

**2011 Region 2 Referee:  
Corn & Soybean Virtual Seedling Evaluation**

Presented by  
Michael Stahr

# Background

- There have been five previous virtual seedling referees in this series: three corn and two soybean.
- Besides classifying seedlings, information has been gathered on substrates, experience level of participants, and opinions on what should be in the revision of volume 4 of the AOSA Rules (formerly the Seedling Evaluation Manual).
- The referees have been primarily composed of scans of seedlings. During the first year drawings were included.
- Very few seedlings have been classified by all participants as normal or abnormal. The majority of seedlings have been in the roughly 80-95% or 10-30% range.
- A significant number were in the 45-55% range. **Who decides the official designation of 'iffy' seedlings?**
- It would be useful to expand Volume 4 to include more iffy seedlings (that have been designated normal or abnormal).

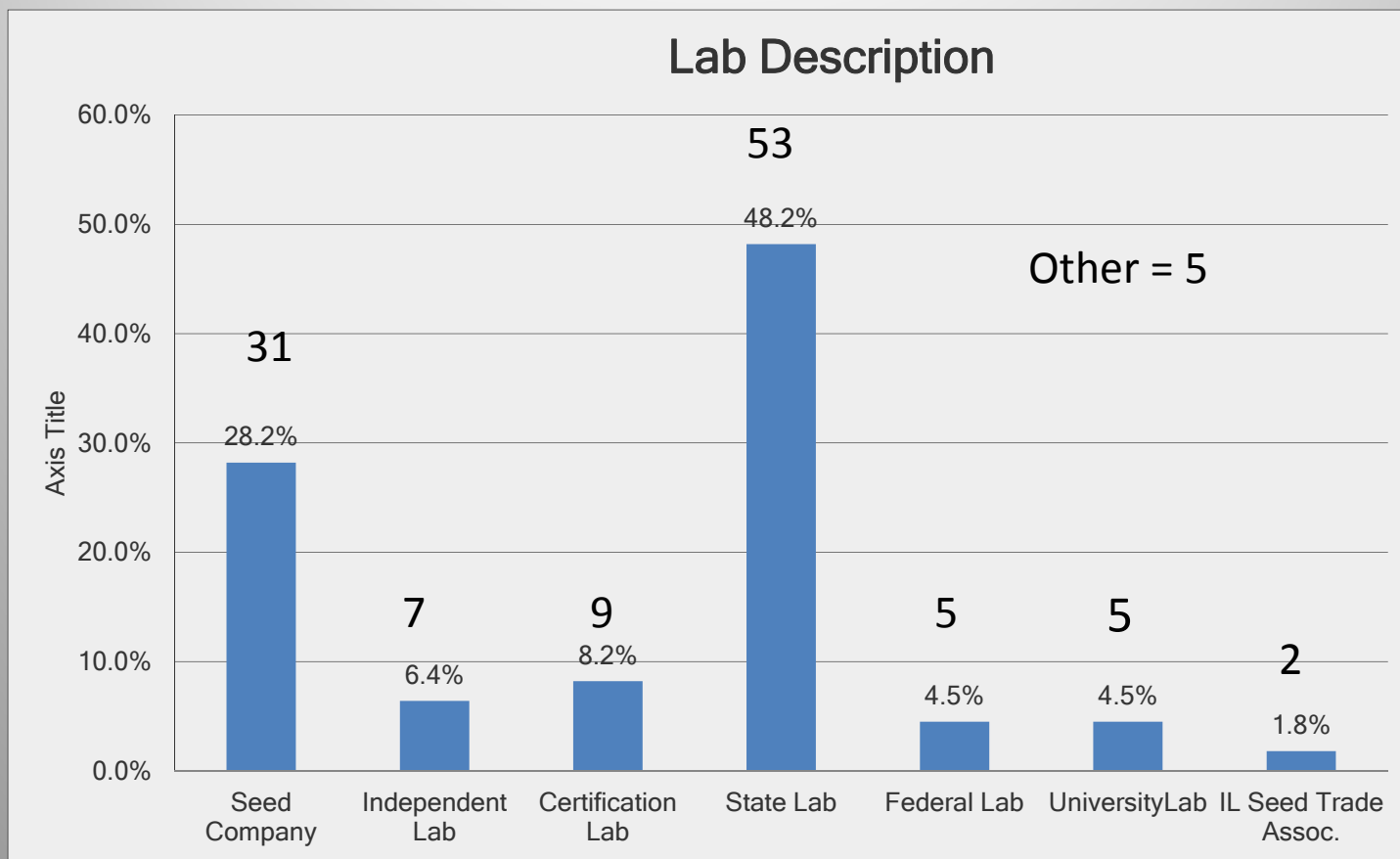
# Particulars

## Participants:

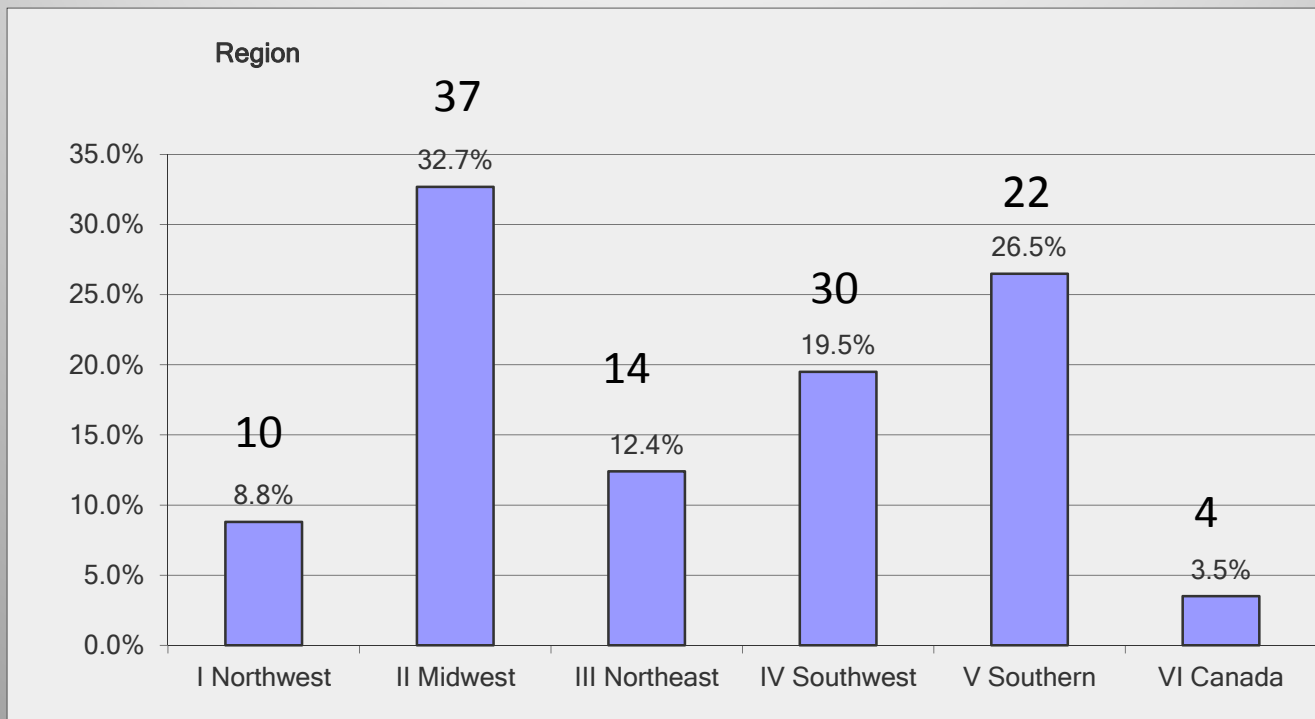
- 136 people participated in this referee using Survey Monkey.
- Most likely there was a range of experience in seed analysis in general and specifically with corn and soybeans.

## The Referee:

- Most seedlings used in this referee were scanned, not 'shot' with a camera.
- Participants don't always key on obvious seedling problems. Eyes that are trained to picking out minute details may spot something I didn't notice (but may key too much on details).



