Cultivation of faba bean in mixtures with naked oat in organic agriculture

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INTRODUCTION

Organic agriculture in Poland has strong possibilities of development, due to low level mineral fertilizers as well as pesticides and less intensive character of agriculture production than in West European countries. Dynamically developing organic agriculture has been observed over the recent years in malopolskie, świętokrzyskie, lubelskie and podkarpackie province, which are naturally predisposed for this system of farming. This fact has been confirmed by the 6% growth in the number of organic farms as compared with 2004. In 2005 the total number of organic farms in the Malopolska area was 1117, whereas in Poland it reached 7183. In 2005 the number of organic farms increased by 91%. In comparison with 2004, whereas in relation to 2003 over three-fold increase was registered in the number of farms using ecological methods of production (Fig.1a, 1b). The asset of organic agriculture development in the discussed province is a greatly numerous farmer population, low cost of labour force, low degree of intensification and chemical use in agriculture and low pollution of the natural environment. Faba bean (Vicia faba ssp. minor) is plant with high potential of yielding and cultivation of faba bean gave advantageous effect to physical and chemical as well as phytosanitary property of soil and for this reason is a good link in cereal crop rotation. Especially interesting is examined usefulness of cultivation of faba bean in mixture with naked oat.

Fig. 1. Number of organic farms in Malopolska (A) and in Poland (B)

MATERIALS AND METHODS

Field experiment was conducted in 2006 (first stage of research) at the Experimental Station located in Prusy, near Krakow on the degraded chernozem soil formed from loess, very good wheat complex. The following factors were examined: cultivars – ‘Optimal’ (determinate) and ‘Olga’ (traditional-zero tannin), the method of sowing – faba bean in pure sowing and in mixtures with naked oat ‘Polar’. The experimental objects were: 1) faba bean ‘Olga’ pure sowing (50 seeds per m²), wide row spacing (50 cm), mechanical cultivation; 2) faba bean ‘Optimal’ pure sowing (70 seeds per m²), wide row spacing (50 cm), mechanical cultivation; 3) oat ‘Polar’ pure sowing (500 seeds per m²), row spacing 12.5 cm; 4) mixture I-25% ‘Olga’ + 75% ‘Polar’; 5) mixture II-50% ‘Olga’ + 50% ‘Polar’; 6) mixture III-75% ‘Olga’+25% ‘Polar’; 7) mixture IV-25% ‘Optimal’ + 75% ‘Polar’; 8) mixture V – 50% ‘Optimal’ + 50% ‘Polar’; 9) mixture VI – 75% ‘Optimal’ + 25% ‘Polar’.

RESULTS

The seed yield was in the range of 1,33 – 3.08 t ha⁻¹ in the 2006, and of 2,11–4.27 t ha⁻¹ in the 2007. In 2006 the year the highest average yield of seeds noticed for mixture M1. In pure sowing yield amount to 1,85 t ha⁻¹ for faba bean ‘Optimal’, 1,33 t ha⁻¹ for ‘Olga’ and 2,47 t ha⁻¹ for oat ‘Polar’. Mean yield for all experimental object was 2,54 t ha⁻¹. The yield of seeds in 2007 was significantly higher, than 2006. Cultivar Olga cultivated in the 2007 in pure stands yielding better than Optimal. Content of total protein in the oats grains was various and depend of composition of mixtures or pure sowing.

Total protein content in seeds (2006) was in the range 12,98 (oat in pure sowing) – 14,66 (in mixture with Optimal /M6/). After convert to kilograms worth for faba bean ‘Olga’ amount to 382 kg ha⁻¹, for ‘Optimal’ – 509 kg ha⁻¹ and for ‘Polar’ – 273 kg ha⁻¹. The highest yield of protein receive in mixture III – 588 kg ha⁻¹.

In the period of maximum development of leaf area the LAI index ranged between 1,74 (Polar) and 2,63 (M6) in the 2006, and between 3,13 (Optimal) and 4,0 (M6) in the 2007. Unfavorable meteorological conditions (drought) in the 2006 inhibited plant growth and cause decrease yield of seeds.

LITERATURE:
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Fig. 3. Leaf area index (LAI)

Fig. 4. Rainfall in Prusy in vegetation period in 2006 and 2007 on the background of many years average (1961-1980)

Fig. 5. Rainfall in Prusy in vegetation period in 2006 and 2007 on the background of many years average (1961-1980)

Fig. 6. Rainfall in Prusy in vegetation period in 2006 and 2007 on the background of many years average (1961-1980)

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CONCLUSIONS

1. Meteorological conditions strongly modified yield of faba bean cultivars. In drought years 2006 higher yield of seeds gave the determinate cultivars Optimal, while in 2007 better yield indeterminate cultivar Olga.

2. In 2007 increase of share faba bean in mixture has positive affect on the level of seeds yield of mixtures, while in critical drought year (2006) that affect was not pronounced.

3. Values of LAI index were depend on the vegetation season, cultivars and percentage share of faba bean in mixtures.