2016 NCIS Agronomic Research Results

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For more than 90 years, National Crop Insurance Services (NCIS) and its predecessor organizations, have conducted loss adjustment research on growing crops. Updates to, or new loss adjustment procedures have originated from the NCIS Agriculture Research program, under the direction of the NCIS Board of Directors. Projects are conducted at university experiment stations and agricultural colleges across the United States, as well as some locations in Canada. All projects are examined over the course of at least three years; however, if for some reason the results are not obtained for one or more years, the research project may be extended.

To know which crops need to be addressed, NCIS relies on company field adjusters, claims supervisors and university researchers for advice. The NCIS research program then focuses on designing experiments that will result in data used to create up-to-date, consistent, and timely loss adjustment procedures. NCIS currently has 17 research projects across 13 states from Washington to South Carolina, and from Saskatchewan, Canada, to New Mexico.

In 2016, NCIS performed research on canola, chickpeas, chile peppers, corn, cotton, soybeans, potatoes, and wheat, and the results are summarized in this article. It is important that these results are not used exclusively, but combined with results from previous years' research, and any subsequent research, to provide the best loss adjustment procedures for NCIS members.

Chickpea research in Washington.

CANOLA Saskatchewan

Research on Saskatchewan canola was done to reexamine the influence of stem breakage during the flowering stages of hybrid spring canola growth and development. Original research was done in the early 1980s on open pollinated varieties that have very different growth rates and plant vigor compared to the hybrid varieties grown currently. This trial was done at two locations just outside of Saskatoon, Saskatchewan, during the

Table 1 **CANOLA** Saskatchewan

Weeks After Flowering	Nodes Cut-Off				
	Control	25%	50%	75%	100%
	Lbs/A				
1 Week	2300	2143	1996	1971	2028
2 Week	2300	2034	1978	1945	1592
3 Week	2300	2099	1930	1637	1279
4 Week	2300	1848	1183	906	774
5 Week	2300	1869	1166	780	680

2016 growing season. Treatments were initiated at the onset of bolting (approx. BBCH 53) and continued weekly until all flowers had fallen off the plants (BBCH>69). *(Please visit* **http://bit.ly/2t-BA8NU** *for an explanation on the BBCH scale.)*

It's important to note that canola has the ability to recover from substantial stem breakage, particularly if this damage occurs during the early phase of flowering.

During the first three weeks of flowering, removing up to 50 percent of the flowering raceme resulted in less than a 15 percent yield loss. Removal of 25 percent of the main raceme at any time during flowering resulted in a 15 percent yield loss or less. However, canola's ability to recover was severely limited with high levels of stem breakage (75 and 100 percent) near the end of flowering. The yield loss ranged from 55 to 70 percent under such conditions.

CHICKPEAS Washington

Chickpeas are an important crop for the Pacific Northwest and the upper plains region of the United States and Canada. This provides an alternative crop to the predominant cereal crops that are grown there while also giving better grass weed control and a disruption to the disease and insect pest cycle of those cereal crops. Questions were raised about the current MPCI appraisal methods dealing with the number of pods/seeds per plant. The loss charts also do not have some of the most commonly grown varieties for the large Kabuli type of beans.

This research was conducted with five widely-grown Kabuli type chickpeas in the Pacific Northwest and studied the average number of pods per plant as well as number of seed per pod and yield. The five varieties were Billybean, a locally derived variety that is slightly smaller than the other Kabuli types; CDC Frontier; CDC Orion; Sawyer; and, Sierra. Billybean had consistently higher average number of pods per plants (33) compared with all of the others. Sierra had a consistently lower average number of pods per plant (14) compared with all of the others. CDC Frontier (28) had an average number of pods closer to Billybean, while CDC Orion (21) and Sawyer (19) were lower. Sierra is the only variety that averaged less than a seed per pod (0.8) compared with the other varieties.

CHILE PEPPERS New Mexico

Within the past 15 years, chile pepper production methods have changed considerably. This is due to the high cost of labor in the United States compared to other growing regions. High labor cost has led to the use of mechanical harvesters to pick the chile peppers, especially for red chile/paprika production.