Note: not all participants answered this question



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Seedling 1 (left)  
92% normal  
2008 – 89% normal

Seedling 2  
65% normal

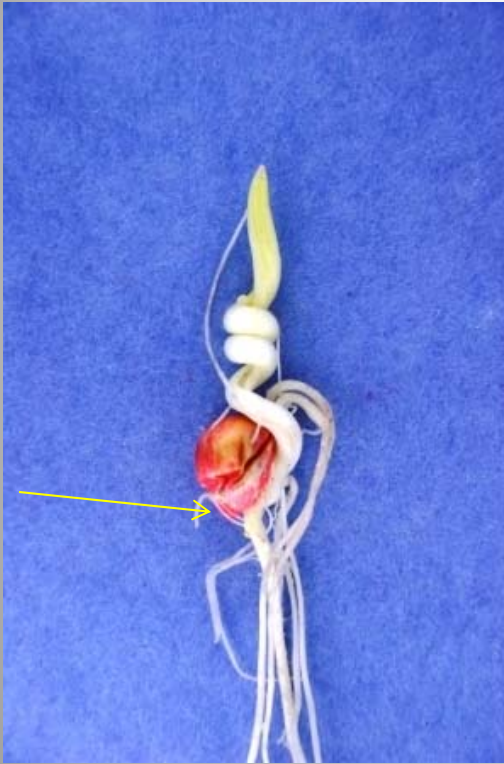
MGS: **Normal** by AOSA & ISTA. Mesocotyls not fused (ISTA). Adequate root and shoot.

- Abn: Two shoots or split
- Abn: Leaf < ½ up coleoptile



MGS: **Abnormal**. Shoot would most likely easily break off if touched. Plenty of root development for the size of the shoot (reason to put pressure on shoot)

- Abn: Late germinating seedling
- Abn: Too small to count, could extended
- N: Normal if shoot not brittle or damaged



Seedling 3 (left)  
42% normal

Seedling 4  
15% normal  
2006 – 64%  
2008 – 4% normal

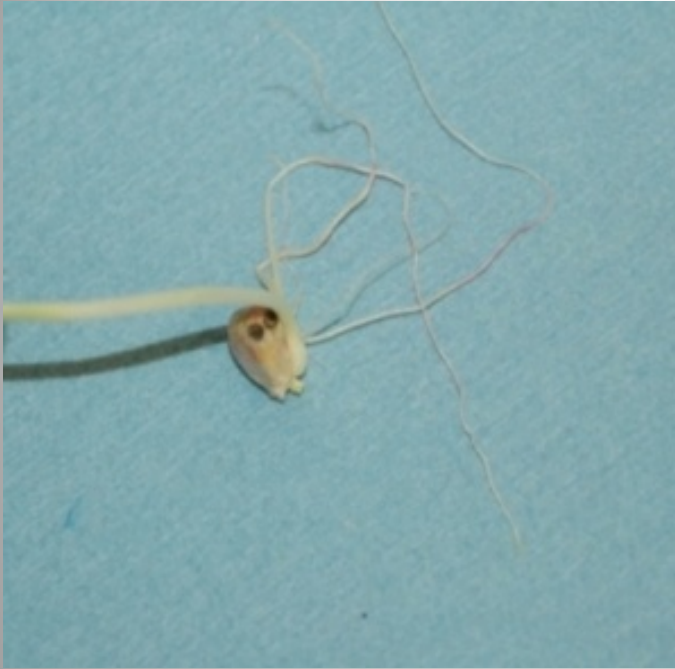
MGS: **Abnormal**. Lesion on mesocotyl caused tight spiral.

- N:By AOSA Rules, twisted or curled is normal
- N: Twisting due to test conditions



MGS: **Abnormal**. First leaf split half or more. Coleoptile doesn't matter.

- N:Leaf split, but healthy



Seedling 5 (left)

59% normal

2007 – 71%

2008 – 75% normal

Seedling 6

77% normal

2007 – 64%

2008 – 75% normal



MGS: **Normal**. Adequate roots & shoot. Insect damage to seed didn't hurt seedling.

