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Economic evaluation of winter wheat leaf fertilization

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Abstract. *During the years 2006-2009 field experiment with winter wheat was held in the region of Stara Zagora. The object of study is the economic impact of leaf treatment with liquid fertilizer micro on productivity of winter wheat. Field experiment includes the following study options: control; fertilization with Wuxal Mikroplant; Wuxal Mikroplant and Kodiche applied in combination, Fertilider; Wuxal Copper. Foliar treatment with micro-fertilizer was made after booting, before inflorescence emergence, during intensive growth and development of plants, where the need for nutrients is the greatest. Economic analysis of the results show that the application of liquid fertilizers leads to low production cost. The cost of grain decreased to 40% of the control average for the period of study. It is therefore recommended for winter wheat, before inflorescence emergence to make leaf fertilization. Research shows that the introduction of micro-fertilizers 9 to 36 percent increase profitability compared to conventionally grown winter wheat.*

Keywords: winter wheat, leaf fertilization, yield, profitability.

Introduction

Fertilization with macro and micro fertilizers continues to be one of the main prerequisites for obtaining high and stable yields. A well balanced program that includes feeding sufficient quantities of all nutrients ensures a maximum degree of effective use of imported fertilizers (Samatlieva and Nikolova, 2008; Meyer-Aurich et al., 2010). This is important not only economically, but also from an environmental perspective. Proper application of fertilizers, adequate to the requirements of crops, on one hand, is a great investment, but also a guarantee for minimization of losses (Jamraiz et al., 2005; Ivanov and Plamenov, 2006; Khan et al., 2010). In improving the nutritional status during the growing season, wheat grain formed with higher protein levels, with better qualities. The purpose of this study was to compare yields and economic performance in winter wheat produced by the conventional system of farming in spring and foliar fertilization with micro fertilizers.

Material and methods

A study for establishing wheat productivity under the influence of leaf fertilization was conducted in the region of Stara Zagora during 2006-2009. Economic effects of foliar absorption of liquid micro fertilizers on the productivity of wheat was measured. According to the technological scheme, the standard for the region in spring wheat fertilization is done once 100 kg/ha of nitrogen in the form of ammonium nitrate. Foliar fertilizers were applied before the onset of inflorescence emergence in wheat at time of intense growth and development of plants, where the need for nutrients is greatest. In the experiment the following variants were examined:

1. Control - 100 kg/ha nitrogen, without application of foliar fertilizer.
2. 100 kg/ha nitrogen +Wuksal Mikroplant at a dose of 2000 ml/ha.
3. 100 kg/ha nitrogen+Wuksal Mikroplant + Kodiche- implemented respectively in combined doses Wuksal Mikroplant (1000 ml/ha) + Kodiche (2500 g/ha).
4. 100 kg/ha nitrogen +Fertilider at a dose of 4000 ml/ha.
5. 100 kg/ha nitrogen + Wuxal Copper at a dose of 2000 ml/ha.

Economic evaluation of the impact of leaf fertilization with different micro fertilizers was made after calculating the establishment of costs incurred in the cultivation of winter wheat. Material costs, production inputs are calculated after making card technology for growing winter wheat. Seeds, fertilizers, plant protection chemicals, micro fertilizers, transport, etc. were calculated at current market prices as at October 2009.

Economic analysis of the results was carried out by a system of indicators. Profit or net income (P) is calculated as the total production (PP) production costs are deducted (IP). The cost of production (C) was determined after separation of the production costs per hectare average yield obtained per hectare. Rate of return (PR) is determined by the formula (HP = P/PRh100).

Results and discussion

In terms of climatic conditions, temperature and rainfall, the years of study are characterized by average air temperatures close to the data for former period (1930-2006) (Figure 1a). Only January shows that the rate at 0.9 °C during the two years of study this month is characterized by significantly higher average values 3.5 and 4.5 °C. The observed period was significantly different in their amount and distribution of rainfall (Figure 1b). The first year of study during the autumn-winter period, precipitation is less but in quantities sufficient to provide adequate moisture for germination. Prevailing rainfall during the spring period, the period of ear of wheat. The amount of rains in the second crop year has contributed to better soil moisture during the first stage of wheat organogenesis. In winter-spring period sufficient moisture retaining soil remains as a result of the fallen rain during the previous period. Elongation, booting wheat and ear of betting take place under optimum moisture and temperature conditions.

