

Pericarp Damage in Seed Corn

INTRODUCTION

The pericarp of a corn kernel is maternal tissue surrounding the embryo sac and nutritive tissues. It has a vascular connection into the corn cob so nutrients from photosynthesis can be supplied to the developing embryo and endosperm. Once seeds reach physiological maturity an abscission layer is formed, this is known as the “black layer”, which blocks the vascular tissue. As the seed dries, the pericarp adheres tightly around the endosperm and embryo. Some hybrids lose the pedicel tip upon shelling which may expose the black layer (Figure 2B.). Shelling corn with high moisture may cause tears in the pedicel area of the pericarp. Other areas of the pericarp can be damaged due to impacts and abrasions during handling and seed conditioning. Rounds can be susceptible to damage due to the plumule being more exposed or even a raised surface. (Figure 2). Because the plumule is less protected severe damage can occur due to impacts and often correlates to a seedling with a damaged coleoptile, growing points and/or shredding of the embryonic leaves. The seed corn industry is expanding the use of plant dessication to reduce the occurrence of raised plumules.

DEFINITIONS

Black layer: abscission layer between embryo and pedicel tip.

Coleoptile: protective covering over plumule leaves that aids in shoot emergence through soil.

Embryonic axis: small plant (root, meristem, scutellum and shoot tissue).

Raised embryo: certain hybrids or seed sizes may have an embryonic axis that is raised and exposes the axis to mechanical impacts.

TESTING

To help identify pericarp damage, dry seeds are submerged in a contrasting dye which penetrates any cracks in the pericarp, after one-minute seeds are removed, rinsed, dried and evaluated. Categories range from no damage to severe based on where the pericarp tearing, or cracking occurs.

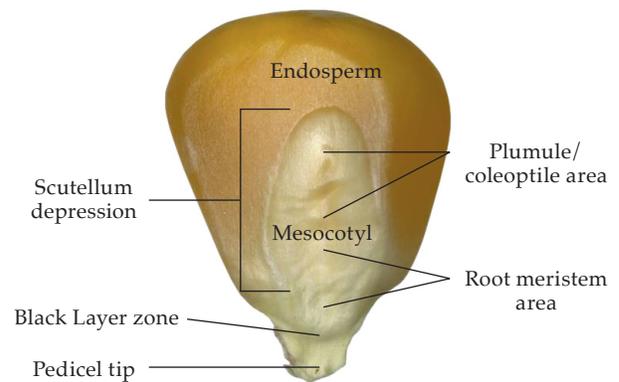


FIGURE 1. Photo of a corn kernels with structure identified.

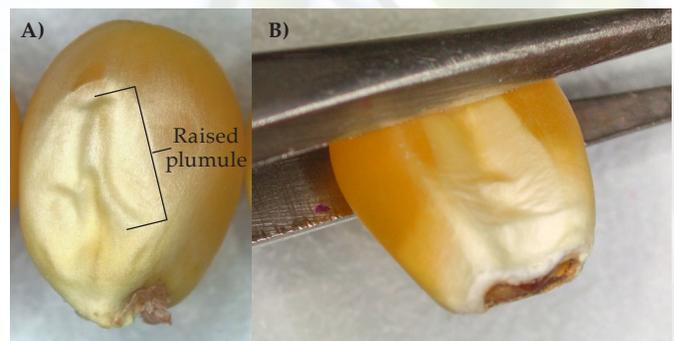


FIGURE 2. A) Raised plumule, B) Black layer exposed

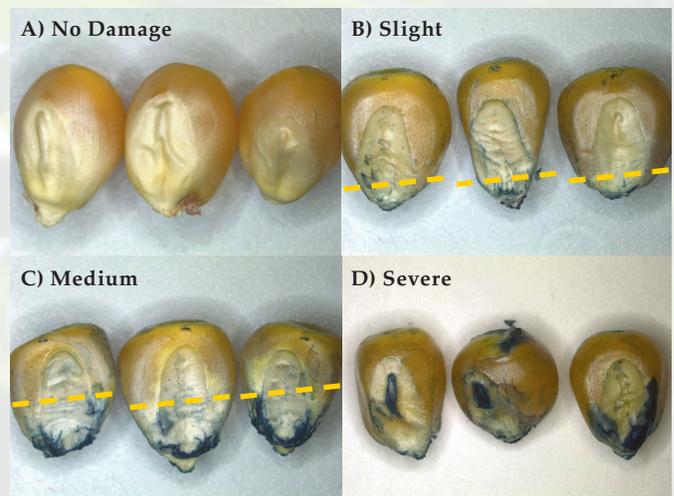


FIGURE 3. A) None: no visible damage to pericarp covering, B) Slight: tearing of pericarp area extending up less than 25% length of embryo pericarp margin/edge, C) Medium: tearing of pericarp extending up to 50% of length of embryo pericarp margin/edge and D) Severe: cracks over the embryonic axis and major breaks in seed or missing parts of the seed.

