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Corporation

FCIC-20660L  
(01-2022)

**POST-  
APPLICATION  
COVERAGE  
ENDORSEMENT  
LOSS  
ADJUSTMENT  
STANDARDS  
HANDBOOK**

**2022 and Succeeding Crop  
Years**



**RISK MANAGEMENT AGENCY  
KANSAS CITY, MO 64133**

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| <b>TITLE: POST-APPLICATION<br/>COVERAGE ENDORSEMENT LOSS<br/>ADJUSTMENT STANDARDS<br/>HANDBOOK</b>  | <b>NUMBER: FCIC-20660L</b>  |
| <b>EFFECTIVE DATE:<br/>2022 and Succeeding Crop Years</b>   | <b>ISSUE DATE: January 5, 2022</b>  |
| <b>SUBJECT:</b><br><br><b>Provides the procedures and instructions<br/>for administering the Post-Application<br/>Coverage Endorsement (PACE) crop<br/>insurance program.</b> | <b>OPI: Product Administration and Standards<br/>Division</b>   |
|   | <b>APPROVED:</b><br><br><i>/s/ Richard Flournoy</i><br><br><b>Deputy Administrator for Product Management</b> |

**REASON FOR ISSUANCE**

This is the first issuance of FCIC-20660L Post-Application Coverage Endorsement Loss Adjustment Handbook.

**POST-APPLICATION COVERAGE ENDORSEMENT LOSS ADJUSTMENT STANDARDS  
HANDBOOK**

**CONTROL CHART**

Post-Application Coverage Application Loss Adjustment Standards Handbook

|                  | TP<br>Page(s) | TC<br>Page(s) | Text<br>Page(s) | Exhibit<br>Number | Exhibit<br>Page(s) | Date    | FCIC<br>Number |
|------------------|---------------|---------------|-----------------|-------------------|--------------------|---------|----------------|
| Current<br>Index | 1-2           | 1             | 1-12            | 1-5               | 13-23              | 12-2021 | FCIC-20660L    |

**FILING INSTRUCTIONS:**

This handbook is effective for the 2022 and succeeding crop years.

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STANDARDS HANDBOOK  
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# PART 1 GENERAL INFORMATION AND RESPONSIBILITIES

## 1 General Information

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### A. Purpose and Objective

The RMA-issued loss adjustment standards for all eligible crops are the official standard requirements for adjusting losses in a uniform and timely manner. The RMA-issued standards for this CY are in effect as of the signature date for this handbook and are located at [www.rma.usda.gov](http://www.rma.usda.gov).

This handbook remains in effect until superseded by reissuance of either the entire handbook or selected portions (through amendments, bulletins, or Final Agency Decisions). If amendments are issued for a handbook, the original handbook as amended shall constitute the handbook. A bulletin or Final Agency Decisions can supersede either the original handbook or subsequent amendments.

### B. Related Handbooks

The following table identifies handbooks that shall be used in conjunction with this handbook.

| Handbook                             | Relation/Purpose   |
|--------------------------------------|--|
| DSSH                                 | Provides the form standards and procedures for use in the sales and service of crop insurance contracts. |
| GFP Determination Standards Handbook | Provides standards and procedures for administering good farming practice decisions and determinations.  |
| GSH                                  | Provides general crop insurance information.   |
| PACE ISH                             | Provides specific form standards and procedures for administering PACE.                                  |
| LAM                                  | Provides overall general loss adjustment (not crop-specific) process.                                    |

- (1) Terms, abbreviations, and definitions general (not crop specific) to loss adjustment are identified in the GSH and the LAM.
- (2) Terms, abbreviations, and definitions specific to this handbook are in [Exhibits 1](#) and [Exhibit 2](#), herein.

## 2 AIP Responsibilities

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### A. Utilization of Standards

All AIPs shall utilize these standards for both loss adjustment and loss training for the applicable crop year. These standards, which include crop appraisal methods, claims completion instructions, and form standards, supplement the general (not crop-specific) loss adjustment standards identified in the LAM.

## 2 AIP Responsibilities (Continued)

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### B. Form Distribution

The following is the minimum distribution of forms completed by the adjuster and signed by the insured (or the insured's authorized representative) for the loss adjustment inspection:

- (1) One legible copy to the insured; and
- (2) The original and all remaining copies as instructed by the AIP.

### C. Record Retention

It is the AIP's responsibility to maintain records (documents) as stated in the SRA and as described in the LAM. Documentation shall include determinations of acreage physically prevented from applying post-application nitrogen.