Growers have also gone to direct seeding with little or no thinning of the fields so the plants tend to grow taller resulting in changes to the plant architecture. The purpose of this research is to determine if early season stand losses would affect the production of the red chile/paprika under closer plant spacing regimes.

Two red chile pepper varieties were used, with thinning applied eight weeks after establishment. Thinning occurred at 6-, 8-, 12-, 24- and 60-inch spacing. (Table 2)

Production per plots did not show major differences in yield, except at the widest difference. The number of basal branches did increase as the distance between plants increased, which also reduced the efficiency of mechanical harvesters.

A second trial was also conducted where the plants were defoliated at three different stages of growth. (Table 3)

The research shows that there is little re-

Corn greensnap research in Nebraska. Many of the undamaged corn plants produce a secondary ear that contributes to yield.

Table 2 **CHILE PEPPERS** New Mexico

Treatment	Fresh Red	Green
	Yeild Ton/Ha	
Control	28.8	13.0
40% Stand Reduction	28.8	12.6
60% Stand Reduction	27.0	12.7
70% Stand Reduction	27.0	13.9
75% Stand Reduction	21.2	13.8

Table 3 **CHILE PEPPERS** New Mexico

Treatment	Fresh Red	Green
	Yeild Ton/Ha	
Control	26.8	11.5
30% Defoliation	24.3	11.1
60% Defoliation	26.2	12.8
90% Defoliation	26.7	13.7

Table 4 **CORN** Ohio

Treatment	Expected	Measured
	Loss%	
50% 10L	6	5
100% 10L	16	9
50% 15L	15	14
100% 15L	51	38*
50% Tassel	31	26
50% 10L + 50% 15L	16	18
50% 10L + 50%T	33	27
100% 10L + 50% 15L	39	24*
100% 10L + 50%T	67	30*
50% 15L + 50%T	34	20*
100% 15L + 50%T	88	49*
50% 10L + 50% 15L + 50%T	35	26

Table 5 **CORN** North Dakota

Leaf Stage	Green Snap%		
	25	50	75
	Loss%		
14L	9	8	23
17L	13	23	36
Chart 14 & 17	16	32	61
Tassel	8	23	35
Chart Tassel	25	50	75

sponse when the chile peppers are direct seeded at the higher rates and not thinned during the growing season.

CORNOhio

This year marks the third year of corn research focused on the accuracy of the second or multiple loss procedures. The research looked at defoliation applied at a single, two and three stages of growth. The stages were 10 leaf, 15 leaf and tasseling. The levels of defoliation were 0, 50 and 100 percent. Differences in yield were measured between the expected loss from the current charts and the actual measured loss. The second and third loss treatments resulted in higher yields than what is contained in current charts. (Table 4)

Second loss corn research in Ohio.

CORNNorth Dakota, Minnesota, Nebraska

Research trials began in 2015 in North Dakota, Minnesota, Illinois, and Nebraska to study the influence of green snap on corn production. The trials are set so that corn plants are treated at either the 14-leaf, 17-leaf, or tassel stage of development. The plants are snapped at the main ear-node at various percentages of total number of plants (0, 25, 50, or 75 percent) and then compared to losses from the current charts.

The results from the 2016 trial in North Dakota had losses that were consistently lower than those contained in the charts. For example, the 75 percent snapped treatments for the 14-leaf stage had losses of 23 percent, compared to 60 percent in the current charts. Similar results were obtained at 17-leaf and tassel stage for the 75 percent treatments and are shown in Table 5.

The 2016 results from Minnesota had similar results to those obtained in North Dakota, except

Researcher **Steve Quiring** looking at corn greensnap research in Minnesota.

not to the same numerical extent. These results are found in Table 6.

The second year of greensnap research evaluating losses at the 14-leaf, 17-leaf, and tassel growth stages and at two locations on the stem was completed in Nebraska. Table 7 displays the results from Nebraska.

