The sort is suitable for cultivation according to conventional and biological management methods. The harvest potential is 6-8 t ha^{-1}, medium-early. The sort is characterized by medium coarse grain, the gluten content average 25.5 %, crude protein around 12.8 %, the quality appropriate to II gr. according to number of IDK units (90-95), fall number average 343 sec. For the sort there are characteristic average resistance to diseases and average resistance to lodging of plants [1].

The potato sort "Agria", bred in Germany, is a late sort with a very harvest high potential. This sort is especially suitable for production of potato chips and due to excellent taste properties it is a favourite food sort. The tubers are long oval, very big, with very shallow potato eyes. The skin is smooth, yellow, pulp selective yellow. Tubers are floury, partially break up when boiling, after boiling do not get dark. The starch content is average. The sort is not resistant to cancer, resistant to nematode (Ro 1.4). In light soil sensitive to ordinary tinea favosa [2].

2. Trial versions

For the **spring wheat** the trial of field is established in four replications. The total size of the fields is 24 m^2 (3.0 x 8.0 m), but the size of the inventory field is 12.0 m^2 (1.5 m x 8 m). There are three versions in the trial:

1) control – without fertilizer;
2) organic fertilizer OrganiQ –500 kg ha^{-1};
3) organic fertilizer OrganiQ (500 kg ha^{-1}) + mineral fertilizer (300 kg 8:19:29);

Fertilizers are embedded in soil before sowing.

Trial scheme:

1	2	3	1	2	3	1	2	3	1	2	3
1st replication			2nd replication			3rd replication			4th replication		

For **potatoes** the trial of field is established in four replications. The total size of the fields is 25.2 m^2 (2.8 m x 9 m) with the plant nutrition field of 0.21 m^2 (0.70 m x 0.30 m).

There are three versions in the trial:

1) mineral fertilizer – 600 kg ha^{-1}, embedding type – frustrated;
2) organic fertilizer OrganiQ – 500 kg ha^{-1}, embedding type – frustrated;
3) organic fertilizer OrganiQ + mineral fertilizer, imitating a combined planting machine (accordingly 600 kg ha^{-1} and 500 kg ha^{-1}).

Trial scheme:

1	2	3
2	3	1

3	1	2
1	2	3

The establishment of the trial is shown in pictures 1, 2 and 3.

Pic.1. The 1st version of the trial before the furrows are earthed-up.

Pic.2. The 2nd version of the trial before the furrows are earthed-up.

Pic.3. The 3rd version of the trial before the furrows are earthed-up.

Agricultural engineering

Spring wheat

The trial was established in a turf podsol soil, where the agrochemical indicators of the soil (determined in 2016) are as follows: pHCl 5.5, organic matter content 2.0 %, amount of phosphorus available to plants 113 mg kg^{-1} (average) and potassium – 130 mg kg^{-1} (average).

Seeding rate – 500 germinating grains on m^{-2}.

Previous plant – perennial grassland

10.04.2017. – soil treatment with discs
02.05.2017. – embedding of fertilizer according to the trial versions
03.05.2017. – milling
03.05.2017. – sowing
30.05.2017. – Nitrogen supplementary fertilizer: N 60 ammonium nitrate (3rd version)
30.05.2017. – spraying with herbicides: 2.4 D Nufarm 1.28 l ha^{-1} + Grodyl 30 g ha^{-1}
16.06.2017. - Fungicide Allegro Super 0.75 l ha-1
10.07.2017. - Fungicide Allegro Super 0.75 l ha-1
08.09.2017. - Harvesting

