Testing of a Fertilizing Plant Stimulator Vermesfluid in Potatoes

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Summary

The efficiencies of a natural fertilizer called Vermicompost and especially its leachate labelled as worm tea or Vermesfluid are studied herein. Vermicompost is an organic fertilizer originating in the earthworms' digestive systems. The substances and nutrients contained in the vermicompost are recovered in a liquid form and this leachate is used for crop-spraying. Within the research, the leachate was applied in field experiments to increase the yields of two potato varieties and the results were contrasted with the check samples. The data acquired in the course of the experiments point at the positive effects of the stimulator on the potato yields, especially in terms of higher total yields of tubers and yields of market size tubers.

Keywords: fertilizer, vermicompost

Introduction

Foliar fertilizers, auxiliary plant preparations and stimulators are used in potato growing in case of any plant nutrition insufficiencies, plant damage by frost or hail, or damage due to stress caused by low or high air temperatures and low moisture. Some preparations may influence the plants' intake of nutrients, water management, etc. In the market there are numerous preparations, particularly special foliar fertilizers, soil and plant-growth substances, growth controllers, growth stimulators, etc. Their choice primarily depends on the user; the most frequently applied are preparations on the base of growth hormones, humic substances, sea-weed preparations and many others. Naturally, the economic factor plays an important role too.

The characteristics of Vermesfluid

Vermesfluid is an auxiliary plant growth stimulator with healing effects. It is produced from an organic fertilizer in the form of vermicompost. Vermicompost is recovered using earthworms in a special composting method. The principle of vermicompost production, the so-called biohumus, is grounded in the capacity of earthworms to convert the taken-in organics in their digestive systems, from which they use 40% for their own metabolism and 60% for the generation of biohumus.

Earthworm biohumus is considered the most effective organic fertilizer. The most valuable ones are the finest humus fractions (up to 1mm), which are 60-70x more efficient than farmyard manure. Such a produced organic fertilizer has a high content of various stimulators, enzymes, humates and nutrients. The substances and nutrients subsequently yield into the liquid form designed for watering and spraying plant foliage. The preparation may be combined with other agents and fertilizers. In potatoes it is applied in a foliar manner and in the concentration of 3% solution in 400 l/ha (12 l/ha of Vermesfluid).

Field experiment set-up and conditions

The field experiments to test the Vermesfluid preparation were executed in 2012 in the potato-growing region of Valečov, Czech Republic, at the altitude of 460 metres, average temperature of 7°C and annual rainfall of 652 mm. The objective of the experiments was to test the efficiency of the preparation as for potato yields and their quality, compared to the check samples.

The preparation was applied on two cultivars. The first tested cultivar was Ditta (semi-early, market variety of cooking type AB); the second was David (semi-early variety for industrial processing, namely for potato starch).

Organic fertilization using 30 t/ha of manure within the experimental plots was executed on 7 November 2011 and autumn-plough followed.

The basic mineral fertilization of the plot was grounded in the soil analysis results, which had been sampled before starting the experiment. 2.5 q/ha of urea were applied, thus supplying 115 kg of N/ha. Next, a dose of 4.0 q/ha of Patentkali fertilizer was applied, corresponding to 120 kg of K_2O and 40 kg of MgO per one hectare. As sufficiently abundant in the soil, phosphorus was not supplied. This implies that the potato vegetation within the experimental plots was well and equally supplied by nutrients and did not suffer from any agricultural deficiencies.

As stated in the introduction, the application of auxiliary preparations is specific and their effectiveness and efficiency are proportional to weather conditions or the occurrence of climatic oscillations, which cause stress in plants.

In 2012 the spring soil preparation was accompanied by dry weather and temperatures typical rather for April. Unusually hot temperatures prevailed in the first decade of May, when the daily air temperatures reached almost tropical values of 29°C and the rainfall amounted to 36.7 mm. On the contrary, the second decade was cold and rather dry. The month of June was average, both as for the temperatures and rainfall. July was above-average, both as for the temperatures and rainfall. For example, the rainfall amounted to 147% of long-term average. August was above-average as for the temperatures and below average in terms of the rainfall. September was almost within the long-term average temperature and rainfall values.

Within the field experiment conditions, in 2012 the potato vegetation did not suffer from any significant climatic oscillations; some stress was caused by the drier period in August, when both the cultivars began to turn yellow and were close to the end of their vegetation season. Chart 1 shows the weather conditions during the vegetation season in contrast to the long-term average weather conditions in the region.

Vermesfluid was applied four times. At all the times of application the vegetation was in good condition, corresponding to the given growth phases. None of the applications within the plots was followed by a visible change in the state of the vegetation. Table 1 gives the dates of the individual applications and the descriptions of the vegetation conditions in both the cultivars at the time of application.