- Abn: Weak secondary roots
- Abn: Watery shoot and weak roots
- Abn: Endosperm diseased

MGS: **Normal**. Coleoptile badly split, but leaf has little or no damage.

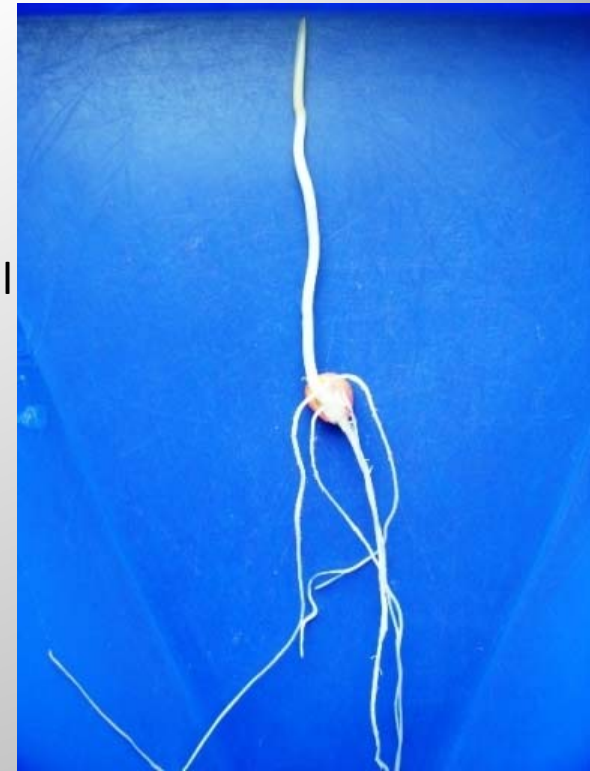
- Abn: Coleoptile split more than 1/3
- Abn: Lead and coleoptile split





Seedling 7 (left)  
34% normal  
2007 – 39%  
2008 – 18% normal

Seedling 8  
72% normal

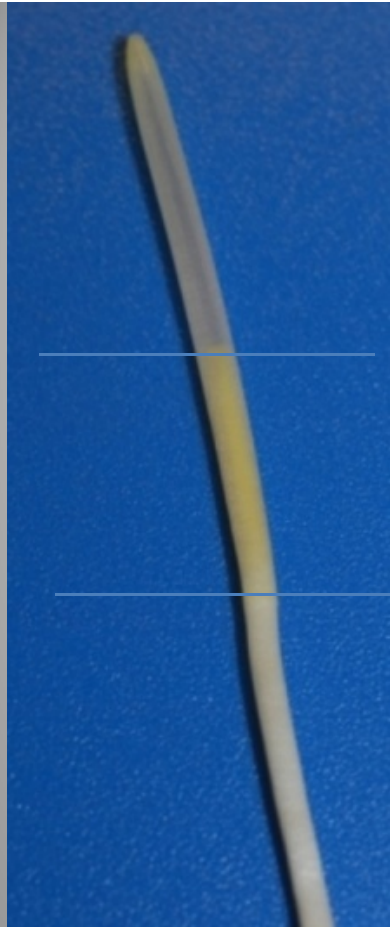


MGS: **Abnormal**. Should check out shoot on actual seedling, but it appears that the shoot tip is trapped and likely damaged.

- Abn: Negative geotropism
- Abn: Terrible picture ...
- N: All structures present. Late germinating ...
- Normal if leaf trapped. Abn. if damaged

MGS: **Normal**. Difficult to see position of leaf in image. Apparently more than halfway.

- Abn: Albino
- N: If hypocotyl is not clear. Can't tell ...



Seedling 9 (left)  
11% normal

Seedling 10  
17% normal  
2007: 29%  
2008: 27% normal

MGS: **Abnormal**. Leaf less than halfway up coleoptile. Real seedling could be pinched just above leaf and coleoptile bent down to check.