Potatoes

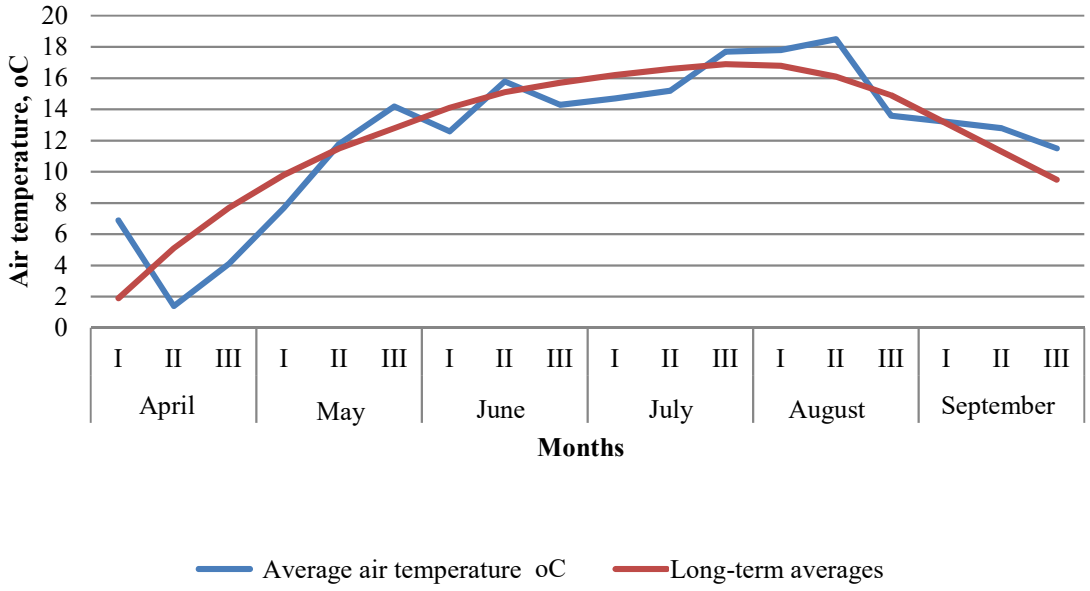
The trial was established in a turf podsol soil, where the agrochemical indicators of the soil (determined in 2016) are as follows: pHCl 5.2, organic matter content 2.4 %, amount of phosphorus available to plants 112 mg kg^{-1} (averages) and potassium – 81 mg kg^{-1} (low).

Planting rate: 47619 thousand tubers on ha^{-1} or the feeding area is 0.21 m^2 (0.30 m between plants x 0.70 m distance of rows).

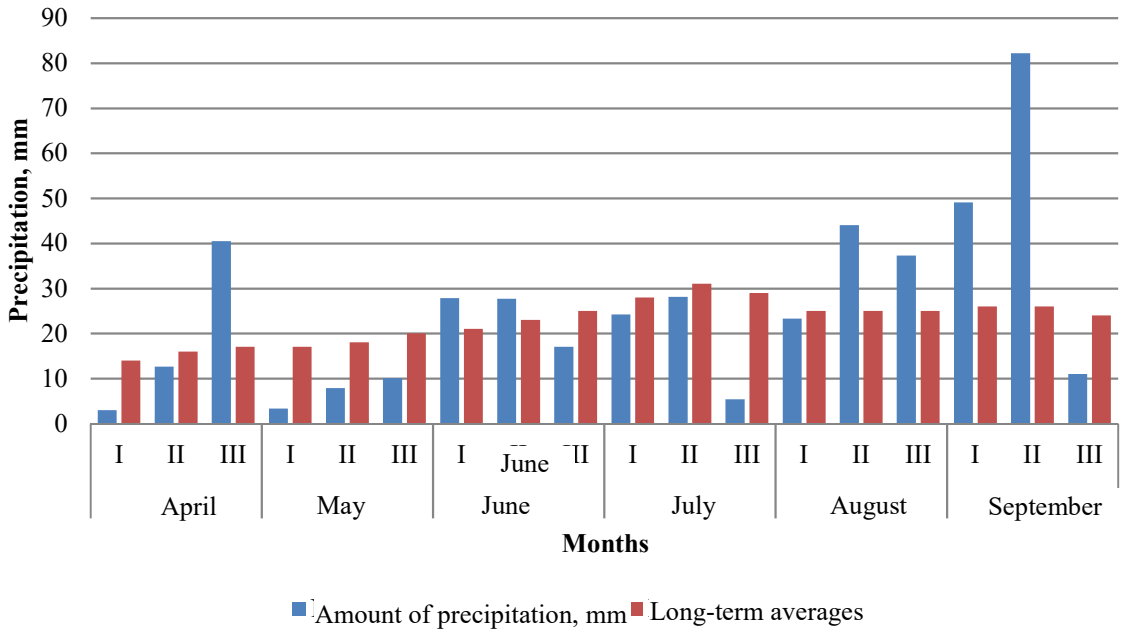
15.05.2017. – cultivation
17.05.2017. – furrowing
19.05.2017. – establishment of trial and spread of fertilizers, according to the versions and scheme of the trial
19.05.2017. – planting
19.05.2017. – earthing-up of the furrows
02.06.2017. – hilling
02.06.2017. – milling the insulation
19.06.2017. – spraying against weeds: Titus 0.05 kg ha-1 + Contact 100 ml/ 100 l
20.06.2017. – milling the insulation
06.07.2017. – milling the insulation
07.07.2017. – spraying against potato stalk rot: Ridomil Gold 2.5 kg ha^{-1}
22.07.2017. – spraying against potato stalk rot: Ridomil Gold 2.5 kg ha^{-1}
08.08.2017. – spraying against potato stalk rot: Infinito 1.6 l ha^{-1}
25.07.2017. – harvesting