CORNKansas, Nebraska

Research on the MPCI corn maturity-line method for appraising grain from the milk stage until kernels are fully mature and kernel moisture drops below 40 percent is being conducted in Manhattan, Kansas, and Clay Center, Nebraska. It builds on prior research in the Central and Eastern Cornbelt. At Manhattan, researchers are evaluating two hybrids differing in relative maturity by six days, and grown under rain-fed and irrigated conditions. At Clay Center, researchers are looking at five hybrids differing in relative maturity and drought tolerance, and an additional old hybrid, B73 x MO17. The researchers are tracking grain fill and weighing ears weekly from silking until black layer to determine grain fill rates and the weight of ears at differing stages of maturity. The previous research indicated that the factors used for appraisals at the early grain fill stages underestimate yield so it will be interesting to see if the same results apply to the Western Cornbelt.

Table 6 **CORN** Minnesota

Leaf Stage	Green Snap%		
	25	50	75
	Loss%		
14L	17	33	50
17L	15	24	40
Chart 14 & 17	16	32	61
Tassel	16	42	68
Chart Tassel	25	50	75

Table 7 **CORN** Nebraska

Leaf Stage	Green Snap%		
	25	50	75
	Loss%		
14L	13	33	53
17L	13	46	57
Chart 14 & 17	16	32	61
Tassel	13	38	61
Chart Tassel	25	50	75

COTTONCalifornia

The California cotton study was initiated to follow up on previous research to determine the effects of limb removal in cotton, specific to the growing conditions of Arizona and California. This research examined limb removal during the later reproductive stages of growth due to the greater number of limbs that are produced consistently under these environmental conditions. The treatments removed limbs at node 20, 24, 28 and 32. NCIS removed either 0, 25, 50 or 75 percent of the limbs from the top of the plant down.

There was little loss associated with limb

Soybeans check plots in Indiana for the R4 and R5 stages of growth.

removal at growth stages of 20, 24, or 28 nodes on the cotton plant. The most significant loss was associated with the treatments done at 32 nodes, where there were losses as high as 45 percent. There are no current NCIS charts that go to these levels of plant growth, so this research will be used to determine new charts for cotton grown in this area.

A second study examined the defoliation of the cotton plant with and without the removal of the terminal nodes. Defoliation was done at nodes 4, 10, 16 and 24 nodes with either 50 or 100 percent of the leaves being removed. The 50 percent defoliation treatments removed the top 50 percent of the leaves. The results from 2016 showed little difference in loss between the treatments due to defoliation. There were some numerical differences, but there were no significant differences found.

Table 8 **COTTON** Mississippi

Treatment	Starkville	Brownville	Charts
		Loss%	
4 Leaf–2 nodes	16	-4	10
4 Leaf–4 nodes	38	4	25
Pinhead–2 nodes	10	-5	15
Pinhead–4 nodes	23	-3	25
Pinhead–6 nodes	44	-8	40
Pinhead–8 nodes	81	31	60
1st Flower–2 nodes	8	-7	20
1st Flower–4 nodes	11	4	30
1st Flower–6 nodes	28	20	40
1st Flower–8 nodes	53	35	40
1st F + 4 Wks–2 nodes	11	1	20
1st F + 4 Wks–4 nodes	9	7	30
1st F + 4 Wks–6 nodes	15	19	40
1st F + 4 Wks–8 nodes	19	31	60

COTTONMississippi

This study was initiated to determine the effects of plant cutoffs to cotton specific to the growing conditions of Mississippi and the mid-south region. The research was conducted under rain-fed conditions and examines plant cut-offs during vegetative and reproductive stages of growth.

The treatments were cut-offs at 4-leaf, pinhead square (R-1), first flower (R-8), and first flower + 4 weeks) (~R12) stages of growth. This research was conducted at both Starkville and Brooksville, Mississippi.

The growth stage, as well as location, at which the plant cut-offs were removed had a significant effect on cotton yield. The loss percentages at Brooksville were consistently lower than the current charts, while the losses at Starkville were very close to the current charts for plant cut-offs at these stages. NCIS is continuing this trial in 2017 at both locations.

