

ENGLISH VERSION

ZESZYTY 394

Małgorzata Haliniarz

The response of selected agrophytocoenoses to different doses of biologically active substances of herbicides

Rozprawy Naukowe UP w Lublinie 394, Lublin 2019, ss. 207

Weeds are an inseparable element accompanying agricultural crops, adversely affecting the growth, development and yield of crop plants. The main treatment that eliminates unwanted vegetation from a crop is to use plant protection chemicals which, though showing high efficacy, cause negative environmental effects. Therefore, out of concern for the natural environment and striving to protect agricultural produce against contamination with biologically active substances, integrated plant protection principles are promoted, which combine ecological aspects and production profitability. To this end, technologies designed to use reduced herbicide rates are developed, while herbicide efficacy can be further enhanced by adding adjuvants.

The aim of the study was to determine the effect of some biologically active substances of herbicides applied at different rates alone or in combination with an oil adjuvant on weed infestation as well as on the morphology, seed production, dry weight and seed germination of weeds found in faba bean, potato, maize, winter wheat, and spring barley. Crop yield, crop structure and architecture, yield structure, and some quality characteristics were also evaluated.

Materials and methods. This study was conducted from autumn 2010 to 2014 in the Czesławice Experimental Farm belonging to the University of Life Sciences in Lublin (51°18'23"N 22°16'02"E). The objects of the study were the following five crop plants: faba bean (cv. 'Titus'), potato (cv. 'Satina'), maize (cv. 'DKC 2971'), winter wheat (cv. 'Natula'), and spring barley (cv. 'Suwerek'). Sugar beet was the previous crop for all crops. The experiment was established on a loess-derived luvisol classified as good wheat soil complex and soil class II. The experiment was set up in a split-block design in three replicates. One herbicide treatment was performed in each crop. All herbicides were applied at manufacturer's recommended rates and at rates reduced by 33 and 50%. In faba bean, pendimethalin was applied (Stomp 330 EC), in potato – rimsulfuron (Titus 25 WG), in maize – nicosulfuron (Innovate 240 SC), in winter wheat – chlorotoluron (Lentipur FLO 500 SC), in spring barley – MCPA, dicamba (Chwastox Turbo 340 SL). Each herbicide was applied alone and with the addition of an activating oil adjuvant – Atpolan 80 EC (paraffin oil) – at a rate of 1.5 l ha⁻¹. Plots without herbicide and adjuvant application were the control treatment.

Based on an evaluation of many parameters of crop plants and weeds, it was proven that application of reduced herbicide and adjuvant rates in different agrocoenoses is justified. A significant and innovative element of this research was to estimate the seed production of segetal flora and the germination capacity of diaspores produced by it under different herbicide protection conditions, that is, the characteristics that affect potential weed infestation in the field in next years. A comprehensive analysis of agrophytocoenoses fills the gap in research in the area of herbology and forms the basis for formulating valuable recommendations for agricultural practice. Study showed that in narrow-row cultivations (winter wheat, spring barley) the herbicide rate can be reduced by even 50% in particular if the herbicide is applied together with an adjuvant and by 33% if used without or with an adjuvant. Such practices do not negatively affect the productivity and quality parameters of crops. Furthermore, in such case weeds occurring in the crop are characterized by relatively low seed production, very frequently not significantly differing from the plants' seed production, which are treated with the full dose of the plant protection product. Thus, application of reduced herbicide rates in these crops does not result in a significant increase in the soil seed bank and does not contribute to greater weed infestation in the field in next years. In such crops as faba bean, potato and maize the application of reduced doses of herbicides has a much higher risk. Good weed control effects, regardless of weather conditions, can be achieved by applying herbicide recommended rates by the manufacturer and a 67% rate in combination with an adjuvant. They ensure a reduction in the number and dry weight of weeds as well as the maintenance of crop productivity at the same level as when the manufacturer's recommended herbicide rates are applied. Weeds occurring in these crops are characterized by significantly higher seed production, biomass and reproductive effort than the same species growing in dense cereal crops. When reduced herbicide rates are applied, some weed species produce many more generative organs than in unweeded plots, whereas the number of diaspores produced under such conditions is many times higher than in plots sprayed at manufacturer's recommended rates. Moreover, diaspores of most of the weed species in question collected from the plots sprayed with the reduced herbicide rates exhibited a greater germination capacity than those obtained from the plots treated with the manufacturer's recommended rates. Over the long term, it results in an increase in the soil seed bank and greater weed infestation in the field.