Meteorological conditions

For the characterization of meteorological conditions there are used data from the Skrīveri Observation Station of the Environment, Geology and Meteorology Center of Latvia (available online www.meteo.lv). Data are collected in pictures 1 and 2. The influence of the meteorological conditions to the growth and evolution of tested cultivated plants, as well as to the crop formation is analysed in a section of results.



Pic.4. average air temperature during the vegetation period, 2017 (data from Skrīveri Observation Station of LVĢMC)



Pic.5 average amount of precipitation during the vegetation period, 2017 (data from Skrīveri Observation Station of LVĢMC)

Results of the Trial

Spring wheat

This year the beginning of the vegetation period was characterized by drastic temperature fluctuation and rich amount of precipitation, therefore the sowing was delayed. The sowing was performed only on the 3rd of May. Also in May the weather conditions were very unstable and were not favourable for the growth and evolution of the spring wheat. At the beginning of May the temperature rises sharply, at the end of month it even exceeds the monthly rate, however in the middle of month there is a period of several days, when at night there are frosts even up to

-3.5 ºC. In May there is a lack of precipitation – during May there was fallen only 39% of the monthly rate.

The further vegetation period is cool and rich with precipitation, which significantly affects the growth and evolution of the spring wheat. Only in few decades the air temperature achieves or slightly exceeds the monthly rate (the 1st and 2nd decade of June and 1st and 2nd decade of August). While the amount of precipitation is close to the monthly rate or significantly exceeds it (1st and 2nd decade of June, 2nd and 3rd decade of August). In the trial already in June12 there was detected a strong spread of mildew, it was successfully restricted by spraying a fungicide. In general the year was favourable for the evolution of the spring wheat, but the harvesting was hampered by heavy rains at the end of August and in the beginning of September. During the threshing of grains there were detected germinating grains.

The use of fertilizers significantly increased the harvest of the spring wheat grains (Table No,). In the control version without any fertilizers ware obtained relatively high grain harvest - 3.38 t ha^{-1}. Only the use of the organic fertilizer OrganiQ significantly increased the harvest of wheat grains for 1.68 t ha^{-1}. Using organic fertilizer OrganiQ together with mineral fertilizer the grain harvest significantly increases – obtained 6.44 t ha^{-1}.

Table No.1

Productivity of the spring wheat, depending of the use of the fertilizers

Version	Harvest, t ha^{-1}	1000 grain mass, g	Volumetric weight, g l^{-1}
Without fertilizer	3.38	38.4	744
Organic fertilizer OrganiQ	5.06	41.3	761
Organic fertilizer OrganiQ + mineral fertilizer	6.44	41.7	755
RS 0.05	0.39	0.9	x

The use of fertilizers significantly increased 1000 grain mass, but there were no significant difference between the types of the fertilizer. The use of fertilizers increased also the volumetric weight of grains, however in general it is average.

The use of fertilizers significantly increased also other grain quality indicators. (Table No.2).