- N: Don't know enough about growing conditions
- N: No evidence that doesn't have all essential structures
- N: Leaf is halfway up coleoptile



MGS: **Abnormal**. Leaf protruding from side of coleoptile.

- Normal by M&P. Coleoptile not considered
- ... leaf curled due to test conditions

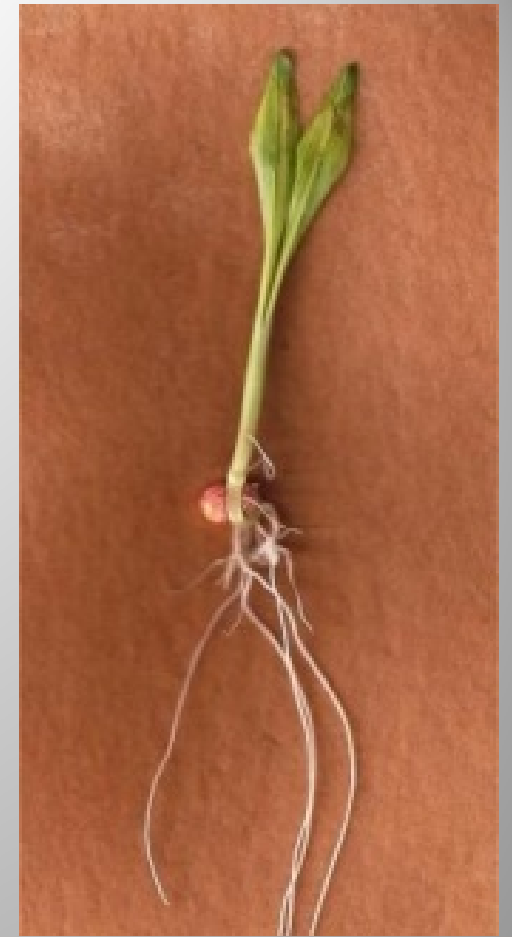


Seedling 11 L(left)  
90% normal  
2008 – 89% normal

Seedling 12  
60% normal  
Similar seedling 2008-44%

MGS: **Normal**. Leaf tip appears pointed, but first leaf not sealed.

- Abn: Fungi on root. Weak sem. Roots
- Abn: Decay at point of attachment



MGS: **Abnormal** by ISTA because mesocotyls & coleoptiles fused. '**Normal**' by AOSA.

- Abn: Diseased primary leaves
- Abn: Epicotyl split
- Abn: Leaf is badly split
- Abn: Leaf protruding below tip of coleoptile

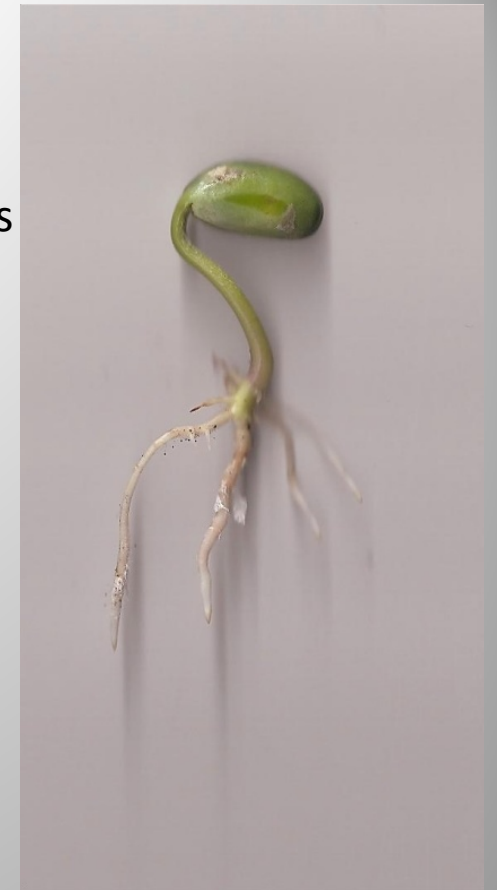


Seedling 1 (left)  
8% normal

MGS: **Abnormal.** Insufficient roots

Seedling 2  
97% normal

MGS: **Normal.** Two or more vigorous secondary roots. Epicotyl can be assumed to be intact because of no damage to point of attachment of hypocotyl to cotyledons.



