

The response of naked and husked spring barley grown in short-term monoculture to different herbicide rates and catch crop

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The aim of this study was to determine the possibility of reducing rates of herbicides applied in combination with adjuvant, at the same time introducing a catch crop in the form of white mustard, in short-term monoculture of naked and husked barley. Existing research has not investigated the combined effect of catch crop and reduced herbicide rates on yield, weed infestation, plant health, and chemical soil properties in the cultivation of two forms of spring barley grown after itself. Also, no study has been conducted on the economic profitability of combined application of the agronomic practices in question.

A three-year field experiment was carried out on a mixed rendzina soil with the grain-size distribution of sandy loam and classified as very good rye soil complex. Spring barley was grown after itself. The study included the following experimental factors: spring barley form (husked and naked), stand regeneration by ploughing in a catch crop during the autumn period (treatment without catch crop, white mustard stubble crop), and herbicide rate (control treatment – without herbicide protection, herbicides applied at the recommended rate, 75% of the recommended herbicide rate + adjuvant, 50% of the recommended herbicide rate + adjuvant). The major barley crop and yield components, grain, straw and protein yield, total grain protein content, weed infestation, infection of plants by a complex of pathogens causing stem base diseases, and selected soil chemical properties were evaluated in this study. An evaluation was also made of the economic profitability of the specific agronomic treatments used in spring barley cropping, which were the subject of this research.

This study showed that a lower grain yield is obtained from the naked barley variety compared to the husked variety. This is mainly due to significantly lower plant density after emergence and number of ears per 1 m² as well as by greater susceptibility to weed infestation and infection by a complex of fungal pathogens damaging the stem base. The unquestionable advantages of the naked form include a higher protein yield and a higher grain protein content. With increasing duration of the barley monoculture, both these barley forms respond with a gradual decline in grain yield, but this can be seen to a greater extent in the naked variety. This is evidence of its greater sensitivity to its cultivation in monocultural stands.

The introduction of a white mustard catch crop beneficially affects spring barley grain and straw yield. The higher yield after the ploughing-in of the catch crop is associated with the positive impact on most of the yield and crop components as well as with reduced weed infestation and stem base infection. Under these conditions, the total grain protein content and the protein yield are higher than in the treatment without a regenerative crop. The introduction of a catch crop also results in an increase in the soil content of organic carbon, phosphorus, potassium and magnesium as well as in an increase in the C:N ratio. The ploughing-in of the catch crop compensates only partially for the negative effects of the cultivation of barley after itself, because it was proved that with increasing duration of the monoculture there was a gradual decrease in grain yield, but it was more evident when no catch crop was used.

Compared to the control treatment, all herbicide rates resulted in a statistically proven increase in grain and protein yield. But no significant differences were found in barley yield after application of the full rate and the rate reduced to 75% applied in combination with adjuvant. In both these treatments, most of the yield and crop components also reached similar values. The evaluation of weed infestation of the spring barley crop revealed that all the herbicide rates applied proved to be effective in reducing the number and dry weight of weeds. It was also demonstrated that application of the herbicides at the recommended rate and at the reduced rate in combination with adjuvant reduced the numbers of *Avena fatua*, the dominant species in the barley crop, but the treatment using the rate reduced by 50% was not very effective in controlling this species.

In the case of both forms of spring barley, from the economic point of view it is most effective to use in barley cultivation a catch crop to be ploughed in, with simultaneous in-crop weed control by applying the recommended rate of weed-killing agents or similarly the rate reduced by 25% applied in combination with adjuvant.

The obtained study results demonstrate that it is justified to reduce herbicide rates (at least by 25%) under the conditions of combined herbicide application with adjuvant and after ploughing in a catch crop in short-term monoculture of spring barley. It was shown that in such case it is possible to obtain satisfactory production effects and economic profitability. Therefore, the introduction of a catch crop can compensate for a loss in crop yield and agricultural profit, resulting from the reduction in rates of weed-killing agents. This is of great practical importance, particularly when the farmer's obligation is to apply integrated crop protection principles, including reducing the use of herbicides to the minimum necessary.