Table No.1

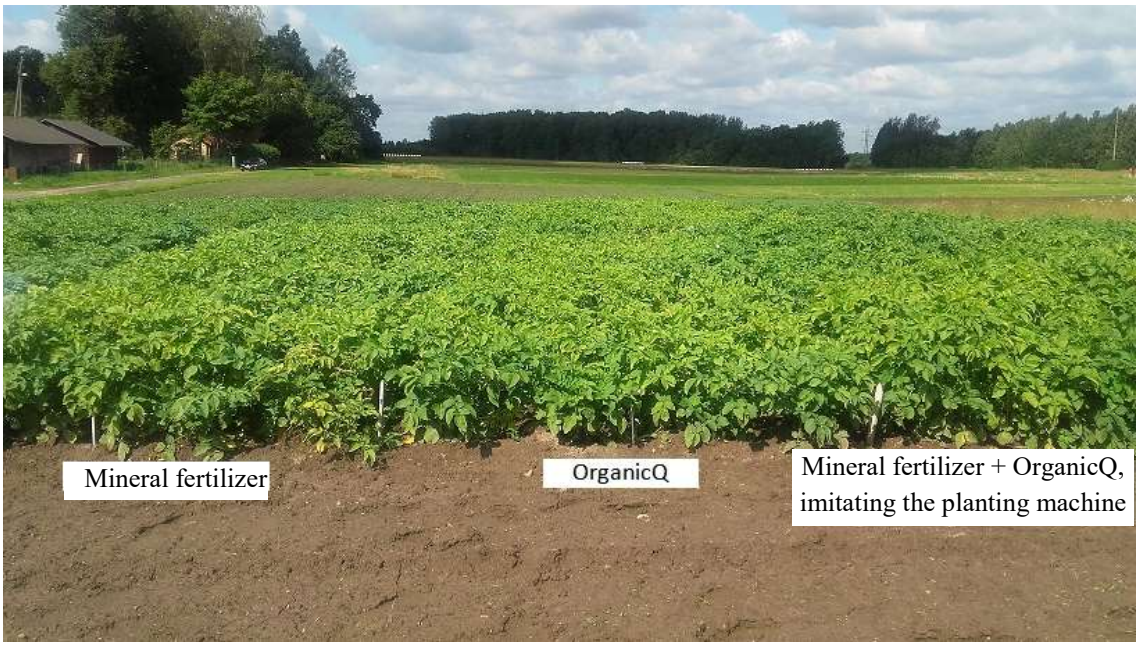
Quality of the spring wheat

Version	Protein, %	Glucose	Zeleny index	Starch, %
Without fertilizer	8.5	16.8	18.2	72.2
Organic fertilizer OrganiQ	12.5	25.9	44.4	67.6
Organic fertilizer OrganiQ + mineral fertilizer	12.4	24.0	41.3	68.0

Cultivating the spring wheat without use of fertilizers, the content of protein in grains is very low (8.5 %), the use of fertilizers significantly increased the content of protein accordingly up to 12.5 % (organic fertilizer OrganiQ) and 12.4% (organic fertilizer OrganiQ together with mineral fertilizer). The use of fertilizers significantly increased also other grain quality indicators

Potatoes

Similarly as to the wheat, also the growth and evolution of potatoes is affected by rich precipitation and relatively low ambient temperature during the period of vegetation. At the potato planting time (19th of May) were very favourable weather conditions, the soil was warm, the sprouts for potatoes appeared on the 6th of June. The cool weather delayed the development of the stalk rot, the first spraying was performed on the 7th of July (relatively late to other years). The development of disease in the planting was low up to medium. The long lasting rain period in August and September significantly affected the harvesting of potatoes and quality of tubers. In general was obtained a high potato harvest, however the proportion of the production of goods is only 80 - 84% from the total harvest (Table No.3). Most of the nonstandard tubers were rotten tubers. The rotting of the potato tubers was promoted by the increased humidity in the soil, as well as delayed harvesting due to rain.