- N: ...small seedling, well proportioned hypocotyl & primary root
- N: ... healed hypocotyl lesion is normal
- N: Bad picture doesn't allow to gauge root length, but is okay.

- Abn: Diseased
- Abn: Weak primary & secondary roots. Would probably develop sufficient roots.

Seedling 3 (left)

84% normal

MGS: **Normal**

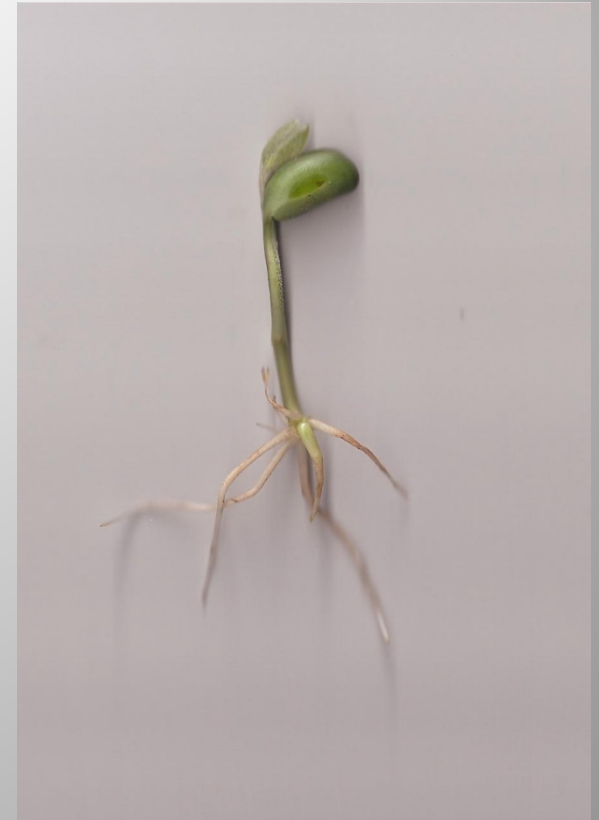
Seedling 4

89% normal

MGS: **Normal**. Not ideal because of reduced hypocotyl development and emergence of epicotyl.



- Abn: Shoot is too short
- Abn: Hypocotyl & cotyledons not good
- Abn: Primary root okay, but insufficient secondary roots



- Abn: Insufficient secondary roots with decay
- Abn: Short seminal roots
- Abn: Secondary roots not quite sufficient



Seedling 5 (left)

0% normal

MGS: **Abnormal**

Seedling 6

86% normal

MGS: Still **Normal**



- Abn: Malformed, short hypocotyl
- Abn: Primary root okay, but insufficient secondary roots
- Abn: Shoot is too short

Seedling 7 (left)

74% normal

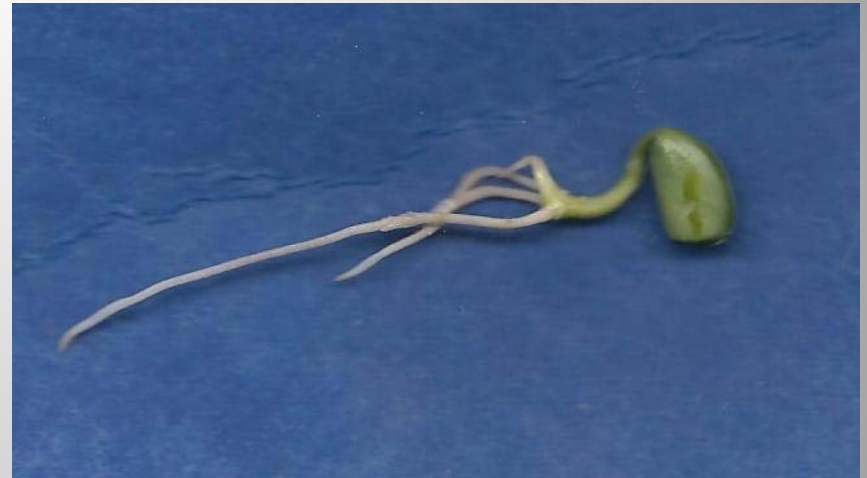


MGS: **Normal**.  
Sufficient secondary roots. Hypocotyl just a little longer than 'necessary'.