Experiment results

The harvest of the crops under experiment was executed on 1 October 2012. The yield within the experiment was very high; in both the varieties the tuber yields ranged from 55.1 to 58.5 t/ha. The yield results in both the varieties point at a trend of growing tuber yields if Vermesfluid has been applied (Chart 2). The increase in the tuber yield was at the level of 4%. The yield of Ditta variety tubers was 57.5 t/ha with Vermesfluid, while the check sample's yield was lower by 2.4 t/ha. The potato

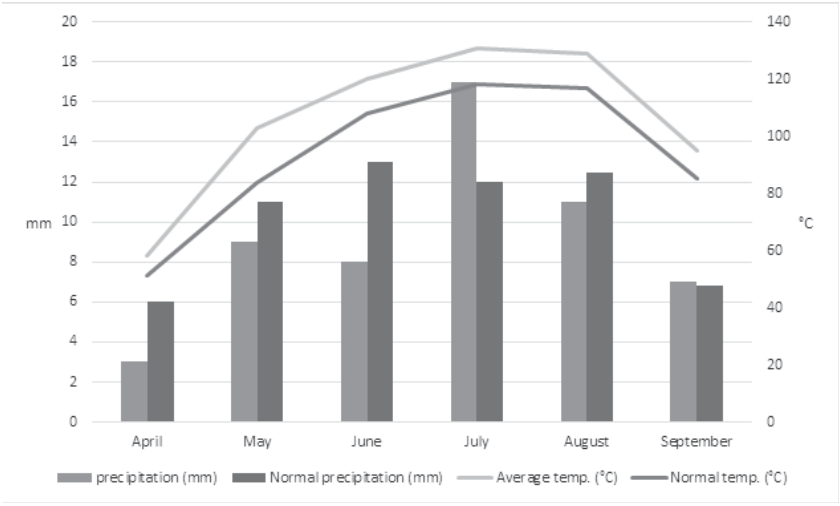

Chart 1. Monthly rainfall (mm) and average monthly air temperatures (°C) within the vegetation period 2012 and the long-term average (own measurements)

Wyk. 1. Miesięczny opad (mm) i miesięczna średnia temperatur (°C) w okresie wegetacji w 2012 i długoterminowa średnia (pomiary własne)

Tab. 1. Data on the experimental applications (note: in all the applications the water dose was 400 l/ha)

Tab. 1. Dane z eksperymentalnych aplikacji (uwaga: ilość wody przy każdej aplikacji wynosiła 400 l/ha)

Date of application	Dosage of Vermesfluid	State of vegetation during application	
7 June 2012	12 l/ha	**DITTA**	full emergence, tops height 10 - 15 cm
		DAVID	full emergence, tops height 10 - 15 cm
20 June 2012	12 l/ha	**DITTA**	formation of buds, tops height 55 - 60 cm, 85 - 90% closure
		DAVID	formation of buds, tops height 55 - 60 cm, 100% closure
2 July 2012	12 l/ha	**DITTA**	blossom, tops height 80 cm, 100% closure
		DAVID	blossom, tops height 80 cm, 100% closure
16 July 2012	12 l/ha	**DITTA**	end of blossom, tops height 80 - 85 cm, 100% closure
		DAVID	end of blossom, tops height 80 - 85 cm, 100% closure

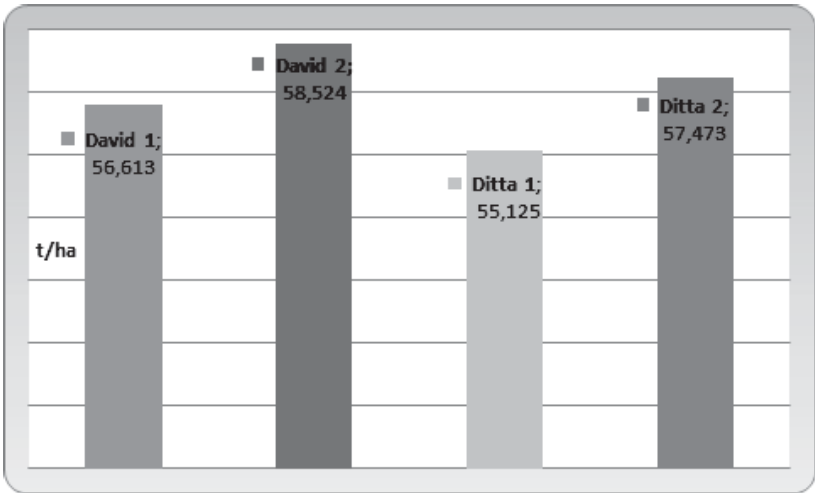

Chart 2. The effect of fertilizing on the tuber yields (t/ha)
(note: David 1, Ditta 1 – designation of check samples, David 2, Ditta 2 – variety samples with Vermesfluid

