Wandering Grass Genes? – Slow Growth Does Not Colonize Environment

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Dear Sirs, "Transgenic lawn escapes readily to environment", states Helsingin Sanomat (22th Sep., 2004) referring to a news article by N.Y. Times. The statement is untenable in a few ways.

The piece of news exaggerates the dispersion of genes from a cultivated bentgrass to grasses in nature by about 100-fold. That becomes evident by reading the original study (Watrud et al., PNAS Oct. 5, 2004).

The false conclusion is derived from the unnatural experimental arrangement, which artificially maximized the rate of distant crossing. Namely, pollen originating from the flowering bentgrass field was captured by self-sterile pot plants distributed in the landscape well in advance of any bentgrass pollen dehiscing in the nature. Due to the total lack of competing compatible pollen from the vicinity, the success of arriving distant pollen in seed production was biased upwards by two orders of magnitude.

In truly natural conditions the vast majority of the seeds originate from next door pollination. In the study in question, their actual proportion was as high as 99.97 per cent, as measured properly from wild bentgrasses.

Similar misunderstandings occurred commonly in media, when our results about gene flow in barley cultivation were reported (Ritala et al., Crop Science 42, 2002). In our study, the resolution of capturing the scarce pollen arriving from far away was greatly enhanced by using male-sterile and open-flowering experimental barley as recipient plants. One has to understand that such measurement results are not valid for male-fertile, conventional barley for which gene flow is far lower.

Furthermore, rare long-distance "findings" should always be considered with certain caution, because these may factually represent inevitable technical noise in experimentation (Ritala et al. 2002). Errors and mixing is bound to occur e.g. in the handling and analyses of millions of tiny seeds.

It is the trait that matters

Ecology does not recognize a species called "genetically modified lawn". The benefits or harms that a plant variety may cause to man or environment depend on its genetic traits, not on the methods applied in breeding.

When a lawn grass is being bred for slow growth it will neither conquer nature, other lawns nor hayfields but will be overgrown by its competitors. Natural selection will eliminate the "slowness competitor" and its progeny rapidly enough.

Natural plants only adopt traits from which they gain benefit. Corn has been changed radically by breeding during at least 7 000 years, and it cannot do without human help even in the field any more. In spite of gene flow, the new traits have not weakened its wild original form, i.e. teosinte. Sunflower oil is being bred ever healthier, but the trait – desirable for human – does not colonize nature, because it brings disadvantage to the plant itself.

Slow-growing "velvet" bentgrass would be ideal for lawn use. Noise and gasoline would be saved with decreased mowing. The lawn would keep nicely even–- provided the competing stronger species are kept in control.

In contrast to what the news article states, broad-leaved weeds are commonly being controlled in lawns with certain herbicides. However, a weedy grass is difficult to control within bentgrass, because herbicides have similar effect on both species. That is why creeping bentgrass was bred to be resistant to one particular herbicide (active substance) – not to many ones as stated in the article (because that would be pointless). The trait enables changing over to a more environmentally friendly herbicide and controlling difficult weeds in the lawn without breaking soil surface.

Herbicide resistance cannot aid a plant in nature or in "ecological" production, and therefore its frequency does not increase in these circumstances. In a conventional field, however, the trait could be advantageous for a weed. Hence, biologists are now thinking over how weeds could be impeded from obtaining that benefit too easily in practice.

Good means are available. The genes for herbicide tolerance and slow growth could be attached tightly together (i.e. consecutively, in tandem) in the chromosome. That can readily be done today (ABIC2004). In that case the traits in question are always carried along in a fixed combination which as a whole brings disadvantage to the weed.

Mowed turf does not flower much. Provided the grass would be allowed to flower, however, gene flow elsewhere via pollen could be cut down by breeding the grass for male-sterility. Additional genetic means exist for preventing dispersion, and even more brilliant methods are under development. For instance, non-flowering birch was developed, and it received an environmental prize in Finland in 2004 (for the delight of allergic people).

Gene flow is age-old biology. For hundreds of millions of years genes have been moving between related plants via crossing. Bred and "wild" genes are transferred from a plant to another exactly alike in pollen. Gene flow has occurred between cultivated and wild plants for as long as agriculture has existed, i.e. at least 11 000 years.

Natural gene flow can most efficiently be measured by using genetically modified test plants. In self-pollinated crops such as barley gene flow is very limited (Ritala et al. 2002).

In plant varieties, there is a legal requirement for uniformity. Therefore, gene flow between varieties shall be restricted e.g. by applying customary isolation distances in the production of seed for sowing.

Pollen of certain cross-pollinating grasses, such as bentgrass, is light and can produce a few seeds more far than that of self-pollinating crops such as barley, wheat and oats. Basic pollination biology has been known to professionals quite well since 1930's, thanks to our lengthy plant breeding experience. Accordingly, greater isolation distances are being used for grass seed production, in order to prevent disproportionate degree of mixing of the special traits characteristic to different grass varieties.