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THE BIOACTIVE PHC - PHYTOHORMONE - HUMIC ACID COMPOSITIONS OF THE SERIES TANDEM AND RESULTS OF THEIR LONG - TERM EFFECT ON PRODUCTIVITY OF PLANT PRODUCTION IN GERMANY

Plenary Talking Points

Система препаратов (Array) daRostim®TANDEM есть результат международной долгосрочной программы Tandem$^{12/21}$ (2012-2021) по улучшению биологических показателей плодородия почвы и создания стабтльного резерва биологического азота в почве. Особенность влияния препаратов daRostim®TANDEM базируется на комбинированном действии фитогормонов и гуминовых кислот (PHC-Tandem-echnologie второго поколения). Многолетние исследования и резульаты практического применения в рамках программы Tandem показывают: биологический азот в почве активируется, что приводит к смещению производственной функции в сторону увеличения урожая при параллельном сокращении норм вносимого азотного удобрения. Показатель BSI (биологический индекс почвы) растёт. В статье детально описываются результаты применения системы препаратов daRostim®TANDEM в Германии.*

The daRostim®TANDEM preparation system (array) is a development product of the international long-term program Tandem$^{12/21}$ (2012-2021) for increasing soil biological fertility and establishing a sustainable biological nutrient reserve in the soil. The particular specificity of daRostim®TANDEM is based on the combinatorial effect of phytohormones and humic acids (2nd generation PHC tandem technology). The studies and practical experience from the long-term trials of the tandem program indicate that the biological nitrogen in the soil is activated and thereby shift the production functions of the fields in the long term to higher yields with reduced nitrogen fertilizer use. The biological soil index BSI is sustainably improved. The article describes detailed practice results of preparation system daRostim®TANDEM application in Germany.*

Ключевые слова: PHC; фитогормоны; гуминовыекислоты; почва; биологический азот; производственные функции.

Keywords: PHC; phytohormones; humicacids; soil; biological nitrogen; production functions.

Introduction

The international long-term program Tandem$^{12/21}$ (2012-2021) and the two previous research projects Radostim A*B (2005-2008) and future$^{9/12}$ (2009-2012) have been investigating the potential of phytohormone-humic acid combinations (PHC compounds) since 2005 to increase soil biological fertility and to create a biological nutrient reserve in the soil. Since 2012, the preparation system (array) daRostim®TANDEM has been used. It is free of chemically synthesized active ingredients. The TANDEM array consists of 6 modifications,3 for spring application (leaf application) and 3 for autumn application (soil application). By the modular selection of the composition of humic acids with a mass fraction of 50 to 85 % of the organic substance and other plant-physiologically active components (natural plant hormone analogues, fatty acids, amino acids, polysaccharides) with a mass fraction of 0.01 to 0.07 % of the organic substance, the modifications are optimally adapted to specific arable area and their soil index AZ (Table 1.).

Table 1. The daRostim®TANDEM Array

daRostimTANDEM-Array	AZ: 20 to 40	AZ: 40 to 60	AZ: 60 to 80
leaf application(spring)	F30	F50	F70
soil application(autumn)	H30	H50	H70

All sixTANDEM modifications contain water with a mass fraction of about 90% as well as macro and micro elements (Table 2.):

Table 2. Content of macro- and microelements in the daRostim®TANDEM preparation system

Macro / microelements in dry matter,%			
sulfur	4,3	copper	0,0009
calcium	0,62	zinc	0,0004
manganese	0,016	molybdenum	<0,002
silicon	0,29	selenium	0,003
iron	1,03	boron	0,026
magnesium	0,134	cobalt	<0,002

daRostim® TANDEM can be used in all field crops. The application is done with the sprayer, in the spring solo or together with the first phytosanitary measure, in the fall after harvest and before the winter sowing or intercrop essential parts of the ground (<30-40 %) covered.The uniform dosage is 0.4 liters/ha. Twice a year - at the end of March and at the end of October - soil samples are taken from a depth of 0 to 30cm and examined for the parameters humus, air-nitrogen fixing bacteria and phosphor-mobilizing bacteria.