### D. Form Standards

- (1) The entry items and the completion instructions in Exhibit 7 in the PACE ISH are the minimum requirements for the PACE Claim requirements. All entry items are "Substantive" (they are required).
- (2) The Privacy Act, Non-Discrimination and the Certification Statements are required statements that must be printed on all forms or provided to the insured as a separate document. These statements are not shown on the example form(s) in Exhibit 7 in the PACE ISH.
  - a) The Non-Discrimination Statement can be found at: <https://www.rma.usda.gov/Web-site-Policies-and-Important-Links/Non-Discrimination-Statement> or successor website.
  - b) The Privacy Act Statement can be found at: <https://www.rma.usda.gov/About-RMA/Laws-and-Regulations/Required-Statements/Collection-of-Information-and-Data-Statement> or successor website.
  - c) The Certification Statement can be found at: <https://www.rma.usda.gov/About-RMA/Laws-and-Regulations/Required-Statements/Certification-Statement> or successor website.
- (3) Refer to the DSSH for other crop insurance form requirements (such as point size of font, and so forth).

**3-10 (Reserved)**





## PART 2 PACE POLICY INFORMATION

### 11 General Information

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The following may not be a complete list of insurability requirements for PACE. Refer to the BP, Coarse Grains CP, PACE, and the SP for a complete list of all insurability requirements. AIPs shall determine if the insured complies with all policy provisions of the insurance contract.

- (1) The BP and the Coarse Grains CP must be in force to elect to insure under the PACE.
- (2) PACE must be elected in writing on or before the applicable SCD for the crop.
- (3) PACE will apply to eligible acreage of non-irrigated corn insurable under the Coarse Grains CP. Only grain type is eligible. Specialty and organic corn are not eligible.
- (4) PACE may not be elected if the insured's non-irrigated corn is insured under the Catastrophic Risk Protection Endorsement.
- (5) Except when in conflict with the PACE, all provisions of the BP and CP apply.
- (6) To be eligible for coverage, the PACE Endorsement must be purchased from the same insurance provider that provides coverage under the BP and applicable Coarse Grains CP.
- (7) The PACE operates only in those crops and counties specified in the actuarial documents.

### 12 Units

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The unit structure provided under the BP and the Coarse Grains CP applicable to the insured acreage may apply under the PACE with the following limitation.

- (1) Units by irrigated practices do not apply. Only actual planted acreage is eligible for coverage.
- (2) Whole farm units are allowed only if specified in the Special Provisions.
- (3) Provided the insured has historical records at the basic unit and/or optional unit level (as applicable) sufficient to calculate an Approved Yield on such units, then PACE may be elected on an optional or basic unit basis if the underlying policy uses enterprise, enterprise by practice, multi-county, or whole farm units; and, optional units may be elected for PACE if the underlying policy uses basic units. All acres in an insured PACE unit must be insured if they are eligible for coverage. For sake of clarity, if acres in a PACE insured unit are non-irrigated corn and not high-risk, then they are eligible and insured, and premium will be due on those acres, even if the Final Post-Application Percent is deemed to be zero percent.

## 12 Units (Continued)

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- (4) The Insureds may elect PACE coverage on some eligible units and not others, provided sufficient records exist to fulfill the requirements of (3) above, but the insured must elect PACE on all units where the post-application Nitrogen practice is used on a majority of the acreage if optional or basic units are elected for PACE. Premium will be charged on all acres in an insured PACE unit where the crop is eligible (even if the Final Post-Application Percent is deemed to be zero percent on any given acreage).

In the event a unit contains acreage that is not eligible, those acres that are not insurable will be excluded from PACE coverage, and no premium will be due on those acres. The insured must specify PACE units on or prior to Sales Closing; otherwise, all eligible acres and units in the underlying policy will be insured and premium will be due on such acres (even if the final post-application percent is deemed to be zero percent). The township, section and range must be specified by the SCD, otherwise all eligible acres in all units in the underlying policy will be insured under PACE and premium will be due.

## 13 Insurance Period

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The insurance period for PACE varies by region and is dependent on the date the planting of the crop is completed in the unit. The insurance periods and insurance period variance are specified in the actuarial documents (ADM). The variance dates were calculated based on approximately the 10<sup>th</sup> and 90<sup>th</sup> percentile of growing degree days (GDD) from the approximate 30-year average PRISM GDD and presumed accurate. The adjuster must, in the event of a claim:

- (1) Verify the date planting was completed in each unit (if planting was split into multiple days, then verify the dates on which the acreage on each day was planted).
- (2) Verify the prevented post-application window from the actuarial documents. Determine if the variance window is applicable based on the percentile of accumulated GDDs compared to the 30-year average accumulated GDDs for the county. If GDDs have accumulated in the year faster than average since planting, then the window may be adjusted forward such that the start date is not before the variance start date; if accumulated GDDs have accrued slower than average, adjust end window back commensurate with the 30-year percentile, such that the variance end date does not exceed the variance end date.