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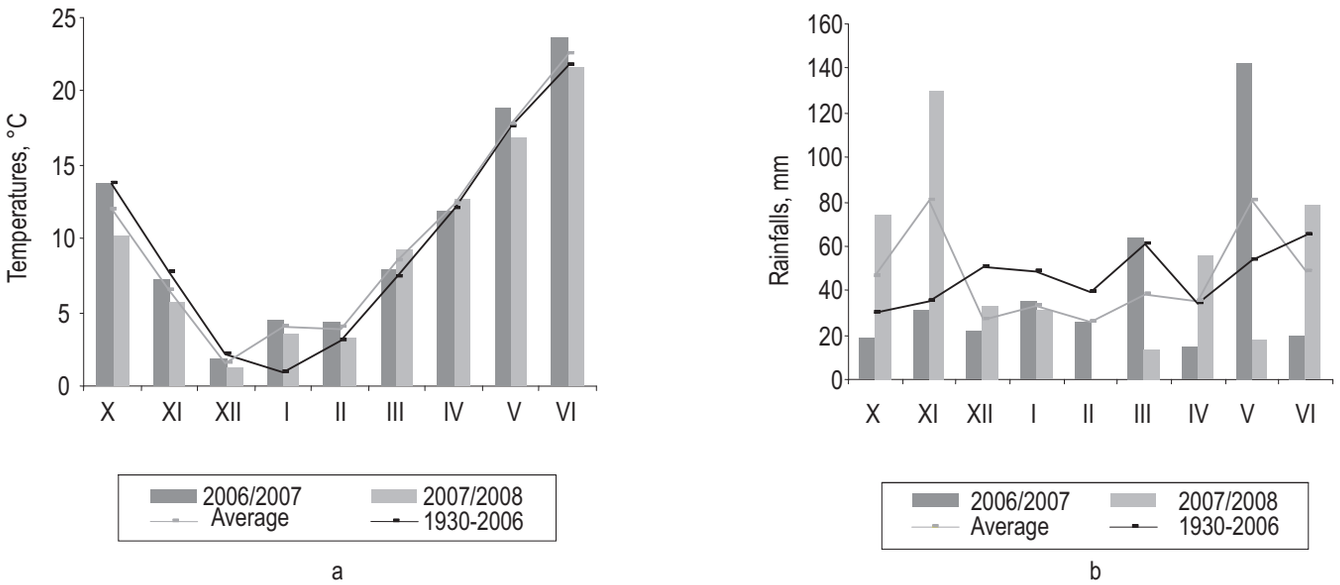

Figure 1. Temperatures (a) and rains (b) during the period October-June in Stara Zagora

Interaction between micronutrients and leaves of wheat were reported to have significant effect on quantitative and qualitative composition of the grain. As a result of leaf fertilization with iron, copper, zinc, manganese, sulfur, molybdenum and other nutrients, the wheat production increased. The results presented in Tables 1 and 2 show that during the two years of field experiments better interaction was obtained by combined application of both leaf and micro-fertilizer Wuksal Mikroplant and Kodiche. The total output for this option, average years of study in 1299 estimated at lv/ha (Table 3). Fertilization with Wuxal Copper also resulted in obtaining better results - 1224 lv/ha. Despite the wide array of nutrients, implementing Wuksal Mikroplant alone led to lower results. This is also seen with rich components Fertilider. In these foliar fertilization fertilizer total production is higher than the control values (755 lv/ha).

Despite the realities faced by agriculture - low purchase prices, rising commodity prices, the results of this study indicate that it is justified to invest in production of wheat. Economic analysis of revenue and expenditure in individual variants of growing winter wheat provides interesting solutions. The production cost of traditional systems are smaller, but after marketing the production

Table 1. Economic efficiency of leaf fertilization in crop year 2006 /2007

Variants	Yield, kg/ha	Statistical significance to Control	Gross output, lv/ha	Production costs, lv/ha	Profit, lv/ha	Cost, lv/kg	Rate of profitability, %
1	3075	-	707.25	920.00	-212.75	0.30	-23
2	5443[a]	+++	1251.89	962.80	289.09	0.18	30
3	5723[a]	+++	1316.29	957.10	359.19	0.17	38
4	4560[b]	++	1048.8	959.20	89.60	0.21	9

LSD, P<0,05=755.7 kg/ha, LSD, P<0,01=1086.8 kg/ha, LSD, P<0,001=1598.4 kg/ha
*Differences among the variants, mentioned by letter statistically significant at P<0,05 if with a different letter