Results and discussion

The particular specific effectiveness of daRostim®TANDEM is based on the combinatorial effect of phytohormones and humic acids (2nd generation PHC tandem technology). According to our findings, it is mainly the phytohormone component in the PHC that makes it possible to obtain the genetic to maximize the yield potential of a variety optimally. Phytohormones control and regulate the growth of plants in all stages of development, e.g. in germination, growth, seed maturity, flower formation or leaf fall. They are the messenger substances that circulate between the plant tissue, transport information and trigger specific reactions. In a complex interaction, they also help the plant to adapt to changing environmental conditions (drought, temperature, soil pH) and to form its own antibodies against phytopathogenic microorganisms. Primarily, the applied PHC increase photosynthetic performance by helping to produce more and faster chlorophyll and form larger leaf areas. The total amount of assimilates produced per unit time increases and this "more" is used in a secondary regulatory effect depending on the growth phase, the climatic factors and the metabolic situation in the root area (nutrient availability, water) of the plant for optimal reproduction, so the yield. The soil bacteria also benefit from this assimilate redistribution. The mean concentration of air nitrogen-binding bacteria increased in 11 years on the 170 trial areas from 11 million CFU/g (2006) to 23 million CFU/g (2017), and for phosphomobilising bacteria from 1.5 million CFU/g to 9 Million CFU/g (Fig. 1). With the "more" of air nitrogen-binding soil bacteria, the working point of the biological-nitrogen part of yield in the YEN-chart shifts towards higher yields with less nitrogen fertilizer use, the production functions shift in sync, as exemplified by the results for two Farms with soil indexes AZ = 33 and 50 respectively (Fig. 2). As a result of the additional activation of soil biology by the PHC preparations, under the conditions of intensive cultivation in Germany on the 170 experimental areas an average yield increase of 13.7 CE was already established in 2016 with a simultaneous reduction of nitrogen fertilizer use by 26.2 kgN / ha. (Fig. 3) [1-4].The monetary effect from fertilizer saving and yield increase is very sustainable: 1 EUR PHC use beats conservatively (0.6 EUR/kg N, 10 EUR/CE) with 2 to 7 EUR profit, corresponding in the average with 153 EUR/ha profit (Fig. 4).

