of the transition time to the generative stage that is defined by genotype, individual *VRN* genes in both cultivars slow down or speed up the isoline development. Slowly developing isolines have the *VRN-AlbBlaDlb* genotype and quickly developing isolines are *VRN-AlaBlbDlb* and *VRN-AlbBlbDla* genotypes. In the field conditions of natural photoperiod at latitude 50° Kharkov, the Mironovskaya 808 NIL with *VRN-AlbBlbDla* was the first to flower followed by the Olviya NIL with *VRN-AlaBlbDld*.

The correlation of carbohydrate and nitrogen levels serves as indirect balance index of the carbohydrate and nitrogen metabolism of plants. We calculated the correlation of carbohydrate and free amino acid content. The correlation index, C/N, in leaves had a maximm value in NILs that were characterized by the longest period of days-to-heading, i.e., the slowly developing NILs, which can be evidence for dependence of carbohydrate and nitrogen metabolism on genotypes of *VRN* genes.

We found out that individual *VNR* genes, and maybe genetic systems in general, which regulate the rate of plant development in wheat, indirectly determine the amount, composition, and distribution between the organs of the main photoassimilates, water-soluble carbohydrates and free amino acids. Slowly developing NILs are characterized by a lower amino acid and monosaccharide content in the leaves during flowering, which possibly can be connected with less productivity of photosynthetic processes in these isolines. The C/N correlation index clearly agrees with the rate of development in the NILs. These effects do not depend on the genotype of the cultivar, but appear in NILs irrespective of their cultivar peculiarities.

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## *Chemical protection of winter wheat shoots using a presowing seed treatment.*

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In the chemical protection of winter wheat, especially at the first stages of organogenesis, a presowing seed treatment is ecologically safe for the environment, technologically easy, and economically profitable. Lately, among the assortment of insecticide treatments, neonycotynoids are obtaining wide application.

Our investigation studied the phytosanitary role of chemical treatment of winter wheat seed with systemic insecticides, especially from the neonycotynoid, group for reducing pest injury, and, to increase grain yield.

All studies were conducted at the Laboratory for Plant \Pproduction and Cultivar Investigations of Plant Production Institute nd. a. V.Ya. Yuriev (Eastern Forest-Steppe of Ukraine) during 2008–12. The soil was a typical medium-humus black earth soil on loess with humus with a plowing layer to 5.4%. Seed of winter bread wheat were pretreated with a tank preparation mixture of insect-fungicid. The active agent, imidaclopryd, was 0.25 kg/t and 0.35 kg/t of seed. Winter wheat was sown at optimal dates with the following rates: 4.0 x $10^6$ viable seed/ha on black fallow and 5.0 x $10^6$ viable seeds/ha after dried peas. Winter wheat was sown in two blocks, without fertilizer and with and application of organic-mineral fertilizer (humus, 6.7 t/ha of crop rotation area and (NPK) 30–60). The agronomic techniques employed are widely used in the investigated area. Counts for plant damage by the larvae of flies were according to conventional methods.

**Results.** Insecticide treatments, on the basis of imidaclopryd, was highly effective against intrastalk pests, namely fly larvae (Table 1). Averaged over two years, the effectiveness of a pretreating winter wheat seed with imidaclopryd prior to sowing was 78.3%, including *Oscinella* (Diptera: Chloropidae), 85.2%; *Mayetiola destructor* (Diptera: Cecidomyiidae), 66.7%; and *Phorbia securis* (Diptera: Anthomyiidae), 62.5%.

**Table 1.** Carbon isotope ratio and carbon concentration in leaves of six cover crops grown in Manhattan, KS, and harvested in 2011 (mean of eight values + SE).

| Cover crop | $\delta^{13}C$ ($^o/_{oo}$) | C ($^o/_o$) |
|---|---|---|
| Winter wheat | –27.31±0.15 | 34.41±2.71 |
| Triticale | –29.02±0.29 | 29.73±4.95 |
| Oat | –29.07±0.10 | 31.92±2.05 |
| Austrian winter pea | –29.52±0.65 | 39.70±0.87 |
| Red clover | –30.48±0.16 | 41.93±4.64 |
| Alfalfa | –31.35±0.51 | 39.36±0.74 |

During the autumn tillering in 2010, solitary damage to plants by flies was observed, so observations were not made at this time. In autumn 2011, a drought resulted in a majority of seed sprouting 30–35 days after sowing. The plants finished the autumn vegetation at the two–three leaf stage. Again, counts for plant damage by pests during this period were not carried out. In the winter wheat fields during autumn tillering in 2012, the dominant flies were *Oscinella spp*. These larvae caused 25.1% shoot damage in the control and 8.8% shoot damage in the (fungicide+insecticide). Chemical treatment of winter wheat seeds with imidaclopryd (0.35 kg/t seeds) has shown to be effective against *Oscinella* larvae (36.4%). The lowest level of damage to the shoots with *P. securis* and *M. destructor* larvae were 0.9% and 0.2%, respectively. According to the 2012 data, imidaclopryd was highly effective against soil pests. The technical effectiveness of the preparation against larvae (Coleoptera: Elateridae) with a dose 0.25 kg active agent/t of seed was 87.5% and 100% at 0.35 kg/t.

Pretreating winter wheat seed prior to sowing with a tank mixture of fungicides and insecticides (on the basis of imidaclopryd) is economical profitable, especially in fertilized blocks (Table 2). Averaged over 2009–12, the increase in the grain yield from applying tank mixtures of fungicides and insecticides (imidaclopryd) was 0.24 t/ha, ranging from 5.25 t/ha (control, without chemical protection) to 5.49 t/ha. Seed pretreatment with this mixture in the block with organic-mineral fertilizers contributed to the increase in grain yield by 33.9% (from 3.63 t/ha, control, without chemical protection and fertilizers, to 5.49 t/ha).

**Table 2.** Economical effectiveness of pre-sowing seed treatment of winter bread wheat with insecticide–fungicide compositions during autumn tillering in 2008–09.

| Variant | Yield capacity (t/ha) | | | | Yield increase (t/ha) from | |
|---|---|---|---|---|---|---|
| | 2009 | 2011 | 2012 | 2009–12 average | chemical protection | chemical protection + fertilizers |
| Control (without fertilizers) | 3.18 | 4.80 | 2.90 | 3.63 | — | — |
| Control (organic - mineral block) | 5.67 | 6.75 | 3.34 | 5.25 | — | — |
| Fungicide + insecticide with active agent imidaclopryd | 6.04 | 6.90 | 3.53 | 5.49 | 0.24 | 1.86 |