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Influence of Dryer Autumn Conditions on Weed Control Based on Soil Active Herbicides

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Abstract : An appropriate weed management in autumn is a prerequisite for an economically successful harvest in the following year. In Luxembourg oilseed rape, wheat and barley is sown from August until October, accompanied by a chemical weed control with soil active herbicides, depending on the state of the weeds and the meteorological conditions. Based on regular ground and surface water-analysis, high levels of contamination by transformation products of respective herbicide compounds have been found in Luxembourg. The most ideal conditions for incorporating soil active herbicides are single rain events. Weed control may be reduced if application is made when weeds are under drought stress or if repeated light rain events followed by dry spells, because the herbicides tend to bind tightly to the soil particles. These effects have been frequently reported for Luxembourg throughout the last years. In the framework of a multisite long-term field experiment (EFFO) weed monitoring, plants observations and corresponding meteorological measurements were conducted. Long-term time series (1947-2016) from the SYNOP station Findel-Airport (WMO ID = 06590) showed a decrease in the number of days with precipitation. As the total precipitation amount has not significantly changed, this indicates a trend towards rain events with higher intensity. All analyses are based on decades (10-day periods) for September and October of each individual year. To assess the future meteorological conditions for Luxembourg, two different approaches were applied. First, multi-model ensembles from the CORDEX experiments (spatial resolution ~12.5 km; transient projections until 2100) were analysed for two different Representative Concentration Pathways (RCP8.5 and RCP4.5), covering the time span from 2005 until 2100. The multi-model ensemble approach allows for the quantification of the uncertainties and also to assess the differences between the two emission scenarios. Second, to assess smaller scale differences within the country a high resolution model projection using the COSMO-LM model was used (spatial resolution 1.3 km). To account for the higher computational demands, caused by the increased spatial resolution, only 10-year time slices have been simulated (reference period 1991-2000; near future 2041-2050 and far future 2091-2100). Statistically significant trends towards higher air temperatures, +1.6 K for September (+5.3 K far future) and +1.3 K for October (+4.3 K), were predicted for the near future compared to the reference period. Precipitation simultaneously decreased by 9.4 mm (September) and 5.0 mm (October) for the near future and -49 mm (September) and -10 mm (October) in the far future. Beside the monthly values also decades were analyzed for the two future time periods of the CLM model. For all decades of September and October the number of days with precipitation decreased for the projected near and far future. Changes in meteorological variables such as air temperature and precipitation did already induce transformations in weed societies (composition, late-emerging etc.) of arable ecosystems in Europe. Therefore, adaptations of agronomic practices as well as effective weed control strategies must be developed to maintain crop yield.

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