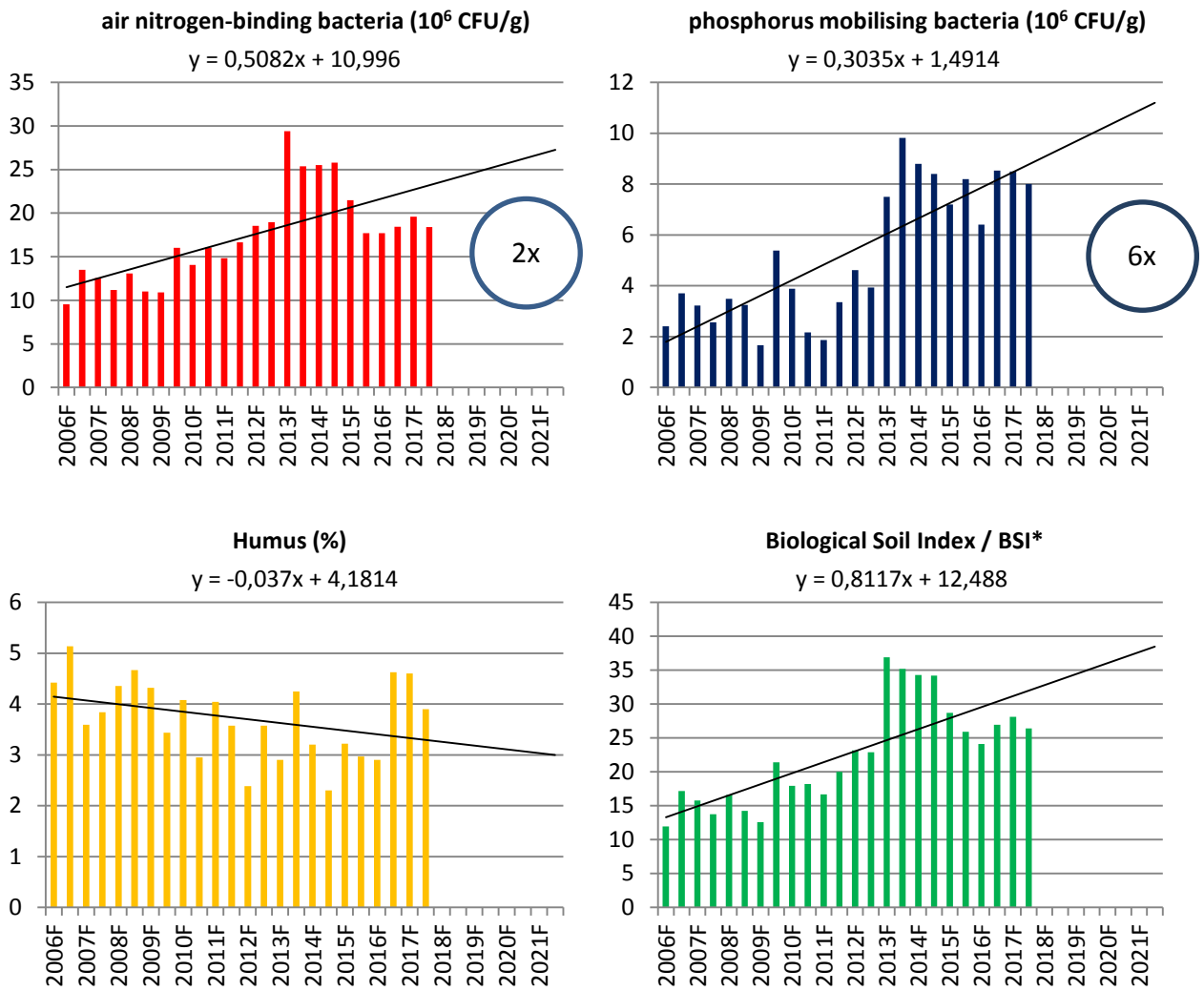

Figure 1. Change in mean biological soil parameters in 11 years (170 areas)

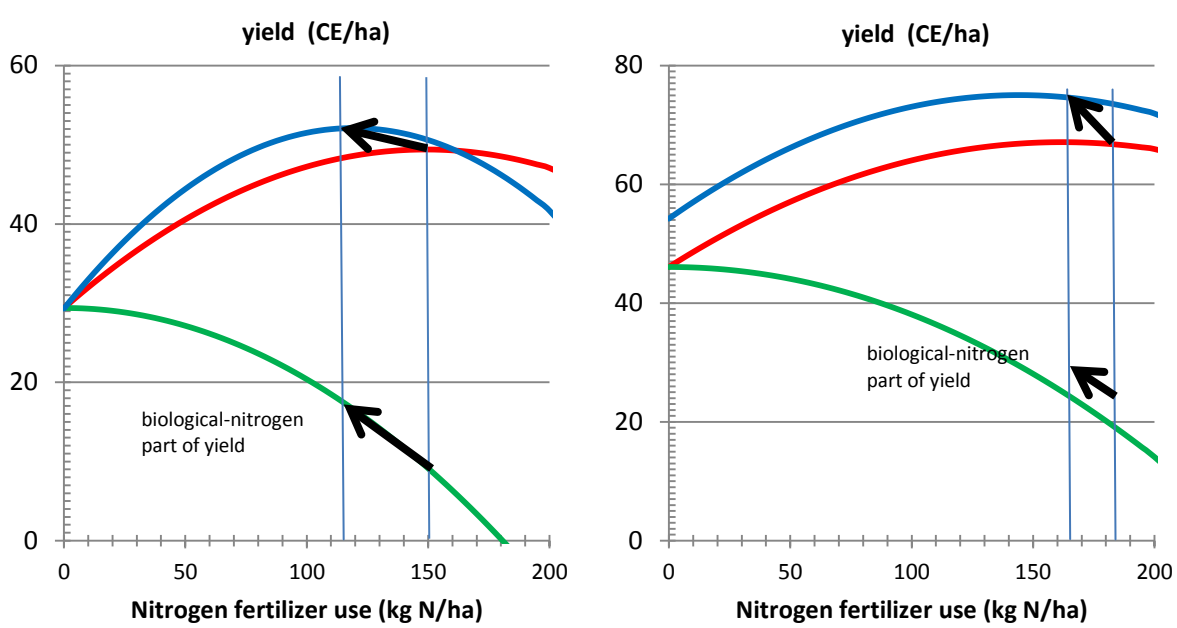

Figure 2. Change inproduction functions (average yield charts of 20 practice areas respectivelyfor 11 years)for two Farms with soil indexes AZ = 33 and 50respectively