For example, if the PACE window end date and variance window end date are June 15<sup>th</sup> and June 25<sup>th</sup> as published in the actuarial documents, respectively, and the current year accumulation of GDDs after the planting date until the window end date are in the 25<sup>th</sup> percentile (slower or colder than average), then the adjuster may adjust the end date back to June 20<sup>th</sup>. If the accumulated GDDs were in the 5<sup>th</sup> percentile, then adjust the end date back to June 25<sup>th</sup> (the published maximum variance window end date). If the accumulated GDDs were in the 50<sup>th</sup> percentile, then use the published end date (June 15<sup>th</sup>).

## 14 Payment Qualifications

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PACE Payments will not be made on acreage that fails to meet the requirements of the Coarse Grain CP and PACE. The amount of the PACE payment will be determined by the calculations and procedures as outlined in the PACE LASH. See Exhibit 5 in the PACE ISH for additional information.

### A. Qualifications for PACE Payment

To qualify for PACE payments, the insured must:

- (1) Have an underlying insurance policy (YP, RP, or RP-HPE) for non-irrigated corn in effect;
- (2) Have coverage for the underlying base policy at an additional coverage level;
- (3) Comply with all terms and conditions of the base policy;
- (4) Provide documentation of which machinery or equipment will be used for any successful and intended nitrogen applications (both pre-plant and post-plant), or purchase orders if such services were contracted;
- (5) Use a split application of nitrogen practice;
- (6) Provide documentation supporting the purchase of nitrogen for the split-application of nitrogen practice;
- (7) Have been physically prevented from applying the post-application of nitrogen during the insurance period by an insurable cause of loss stated in the base policy; and
- (8) List on their timely submitted PACE acreage report the acreage on which a split application of nitrogen practice was intended, and the pre-application of nitrogen applied.

### B. Prevented Post-Application

- (1) Insured's duties in the event of prevented post-application:
  - (a) Provide a notice of loss that they were prevented from applying the post-application nitrogen to an insured crop within 72 hours after the end of the insurance period for the PACE Endorsement as stated in the actuarial documents, and/or within 72 hours of being physically prevented from post-applying nitrogen, whichever is later.
  - (b) Provide a completed Post-Application Coverage Endorsement Nitrogen Report (Exhibit 5 in the PACE ISH) with the notice of loss (Exhibit 6 in the PACE ISH).
- (2) If the insured fails to provide a timely notice of loss as described above or provide a completed PACE Nitrogen Report, the PACE claim will result in no PACE coverage. However, the PACE premium will still be due.

## **15 Perils Covered by PACE**

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Insured causes of loss include any cause listed in the underlying insurance policy and this Endorsement that physically prevented the insured from applying the post-application of nitrogen on any acreage in a PACE insured unit.

## **16 PACE Coverage Levels**

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The insured may select a coverage level between 75 and 90 percent.

## **17 Eligible Acreage**

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The eligible acreage is all acreage in the unit in which the insured designated on the application that a split application of nitrogen practice will be used and the number of acres in which the pre-application of nitrogen has been applied as contained in the PACE acreage report. The acreage reporting date is the same as the policy.

## **18-20 (Reserved)**

## PART 3 FIELD INSPECTIONS

### 21 General Information

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During the field inspection, the AIP must verify:

- (1) an insured cause of loss prevented the insured from applying the post-application nitrogen, and if so, what was the insured cause of loss;
- (2) the insured cause of loss occurred during the insurance period; and
- (3) the acreage reports provided as in Exhibit 4 PACE ISH.

### 22 Acreage Reporting

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The acreage report is the primary tool for establishing the liability for all acreage in which a pre-application of nitrogen has been applied and where the post-application of nitrogen was prevented.

#### A. Insured's Responsibilities

The insured is responsible for:

- (1) reporting all acreage in which a pre-application of nitrogen was applied along with any information required to complete an accurate initial PACE acreage report. Please refer to Exhibit 4 in the PACE ISH.
- (2) reporting the correct unit number for the acreage in which a pre-application of nitrogen was applied.

