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Seasonal study of tillering and phyllochron of winter wheat in field trials

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ABSTRACT In 4-year field trials 3 winter wheat (Triticum aestivum L.) genotypes were studied to identify their shoot and phyllochronal development. Plant samples were picked up 5-8 times in each year from the 1st node to the ripening. The number of tillers achieved the highest rate in the period 6-13 of May in every year. In the late sowings, the decreased source couldn't be compensated by the increasing number of spikelets and their kernels. The adaptation related mainly to the source-sink ratio. The tillering of cultivar GK Öthalom was more sensitive to the thermal time than the other parent line (GK 44-87). The better productivity of the progeny (cv. GK Miska) were due to the higher shoot and leaf number, but other characteristics were intermediate.

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KEY WORDS

winter wheat
tillering
phylochrone
sowing date
genotype

The phyllochron is a measure of rate of development of plant leaves. Knowledge of the phyllochron for crop species is useful in formulating simulation models and for tracking plant development to determine when to apply management practices that depend on crop development stage. The effect of environmental changes on the rate of leaf emergence in wheat must be understood to make the accurate predictions of the croping technologies.

The phyllochron of plants is strongly related to air temperature (Bauer et al. 1984; Rickman and Klepper 1991). Other environmental factors such as daylenght, water stress, carbohydrate reserves, and nutrient stress have been shown to have little effect on the phyllochron of grasses (Kiniry et al. 1991). However, water stress decreases the phyllochron (Cutforth et al. 1992) and severe N (Longnecker et al. 1993) stress decreases rate of leaf emergence in wheat.

McMaster et al. (1992) did not find differences in the phyllochron among 10 cultivars of winter wheat or between maturity classes. However, others have reported that leaf emergence rate for wheat cultivars (Baker et al. 1980; Baker el al. 1986; Cao and Moss 1989; Cutforth et al. 1992; Kirby and Perry 1987) and sowing dates differed (Kirby et al. 1985; Kirby and Perry 1987; Cao and Moss 1991), with later sowing dates resulting in fewer leaves per plant. Cutforth et at. (1992) studied the phyllochron of vernalization-responsive spring wheat cultivars and found that the phyllochron and final leaf numbers were reduced significantly by vernalization in responsive cultivars.

Researchers have concentrated on understanding how environmental factors such as temperature, water, soil fertility, and photoperiod affect the phyllochron. Only a few studies have evaluated cultivar influences on the phyllochron. In our study the role of plant genotype and sowing dates in determining the leaf and shoot development of wheat was observed.

Materials and Methods

Field experiments were carried out on meadow chernozem soil with salinity in depth. Nitrogen supplying capacity of the soil was good, availability of phosphorus and potessium was very good. The NPK active ingredients were uniformly applied after peas as forecrop in autumn at 210 kgha^{-1} rate, in 1:1:1 ratio. A preventive plant protection was carried out. Plant density was the same as in the usual croping practice (500 plant m^{-2}). In the 4 year research period altogether 6 sowing dates were applied to study the development of 3 winter wheat genotypes (2 parents and their progeny) on 50 m^2 plots with 4 repetitions in a random block design. Plant samples (0.25 m from the inside rows) were picked up 5-8 times in each year from the 1st node stage to full ripening. The number of plants, tillers, leaves, their fresh and dry weight as well as the number and weight of ripened spikes, spikelets, kernels and straw were measured.

Results and Discussions

The number of tillers achieved the highest rate in the period 6-13 of May in every year. The rate of appearance and senescence of leaves of the early ripening variety GK Öthalom was more intensive than the medium ripening parrent line (GK 44-87). The phyllochron character of the progeny (cv GK Miska) was similar to cv. GK Öthalom, but its leaf number was greater during all the tested period (Fig. 1). Results emphasize the role of genotypes in shoot and leaf development in contrast with the observation of McMaster (1992).

Tillering and leaf development were completed at the thermal sum interval of 470-550ºC. Rate of leaf emergence was changed with sowing date. The later sowings resulted in fewer leaves per plant. One month difference in sowing date resulted 5-7 leaves differences in the leaf number of plants, but not more than 100ºC thermal alternation in the peaks (Fig. 2). Experimental results show that as planting date is delayed, the phyllocron slightly decreases. This observation

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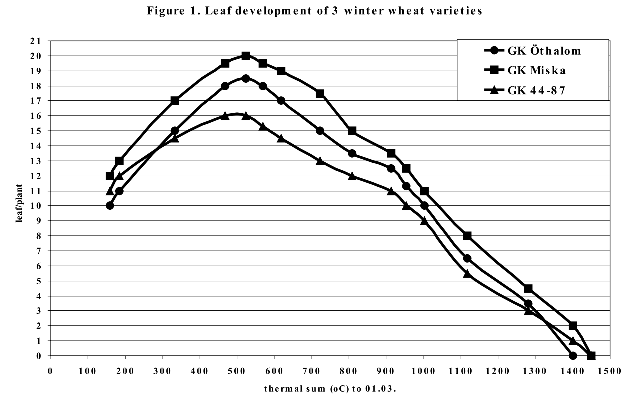

Figure 1

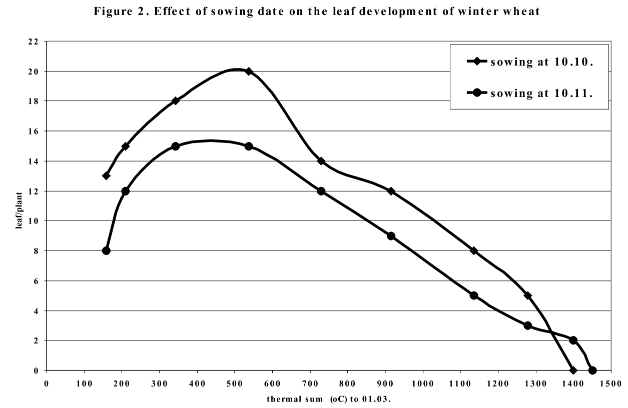

Figure 2

confirm the conclusions of other authors (Baker et al. 1980; Kirby and Perry 1987; Kirby et al. 1985). In the late sowings, the increasing number of spikelets and their kernels couldn't compensate the decreased source. The adaptation related mainly to the source-sink ratio. The tillering of cultivar GK Öthalom was more sensitive to the thermal time than the other parent line (GK 44-87). The better productivity of the progeny (cv GK Miska) were due to the higher shoot and leaf number, but other characteristics were intermediate.

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