Table 2. Economic efficiency of leaf fertilization in crop year 2007/2008

Variants	Yield, kg/ha	Statistical significance to Control	Gross output, lv/ha	Production costs, lv/ha	Profit, lv/ha	Cost, lv/kg	Rate of profitability, %
1	3493	-	803.39	920.00	-116.61	0.26	-13
2	4962[a]	+	1141.26	962.80	178.46	0.19	19
3	5571[a]	++	1281.33	957.10	324.23	0.17	34
4	5323[a]	++	1224.29	962.60	261.69	0.18	27

LSD, P<0,05=1186.5 kg/ha, LSD, P<0,01= 1796.7 kg/ha, LSD, P<0,001= 2886.4kg/ha
*Differences among the variants, mentioned by letter statistically significant at P<0,05 if with a different letter

Table 3. Economic efficiency of leaf fertilization – average

Variants	Yield, kg/ha	Gross output, lv/ha	Production costs, lv/ha	Profit, lv/ha	Cost,lv/kg	Rate of profitability, %
1	3284	755.32	920.00	-164.68	0.28	-18
2	5203	1196.69	962.80	233.89	0.19	24
3	5647	1298.81	957.10	341.71	0.17	36
4	4560	1048.8	959.20	89.60	0.21	9
5	5323	1224.29	962.60	261.69	0.18	27

and calculation of all economic indicators show that net income after the additional placement (leaf fertilizer) ranged from 90 to 243 lv/ha compared to the conventional method of cultivation. The results of the control variant were negative(Figure 2). Production of wheat, carried out without feeding in spring is not profitable.

After a detailed economic analysis indicators show that spring fertilization with leaf fertilizers has contributed not only to obtain higher yields. The products are characterized by lower cost. Average cost for the period of wheat grown in the conventional system of farming practices is 0.28 lv/kg. Application of liquid fertilizer in all variants reduced to varying degrees the cost of production. After fertilization combined with rich trace elements and fertilizers Wuksal Mikroplant and Kodiche, the cost of grain has decreased by nearly 40% compared to the control variant (0.17 lv/kg). Liquid fertilizer

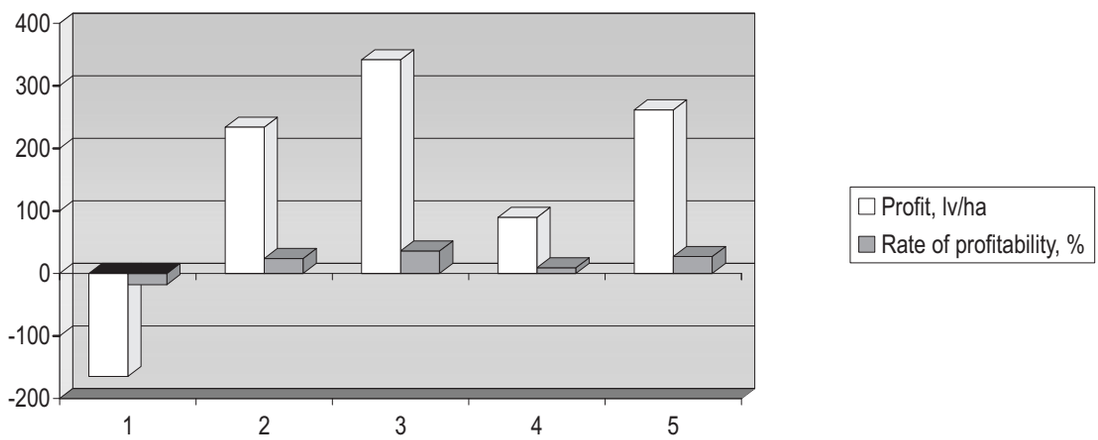

Figure 2. Profit (lv/ha), and rate of profitability (%) in winter wheat, spring made after leaf feeding with fertilizers, average for the period of study

effect ranged from 25 to 36% on average for the period. In the first year profitable production of wheat in the second and third option was increased to 30 and 38 percent rate of return. Next year there is stabilization of high yields in spring feeding with a combination of two liquid fertilizers (34% rate of return). Spring root out nourishing with liquid micro-fertilizers increased profitability from 9 to 36% on average for the period.

Conclusion

Application of liquid fertilizers, enriched with different macro and micro nutrients increased wheat productivity and leads to decreasing the production cost by 40%. The rate of return increased from 9 to 36% after treatment of winter wheat with liquid manure prior to the occurrence of inflorescence emergence.

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