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Over-Extended Mesocotyls and Floppy Corn Syndrome

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- Reports of "floppy" corn were numerous earlier this month.
- Many causes have been proposed for this problem.
- Herein lies one more look at this curious phenomenon.

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The curious phenomenon referred to as "floppy corn syndrome" reared (or lowered, as it were) its ugly head in some fields in Indiana and Ohio back in early June. The term "floppy corn" simply describes a young (V5 to V8) plant that has fallen over because of the absence of an established nodal root system at the crown of the plant. Affected plants may survive if the mesocotyl remains intact long enough for subsequent nodes of roots to establish themselves in moist soil. If the mesocotyl breaks before subsequent establishment of additional nodal roots, the plant dies. The causes of the poor nodal root development have been debated for years and, indeed, likely vary from situation to situation.



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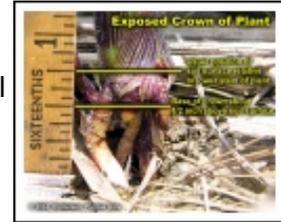


My own experience with investigating floppy corn events over the years has primarily been associated with the detrimental effects of excessively dry surface soil at the time of initial nodal root elongation in young (V2 to V4) corn plants ([Nielsen, 2001](#)). Young roots that emerge from the crown area of the plant will die if their root tips dessicate prior to successful root establishment in moist soil. The crown of a young corn plant is typically located only 3/4 inch or so below the soil surface and so is particularly vulnerable to dry upper soil conditions.

Other causes have been implicated in the development of floppy corn, including excessive settling of the seedbed prior to emergence ([Hartzler, 2001](#); [Hicks, 2003](#); [Sprague & Hager, 2001](#)), seedbed erosion ([Lauer, 2001](#)), shallow planting ([Hartzler, 2001](#); [Hicks, 2003](#); [Lauer, 2001](#)), and various other soil conditions. Responses to pre-plant or pre-emergence applications of certain growth regulators have been suggested, but largely discounted due to inconsistencies in the reported symptomology of the mesocotyl and initial nodal roots ([Hartzler, 2001](#); [Sprague & Hager, 2001](#)).

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In early June, I visited two no-till corn fields that exhibited dramatic levels of floppy corn plants, but which failed to correlate with any of the usual diagnostic causes. Other than the usual symptoms of dead or dying nodal roots and the floppy corn plants themselves, the other common symptom was the combination of unusually long mesocotyls and the resulting position of the crowns of the plants 1/4 to 1/2 inch above the soil surface.



The overwhelming majority of plants in the fields, standing or flopped, exhibited this unusual placement of the crown above ground. Plants still standing and surviving were the result of successful nodal root establishment before the root tips desiccated and died. The combination of the aboveground crown and nodal roots penetrating the soil reminds one of the image of houses built on stilts along rivers.

Shallow seeding depth was not a contributing factor (see below) nor was there any visible soil erosion from the row areas. I also don't believe that the placement of the crown above ground was caused by settling of the seedbed prior to emergence for three reasons. First, the grower told me his intended planting depth was 1.5 inches. Careful inspection of the plants showed that the seed was indeed about 1.5 inches below the soil surface. Settling of the seedbed does not concurrently cause the seed to settle deeper also. Secondly, the seedbed was not a loose, fluffy conventional till seedbed vulnerable to the settling effects of a toadstrangler rain, but rather the typically firmer seedbed of a no-till system. Thirdly, there was no evidence of a toadstrangler rain event anyway.

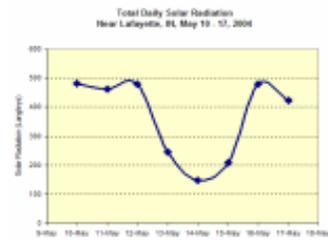


So, the question remains: What factor(s) contributed to the over-extension of the mesocotyls that played such an important role in the development of floppy corn in these fields? I pose two possibilities, neither of which can be easily verified.

Both of the affected fields were treated with a pre-emergent application of a herbicide tank mix that included a dicamba component (a plant growth regulator) within 3 to 4 days prior to crop emergence. While there was no evidence of open planter slots, reports from a number of nearby weather stations all suggest that from 1/2 to 1 inch of rainfall occurred during the 3 to 4 days prior to crop emergence. Is it possible that the plant growth regulator moved into the vicinity of the elongating mesocotyl tissue and caused unusual stimulation of the mesocotyl elongation prior to and shortly after crop emergence? Several weed scientists have discounted this in the past ([Hartzler, 2001](#); [Sprague & Hager, 2001](#)), but nevertheless the dicamba may have played a growth regulating role in the otherwise auxin-mediated elongation of the mesocotyls.

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The other possibility was broached to me by an ag. industry colleague who asked whether several consecutive days of very cloudy, low light intensity days just prior to emergence could delay the red-light regulated cessation of mesocotyl elongation and allow the mesocotyls to over-extend beyond the soil surface. This indeed is a curious question, so I checked the solar radiation records of the Purdue Automated Weather Station nearest to the affected fields (~ 20 miles). Interestingly, there were indeed three consecutive days with low light intensity immediately prior to the reported emergence of the corn. Were these light intensities low enough to significantly alter the mesocotyl's ability to detect red light? I don't have the answer to that, but it makes for good discussion down at the Chat 'n Chew Cafe.



There is an obvious nagging issue with either of these last two possible causes of over-extended mesocotyls in corn. One would think that the phenomenon would occur more frequently than it does given a) the common use of PGRs in pre-emergence herbicide mixes and b) the likely frequent occurrence of very cloudy days prior to emergence.

[ [Image Gallery](#)]

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