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Study of pesticide side-effects in winter wheat trials

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ABSTRACT Wide range of wheat varieties were investigated in field trials and greenhouse, to study the different side-effects of herbicides and fungicides. Side-effects of seed dressings were more characterized on the wheat varieties with a short vegetation period, than for those with a longer one, both in the intensity of germination, dry matter accumulation and yield production. The depressive side-effects of herbicides were also in a close connection with the genotypes. Spraying with triazole fungicides increased the yield and inhibited the senescence of flag leaf with a protracted chlorophyll retention. **Acta Biol Szeged 46(3-4):207-208 (2002)**

KEY WORDS

wheat
fungicide
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seed treatment
side-effect

The influence of pesticides on the yield can be attributed to two factors. In addition to their primary fungicide or weed killing effects often they have physiologically advantageous or depressive side-effects. Bruck et al. (1984) observed in field experiments a delayed senescence caused by benzimidazoles in pathogen free plant population. The preventive application of triazole fungicides resulted in a yield increase of 5-10% even when no fungal infection occured later, which is an indication of a cytokinin-like effect of these compounds (Stevens and Palmer 1980). Spraying with Propiconazole inhibited - also irrespective of pathogen infection - the senescence of flag leaf of wheat, sustained the photosynthesis per chlorophyll unit and resulted a significant surplus yield (Kettlevell et al. 1982). Paclobutrazol reducted the height, fresh weight and ABA levels of wheat seedlings (Buta 1991) and protected them from injury due to heat, paraquat (Kraus, 1994) and waterlogging (Webb 1996). Triadimenole and triticonazole, applied as seed treatments at various rates affected plant growth, shoot development and root axis production (Montfort 1996). The overdose sprayings of 2,4-D herbicide could reduce the yield by 8-20 % (Fajerson 1958; Dial 1991). Taking into consideration that the main and additional activity of the chemicals works simultaneously during croping, it seems to be reasonable to seek their resultant effect for each variety tested.

Materials and Methods

Several wheat varieties were investigated in 3-5 years field trials (1991-2001) on meadow chernozem soil and in greenhouse. The plants were treated with the different pesticides at doses suggested by the producers or at doubled (provocative) rates. Random block design field experiments with 4 repetitions were carried out on 10-20 m^2 plots. Plants were grown in greenhouse soil or sand cultures, irrigated daily with water or modified Hoagland's solution. Treatments were carried out on seed samples or plants vernalized for 40 days (8/4°C). The plants were sprayed at the appearance of 1st and 2nd node as well as before shooting.

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Results and Discussions

Comparing the field and laboratory results we concluded that growth in juvenile stage (both root stimulation and shoot retardation) can be effected by seed treatment with plant growth regulators and fungicides. This may have, however, both advantageous and disadvantageous effects. In our study the seed coating with CCC had a negative effect (delayed emergence, yield decrease) on plants, which is in disagreement with the observations of Zadoncev et al. (1977). In the average of 3 years only one cultivar yielded significantly better when treated with gibberellic acid. Triadimenole and Carbendazime as well as their combination were studied as seed treatments, too. They caused delayed emergence and decrease of plant density on the varieties tested, which resulted in different yielding reaction of the genotypes. The main growth regulatory effects were reductions in length of the coleoptile, the first 2 leaves and the subcrown internode. Other triazole fungicides indiced various beneficial and deleterious effect on growth and development, but the magnitude of deleterious effects was less with any other triazole than with triadimenol. The side-effects of seed dressings were more characterized on the wheat varieties with a short vegetation period, than for those with a longer one, both in the intensity of germination, dry matter accumulation and yield production. This reaction should be tested for each variety in order to be able to improve the market value of the seeds.

The application of hormone-like (2,4-D, MCPA, Dichloroprop) herbicides had productivity improving or depressive side-effects depending on the genotypes under field conditions. This was proven also under controlled conditions. Herbicides combined with retardants (Dicamba) caused the most significant yield decrease in those genotypes, the productivity of which could be improved by synthetic auxins. The disadvantageous side-effects of herbicides manifested themselves in simple visual symptoms (head deformation, leaf burning) and in the change of certain production characteristics such as plant height, number of heads, thousand grain weight. The depressive side-effects could be characterized first of all by the relative yield decrease of different varieties.

Spraying with triazole-fungicides increased the yield and inhibited the senescence of flag leaf with a protracted chlorophyll retention depending on the genotype. Under the effect of triazole treatments the chlorophyll content of flag leaf measured during the grain filling as well as thousand grain weight changed considerably, which often cannot be explained by the fungicidal effect.

Summing up: Physiological side-effects of pesticides on different varieties should be continuously tested for purposes of both breeding and improvement of technology. Since the results may influence large scale field application of these chemicals, this analysis of variety-specific effects may be of importance for management practice as well.

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