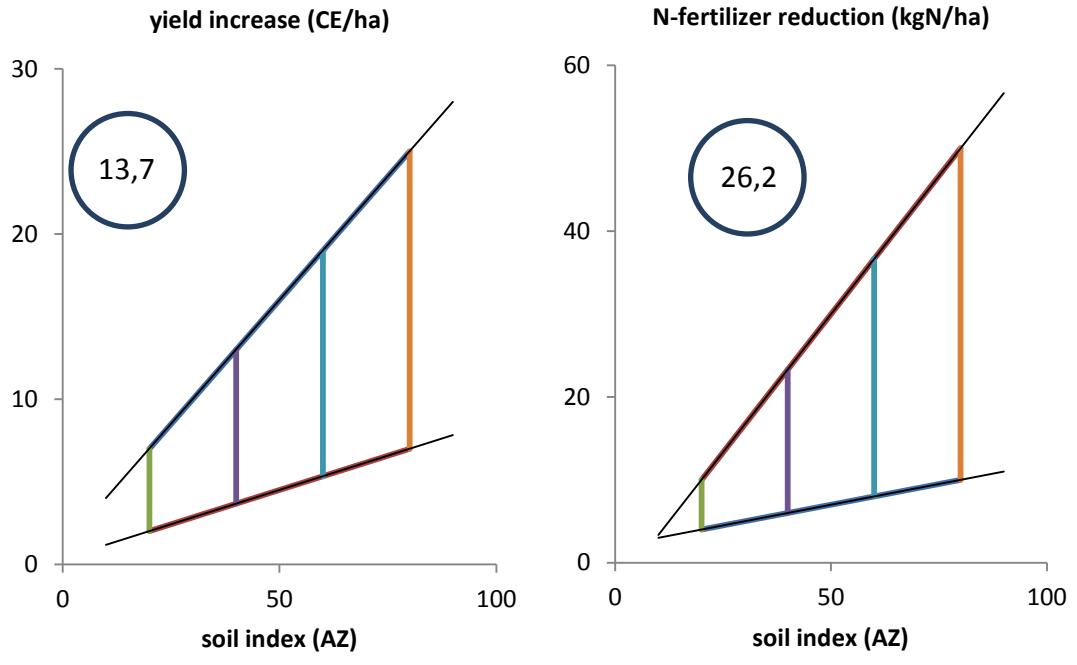

Figure 3. Practical sector for yield increase and nitrogen fertilizer reduction vs soil index sector

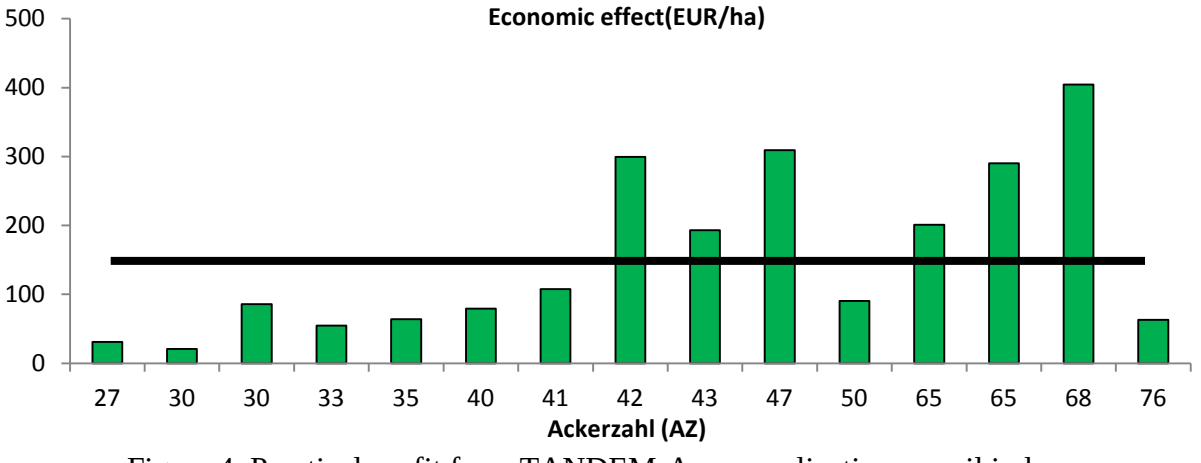

Figure 4. Practical profit from TANDEM-Array application vs soil index

References

1. *Новик В.* Актуальные результаты по улучшению показателей биологического плодородия почвы после применения фитогуминовой комбинации (PHCs) в рамках программы Tandem[12/21] (2012-2021) // Конференция daRostim 2014, Московский государственный университет им. М.В. Ломоносова, Россия, Москва, 2014. С. 255–264.
2. *Новик В.* Перспективы применения комбинации PHC - PHYTOHUMINCOMPOUNDS - как стандартной технологии для увеличения продуктивности сельскохозяйственных культур // Конференция daRostim 2015, Институт химии Коми НЦ УрО РАН, Россия, Сыктывкар, 2015. С. 112–121.
3. *Nowick W.* Results of the increase in productivity in crop production and the reduction of nitrogen fertilizer during the application of agricultural practice areas in Germany with a combination of plant hormones and humic acids (PHC) - in the program Tandem[12/21] // Конференция daRostim 2016 Одесский национальный университет им. И.И. Мечникова, Украина, Одесса, 2016. С. 160–161.
4. *Новик В.* Tandem[12/21] Международная многолетняя программа для обеспечения резерва биологического азота в почве и актуальность этой задачи для с/х и экологии Германии // Конференция daRostim 2017. Казахский национальный университет имени аль-Фараби, Казахстан, Алматы, 2017. С. 17–30.