POTATOESColorado

Research began in 2014 to examine the losses associated with simulated hail damage to white potatoes: both medium and late maturing varieties under the growing conditions in Colorado. Two different varieties, Russet Norkotah Sel. 8 (a medium maturing variety) and Russet Nugget (a late maturing variety) were grown with simulated hail applied at three growth stages: Tuber Initiation (TI), Early Bulking (EB), and Late Bulking (LB). Damage was applied at 0, 33, 66 and 95 percent. The plants were then taken to harvest. This was the third year of a planned three-year trial so final conclusions will be made as we combine the results together. Losses varied depending on the maturity of the potatoes. The medium maturity potatoes had slightly higher losses when compared with the current charts for the early bulking stage while the late maturing potatoes had losses very close to the current charts.

POTATOESNorth Dakota

Both medium and late maturing white potato varieties are part of a three-year, North Dakota-based research study on simulated hail damage. Two different varieties, Russet Norkotah (a medium maturing variety) and Ranger Russet (a late maturing variety) were grown and had sim-

Soybean research in Indiana studying the effects of 100 defoliation on soybeans at the R4 (*left*) and R5 (*right*) stages of growth.

Table 9 POTATOES Colorado

Treatment	Russet Norkotah	Russet Nugget
	Yield (CWT/A)	
Control	503	479
Tuber In.–33	426	442
Tuber In.–66	395	405
Tuber In.–95	287	319
Early Bulking–33	420	392
Early Bulking–66	355	395
Early Bulking–95	320	236
Late Bulking–33	466	474
Late Bulking–66	487	427
Late Bulking–95	456	443

Table 10 POTATOES North Dakota

Treatment	Russet Norkotah	Russet Ranger
	Yield (CWT/A)	
Control	458	400
Tuber In.–33	383	279
Tuber In.–66	361	245
Tuber In.–95	202	172
Early Bulking–33	373	327
Early Bulking–66	329	299
Early Bulking–95	225	238
Late Bulking–33	381	374
Late Bulking–66	316	338
Late Bulking–95	254	191

ulated hail applied at three growth stages: Tuber Initiation (TI), Early Bulking (EB) and Late Bulking (LB).

Damage was applied at 0, 33, 66 and 95 percent and later were harvested. Losses varied depending on the maturity of the potatoes as shown with the medium maturity variety having losses very close to the current charts. The late maturing variety had losses that were lower than what the current charts would suggest. (Table 10) The data from this trial, along with that conducted in Colorado, Washington, and Michigan will be reviewed and incorporated into the NCIS potato loss procedures.

SOYBEANS Arkansas

A study began in 2013 to investigate the defoliation charts for both indeterminant and determinant type soybeans in Arkansas. Arkansas has historically grown more determinant soybeans, but more recently there has been a trend to start growing an earlier maturing indeterminant variety.

Soybean plot that was defoliated 50% at R4 in Iowa.

When viewing additional research, NCIS has seen greater amounts of loss associated with defoliation damage occurring during the early to mid-reproductive stages (R1 and R3) of development and wanted to see if this was true. Two different varieties were used—MG 4.7 indeterminant and MG 5.4 determinant variety were planted at Newport Arkansas.

Defoliation was applied at 0, 25, 50, 75 and 100 percent at either R1 or R3 stage of growth. Losses were significantly greater for the indeterminant MG 4.7 variety at the higher levels of damage than the current charts show (Table 11). The determinant MG 5.4 variety also showed higher losses at the highest damage level (100 percent); this occurred only during the R3 stage (27 percent greater loss).

A second study was initiated in 2016 to determine the losses from defoliation at the R-4 and R-5 stages of development. The same varieties of soybeans were used as was previously discussed with regards to defoliation at R-1 and R-3. The losses at R-4 for the indeterminate soybean variety were between six and 40 percent greater than the current charts suggest at the 50 percent to 100 percent defoliation levels (Table 12). The losses at R-5 for the indeterminate variety were very close to what our current chart would suggest. The defoliation at R-4 and R-5 for the determinate variety were also very similar to what the current charts would suggest.