Pic.6. Trial, 04.08.2017

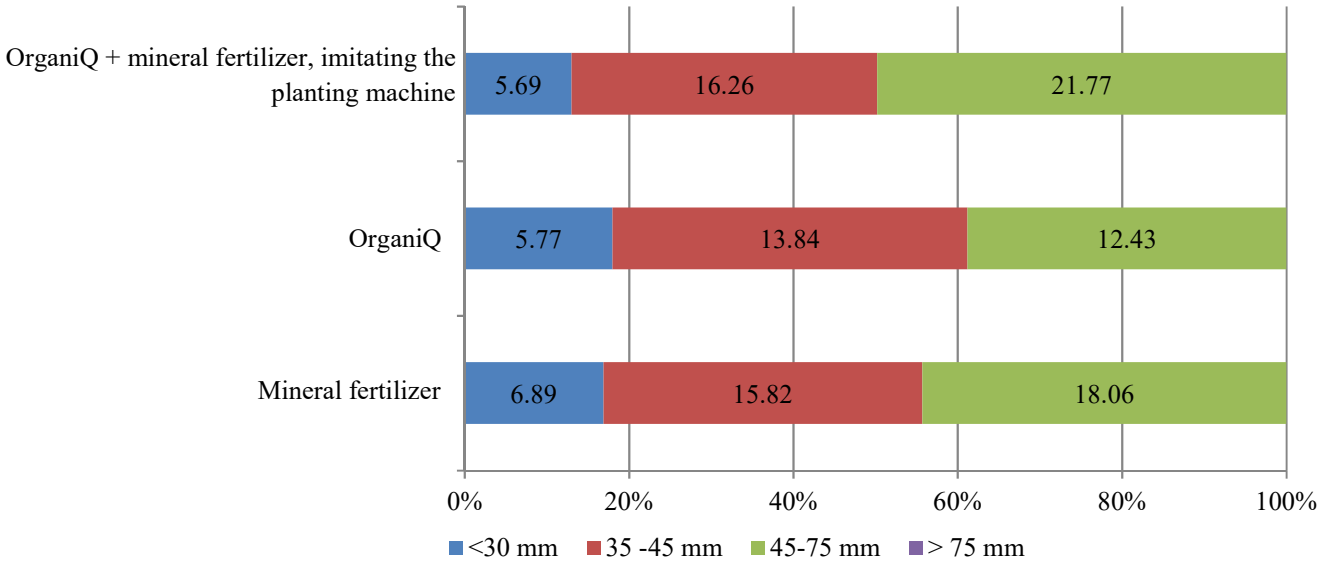
Cultivating the potatoes only with the organic fertilizer OrganiQ, which is embedded in the soil frustrated, there was obtained relatively low potato harvest – 32.84 t ha^{-1} or 26.27 t ha^{-1} of the production of goods. The use of mineral fertilizers provided 42.18 t ha^{-1} or 33.88 t ha^{-1} of the production of goods. Using the organic fertilizer OrganiQ kopā with mineral fertilizer, imitating the planting machine, the potato harvest grew up to 45.18 t ha^{-1} or 38.03 t ha^{-1} of standard production. In this version were significantly increased exactly the outcome of the production of goods in the harvest.

Table No.2

Potato harvest, t ha^{-1}

Versions	Total harvest, t ha^{-1}	Production of goods, t ha^{-1}	Production of goods, %
Mineral fertilizer	42.18	33.88	80
Organic fertilizer OrganiQ	32.84	26.27	80
Organic fertilizer OrganiQ + mineral fertilizer, imitating the combined planting machine	45.18	38.03	84
RS 0.05	3.66	3.59	x

The use of fertilizes and type of embedding affected the potato fraction distribution in harvest. The common use of the organic fertilizer OrganiQ and mineral fertilizers, imitating the planting machine, significantly increased the size of tubers, in this version there is significantly increased the proportion of tubers with a size of 45-75 mm.



Pic.6. The weight of potato fractions (t ha^{-1}) and distribution in harvest, %

Conclusion

1. The use of the organic fertilizer OrganiQ significantly increased the harvest of wheat in both versions – using it as a single basic fertilizer and together with mineral fertilizers, compared to the control version. The highest grain harvest was provided by the combined use of both fertilizers.
2. Cultivating the potatoes only with the organic fertilizer OrganiQ (embedded in the soil frustrated), the obtained harvest was lower than cultivating them with mineral fertilizer.
3. Using the organic fertilizer OrganiQ together with mineral fertilizer, imitating the potato planting machine, the total harvest of potatoes increases, but the increase of the harvest is not significant. However the use of this type of fertilizers significantly increased the outcome of the production of goods in the harvest.
4. The common use of the organic fertilizer OrganiQ and mineral fertilizer, imitating the planting machine, significantly increased the size of tubers, in this version there was significantly increased the proportion of tubers with a size of 45-75.

Used literature

1. Spring wheat ‘Robijs’ http://www.arei.lv/lv/vasaras-kviesi-robijs
2. Potatoes ‘Agria’ http://www.kartupeli.lv/lv/kartupelju-seekla-3799/zs-kalnaares-3936/agria-5573