Wyk. 2. Wpływ nawozu na plony bulwy (t/ha)
(uwaga: David 1, Ditta 1 – nazwy prób kontrolnych, David 2, Ditta 2 – różne próbki z Vermesfluid)

Tab. 2. Tuber yields, percentage representation of the size ranges and average tuber mass

Tab. 2. Plony bulwy, procentowe przedstawienie zakresu rozmiarów i średniej masy bulwy

Variety	Sample	Size ranges (%)			Tuber yields in sizes (t/ha)			Average mass of one tuber (g)
		below 3.5 cm	3.5 - 5.5 cm	over 5.5 cm	below 3.5 cm	3.5-5.5 cm	over 5.5 cm	
DITTA	1	5.23	76.18	18.59	2.895	41.952	52.23	84.708
	2	6.27	80.02	13.7	3.602	45.977	53.872	72.455
DAVID	1	2.22	67.28	30.5	1.26	38.095	55.353	83.389
	2	2.8	68.02	29.19	1.637	39.773	56.888	81.414

Tab. 3. Starch content and yield in potato tubers

Tab. 3. Zawartość i plony skrobi w bulwie ziemniaka

Variety	Sample	Starch content (%)	Starch yield (t/ha)
DITTA	1	13.9	7.661
	2	13.7	7.854
DAVID	1	21.9	12.398
	2	21.7	12.719

variety for industrial processing, David, yielded 58.5 t/ha with Vermesfluid, which represented an increase of 1.9 t/ha, when compared to the check sample without Vermesfluid.

As for the percentages of tubers in the individual size ranges, we discovered that having applied Vermesfluid there was an increase in the yield of tuber size ranging from 35 to 55 mm in the variety 2 (Table 2). The increase was even more pronounced in the cultivar for cooking called Ditta, namely at the level of about 4%. Although there was a decrease in the mean mass of one tuber in both the cultivars, it may be stated that a steady production of tubers of the mean size category is important for the subsequent tuber processing for the market (washing, packaging, etc.). The experiment did not prove any influence of Vermesfluid on the starch content in the tubers in any of the cultivars (Table 3). The slight fluctuations in the starch content in both the cultivars cannot be attributed to the experimental applications of Vermesfluid. Therefore, the increase in the starch yield from one hectare must be related to the increase in the tuber yields in samples 2.

Conclusion

In conclusion, under the weather conditions and full and balanced plant supply with nutrients, the obtained results show the positive effects of the Vermesfluid preparation on the potato production. Based on the tests carried out so far, the positive trends manifest in the form of higher tuber yields and the overall yields of market size tubers.

The significance of the preparation under examination and its efficiency even grows in the cases of long plant stress due to weather, plant damage or deficiencies in nutrition. The economic effects are also apparent for the growers when Vermesfluid is used. Next, it is also possible to reduce the dosage of especially mineral fertilizers at maintaining or even increasing the yield and quality parameters of potato production. This way it is possible to save costs related to purchase, transport and application of fertilizers, at relatively low costs of purchase and application of Vermesfluid. From the ecological point of view, each drop in the input of nitrogenous mineral fertilizers reduces the risk of loading the surface and ground waters by nitrates, which is significant in the conditions of lighter and permeable soils, characteristic for the potatoes regions in the Czech Republic. The application of Vermesfluid in potatoes may also be of a considerable significance when there is a shortage of quality farm fertilizers, especially manure, for regular fertilizing of the land.

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Test środka wspomagającego uprawę roślin Vermesfluid na ziemniakach

W niniejszym artykule badamy wydajność nawozu o nazwie Vermicompost, w szczególności skupiając się na jego odciekach z takimi nazwami firmowymi jak Worm Tea czy Vermesfluid. Vermicompost to organiczny nawóz pochodzący z układu pokarmowego dżdżownic. Substancje i wartości odżywcze zawarte w vermicompost zostają odzyskane w postaci płynu i jako odciek stosowane są jako spryskiwacz. W obrębie badań odciek został zastosowany na eksperymentalnych polach w celu zwiększenia plonów dwóch rodzajów ziemniaków, po czym wyniki zostały skonfrontowane z próbami kontrolnymi. Wyniki otrzymane w trakcie badań wykazują pozytywny wpływ środka na plony ziemniaków, w szczególności w znaczeniu zwiększonych plonów i plonów ziemniaków standardowego rozmiaru.

Słowa kluczowe: nawóz, vermikompost