Table 11 SOYBEANS Arkansas

Growth Stage	Defoliation%			
	25	50	75	100
	Loss%			
R1	5	12	10	39
R1 Chart	1	3	5	12
R3	14	20	35	82
R3 Chart	4	8	16	33

Table 12 SOYBEANS Arkansas

Growth Stage	Defoliation%			
	25	50	75	100
	Loss%			
R4	7	19	40	96
R4 Chart	6	12	26	56
R5	16	27	36	94
R5 Chart	9	17	36	75

SOYBEANSIndiana

This trial was initiated in 2016 to study the impact of simulated hail defoliation on the yield and percent loss of soybeans at the R-4 and R-5 stages of development. This is a follow-up to the studies that showed great losses from defoliation at R-1 and R-3. A maturity group MG 3.8 soybean variety was grown at the Purdue research farm just west of Lafayette, Indiana.

Defoliation treatments were applied at R4 and R5 growth stages with defoliation levels of 25, 50, 75 and 100 percent. The losses at the R4 stage were higher than our current charts suggest (Table 13). The losses at the R-5 stage of development were the same as what our current charts would suggest.

SOYBEANSIowa

Research conducted at Boone, Iowa, is evaluating the effects of 25, 50, 75, and 100 percent defoliation at the R4 and R5 soybean growth stages. This is follow-up to research conducted at earlier R-stages that suggests that defoliation causes greater losses than previously thought. Table 14 shows the 2016 results for Iowa.

Table 13 **SOYBEANS** Indiana

Growth Stage	Defoliation%			
	25	50	75	100
	Loss%			
R4	7	18	40	88
R4 Chart	6	12	26	56
R5	6	18	34	81
R5 Chart	9	17	36	75

Researcher **Darrin Dodds** and a graduate student evaluating cotton plots in Mississippi.

SOYBEANSNorth Dakota

The impact of defoliation on soybeans at the R-4 and R-5 stages of growth is being examined as follow-up to similar research at the R-1 and R-3 stages. The first research showed significant differences in losses when compared with current NCIS charts. The research, conducted in North Dakota at the Prosper research site, used a MG 0.8 variety. Defoliation was done at R-4 and R-5 at levels of 0, 33, 66, and 100 percent.

The research results showed little difference in amount of loss due to defoliation at either R-4 or R-5 when compared with current charts. (Table 15)

WHEATKansas

In 2016, winter wheat research at Manhattan, Kansas, began to evaluate the current chart factors for hanging wheat heads broken above and below the flag leaf. Treatments consist of breaking-over all of the wheat heads in each plot at the boot, milk, anthesis, soft dough, and hard dough stages of reproductive development. In the first year, high hanger (above flag leaf breaks) losses at anthesis were 32 percent and were considerably less than the current loss factor of 60 percent for Zone 1 wheat (Table 16). However, high hanger losses at the other reproductive growth stages were within five percentage points of the current loss factors. Low hangers (below flag leaf breaks) losses at the boot, anthesis, and soft dough stages ranged from 12-26 percentage points less than the current Zone 1 loss factors. Losses at the milk and hard dough stages were within five points of the current loss factors. This research was expanded in 2017 to include locations in Zone 2 and Zone 5.

Table 14 **SOYBEANS** Iowa

Growth Stage	Defoliation%			
	25	50	75	100
	Loss%			
R4	0	0	7	41
R4 Chart	6	12	26	56
R5	5	9	33	87
R5 Chart	9	17	36	75

Table 15 **SOYBEANS** North Dakota

Growth Stage	Defoliation%		
	33	66	100
	Loss%		
R4	9	19	52
R4 Chart	8	20	56
R5	5	24	84
R5 Chart	11	28	75

Table 16 **WHEAT** Kansas

Stage	Breakpoint (flag leaf)	Loss%	Zone 1 Appraised %
Boot	Below	23	50
Anthesis	Above	26	60
Anthesis	Below	24	40
Milk	Above	36	40
Milk	Below	34	30
Soft Dough	Above	34	30
Soft Dough	Below	11	20
Hard Dough	Above	17	20
Hard Dough	Below	9	10

In conclusion, the NCIS research program could not happen without the support of NCIS member companies. For decades, research has provided the science behind the industry loss adjustment procedures. This provides company adjusters with the knowledge they need to determine accurate losses, giving farmers peace of mind knowing that their loss has been adjusted accurately and fairly. We, at NCIS, strive to continue providing this service to the crop insurance industry. Continue to look for future NCIS agronomic research reports for final conclusions on recent studies.