Seedling 8

75% normal

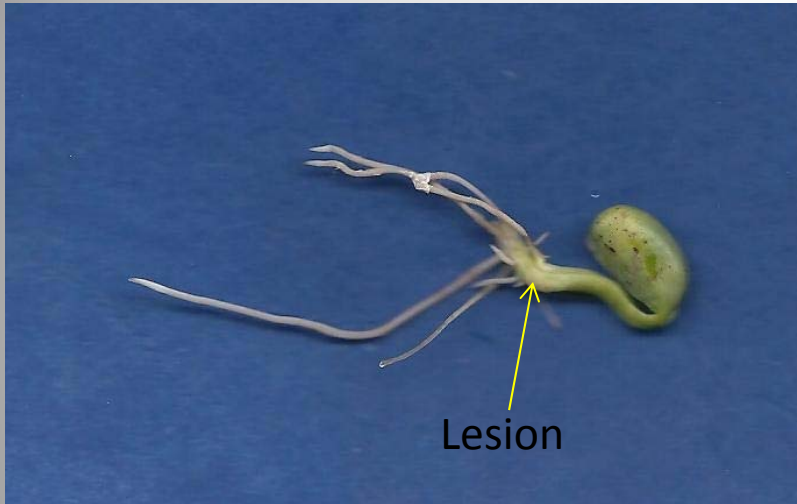
- Abn: Impaired roots
- Abn: Lesions in hypocotyl
- Abn: More than 50% infected
- Abn: ...good secondary roots. No primary roots. Quite a bit of decay



MGS: Border-line **normal**.

Stubby primary root. One very vigorous secondary root, one less so. Cotyledon barely big enough.

- N: Lesion isn't into central conductive tissue



Seedling 9 (left)  
51% normal

Seedling 10  
63% normal



MGS: Borderline **Abnormal**.

Adequate roots. Hypocotyl shorter because of lesion and thickening.

- Abn: Looks like a deep lesion
- Abn: Bad primary root, not enough secondary roots
- N: A little moldy

MGS: **Abnormal**.

Adequate roots. Short, thickened hypocotyl.

- N: All essential structures present. Strong primary root. Healthy epicotyl
- N: Could be a Kimpac issue
- N: Looks a little unusual, but otherwise healthy





Seedling 11  
23% normal

Seedling 12  
78% normal



MGS: **Abnormal**. Adequate roots.  
Lesion into central conducting  
tissue. Twisted hypocotyl.

- Abn: Test induced?
- Abn: Very moldy
- N: ... too tightly in substrate. Twisted seedling, but intact.

MGS: **Normal**. Nearly perfect seedling  
(cotyledon was removed to show epicotyl).

- Abn: Half of cotyledon is missing. Small leaves.

# Observations

- 'Seedling Evaluation' (Volume 4) should be routinely used, even by experienced analysts.
- There was confusion about the names of parts of corn and soybean seedlings.
- Some participants misquoted parts of the abnormal description in 'Seedling Evaluation'.
- Although it may be difficult to put a measurement on what is normal (roots, shoot, hypocotyl), there is a range of what people classify as vigorous. Roots need to be vigorous, but not the seedling.
- A proven way to help with this is to provide a range of seedlings from absolutely abnormal to iffy (gray area) to absolutely normal.
- It may be useful to have a portion of the AOSA and SCST web sites available for sharing virtual seedlings.
- Clear images are crucial. It may be helpful to direct attention by using lines or arrows.

Plans are to post this presentation on the AOSA and SCST web sites. Previous virtual seedling referees are currently posted there.

Thanks to all who completed this referee.

Special thanks to Anita Hall for putting together the Survey Monkey portion of this referee and compiling the results.