RELATIONSHIP TO GERMINATION & COLD TESTS

During the spring of 2022, SoDak Labs identified 20 submitted seed corn samples with reported low to high pericarp damages as determined by the Pericarp Damage Test (Fast Green Test). These seed lots were then subjected to 77F warm germination, NPK 50F cold test, and 50F cold test. The NPK cold test has a fertilizer solution applied to the media to emulate an in-furrow field application. Data in Table 1. organized the lots based on their warm germination percentage in descending order: note the pink shaded values. Warm germination values below 93% are commonly considered unmarketable seed. Traditionally, an inverse relationship correlating decreasing warm germination values to increasing pericarp damage was speculated, especially as level of severe impact to the embryonic axis was recorded.

50F cold and 50F NPK cold values of 85% are considered the minimum acceptable by the majority of seed corn companies. Lots R and H seem to show a slight drop in 50F NPK cold compared to 50F cold indicating the possibility that the fertilizer solution is causing a drop in cold germination. Table 2. contains correlations among the respective variables: note that a correlation value that falls below -0.70 and 0.70 is considered not correlated. Two correlations, responses in Table 2., were considered slightly correlated: warm germination to NPK 50F cold (0.70) as well as warm germination to 50F cold (0.72). The correlation from severe or severe + medium damage was not well correlated (-0.70< and <0.70) with warm germination, NPK 50F cold, or 50F cold based on data generated from the seed lots studied.

TABLE 1. Lots in descending order of Warm Germination percentage and their individual responses to Pericarp Damage test, NPK 50F Cold, and 50F Cold for 20 seed corn lots.

Lot	Warm Germination	50F Cold			NPK 50F Cold			Pericarp Damage			
		Normal	Slow Normal	Abnormal	Normal	Slow Normal	Abnormal	Severe	Medium	Light	None
B	99	98	0	0	98	0	0	0	0	9	91
D	99	95	0	0	91	4	0	0	0	15	85
C	98	95	0	0	92	0	1	0	0	10	90
A	97	92	0	0	96	0	0	0	0	0	100
E	97	95	1	0	94	0	0	0	1	23	76
I	97	94	0	1	91	2	2	44	0	3	53
K	96	90	1	2	87	2	1	37	2	14	47
L	95	94	0	1	92	1	0	32	4	18	46
Q	95	91	1	1	88	1	3	42	4	17	37
N	94	94	0	2	96	2	1	51	1	6	42
R	94	85	0	2	84	2	2	55	6	6	33
S	94	94	0	2	89	1	1	42	8	21	29
G	93	84	0	3	89	3	0	41	0	2	57
H	93	89	1	2	84	1	5	42	3	1	54
T	92	87	1	1	84	1	4	45	5	22	28
J	91	85	0	2	84	1	2	40	3	5	52
F	90	94	0	2	84	2	2	32	1	0	67
M	89	86	2	2	71	3	1	34	7	16	43
O	89	84	0	3	85	1	3	32	26	3	39
P	89	87	2	1	90	1	1	40	4	19	37

 = LOW warm germination (6)
 = LOW NPK normal, high Sev./Med. P. Damage (6)
 = LOW warm germination, AND LOW NPK Normal with high Sev./Med. P. Damage (4)

TABLE 2. Correlations amongst the response variables averaged across 20 seed corn lots. The correlation response value is a measure of the strength of the linear relationship between two quantitative variables.

	Warm Germination Normal	NPK 50F Cold Normal	Pericarp Damage Severe	Pericarp Damage Medium	Pericarp Damage Severe and Medium	50F Cold Normal
Warm Germination Normal	-- ¹	0.7	-0.59	-0.55	-0.68	0.72
NPK 50F Cold Normal	0.7	--	-0.46	-0.39	-0.52	0.65
Pericarp Damage Severe	-0.59	-0.46	--	0.26	0.96	-0.56
Pericarp Damage Medium	-0.55	-0.39	0.26	--	0.5	-0.5
Pericarp Damage Severe and Medium	-0.68	-0.52	0.96	0.5	--	-0.64
50F Cold Normal	0.72	0.65	-0.56	-0.5	-0.64	--

¹ Correlations levels: 1) less than .70 or -.70 is not correlated, 2) greater than or equal to .70 or -.70 is slightly correlated, 3) greater than or equal to .80 or -.80 is correlated, and 4) greater than or equal to .90 or -.90 is highly correlated.