#### B. Separate Line Entries on PACE Acreage Report

- (1) Separate line entries are required on the PACE acreage report for the following:
  - (a) Basic, enterprise, and optional units, and within each unit, separate line entries for differing practices, types, varieties, shares, APH yields, and risk classifications;
  - (b) For whole farm units, a separate line for each crop with differing practices, types, varieties, shares, APH yield, and risk classifications;
  - (c) Timely planted acres;
  - (d) Late planted acres, with a separate line entry for each day of planting during the late planting period, or if insurable, acreage planted after the late planting period or after the final planting date for crops that do have a late planting period (with a reduced production guarantee based upon the planting date);
  - (e) The total amount of planted acres eligible for PACE cannot exceed the maximum number of acres for which a pre-application of nitrogen was applied; and

## 22 Acreage Reporting (Continued)

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- (2) The PACE acreage reporting date is the same as the underlying insurance policy acreage reporting date.

## 23 Field Inspection Process

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### A. AIP Responsibilities

After the AIP has received the insured's PACE Notice of Probable Loss, an inspection must be made as soon as possible to verify an insured COL occurred during the PACE insurance period and the insurable cause of loss did physically prevent the post-application nitrogen from being applied to the insured acres. Document any of the situations noted below.

- (1) There is not a known cause of loss in the geographic area where the insured states they have been prevented from post-application nitrogen being applied.
- (2) Only a minimal percentage of the insureds for a particular area submitted a PACE notices of loss.
- (3) It does not seem reasonable for the respective acreage to have been prevented from post-application nitrogen being applied (e.g., acreages of lower elevation have been affected but this acreage is of higher elevation and should not have been affected).
- (4) The AIP has reason to suspect the insured of misrepresentation; or
- (5) For any other reason, the AIP deems appropriate.

### B. Nitrogen Stress Visibility/Testing

In fields where inspection is required, and records cannot be produced to demonstrate planned nitrogen purchases and production plans deemed sufficient by the adjuster to demonstrate intent, the adjuster will inspect a sample of the leaves of the plants on affected acres, especially older leaves, which appear lower on the stalk of the corn plant and compare it with [Exhibit 4](#) and [Exhibit 5](#).

The timeframe of nitrogen stress which is evident as a spear-shaped yellowing pointing away from the leaf tip is around 45-85 days after planting depending on the planting date, region, and the insurance period, as published in the actuarial documents. [Exhibit 5](#) graphically shows the nitrogen deficiency symptom along with other deficiency symptom appearances in a leaf. Note that nitrogen stress may in some cases not present until many days after the insurance period, and the presence of nitrogen stress is not necessarily required for a PACE loss (only the actual physical inability to post-apply due to a COL, and only when post-application was intended). However, the AIP reserves the right to inspect the crop and investigate if nitrogen stress is present in the event there is reason to suspect misrepresentation or lack of an actual COL.

## 24-30 (Reserved)

## PART 4 CLAIMS PROCEDURE

### 31 General Claim Information

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#### A. AIP's Responsibilities

The AIP is responsible for ensuring that:

- (1) documentation of actions taken by the adjuster or AIP for verification and review of the PACE claim is retained by the AIP.
- (2) before processing a PACE payment, the correct PACE guarantee is used to process the PACE claim.

#### B. Loss Adjustment Responsibilities

The adjuster is responsible for verifying:

- (1) The insured was physically prevented from post-application of nitrogen due to an insured cause of loss and, if applicable, a visual inspection as described in Section 23(F);
- (2) The number of prevented post-application acres, and that those acres are eligible for PACE; and the units which the insured practices post-application nitrogen practice cover a majority of those acres (as determined by if at least 50% of the acres in the unit utilize the post-application nitrogen practice);
- (3) The acceptable records (e.g., purchase receipts) that show the name of the insured, date of purchase, type of fertilizer purchased, brand name (if applicable), the nitrogen, phosphorus, potassium content, and the total amount of fertilizer, and the number of acres and each date on which it was applied (Exhibit 5 of the PACE ISH and Exhibit 3 of the PACE LASH); and
- (4) All other PACE requirements have been met.

### 32 Payment Determination

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#### A. The Guarantee

The guarantee for PACE acreage is determined separately from the guarantee of the underlying insurance policy.

## 32 Payment Determination (Continued)

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### B. PACE Payment Claim

When preparing a claim for a PACE payment, the acres on which the pre-application of nitrogen was applied and the acres in which the post-application of nitrogen was prevented must be shown on the Production Worksheet.

**Example:** If 70 acres has pre-application of nitrogen applied and 30 acres were prevented from applying the post-application of nitrogen, the Production Worksheet will be completed as follows: There will be one line with the 70 pre-application acres and a separate line with the 30 acres prevented from post-application of nitrogen.

## 33 PACE Payment Calculation

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### A. Eligible Acreage Determination

Determine the number of acres in each unit on which pre-application nitrogen was applied but the post-application was prevented by an insurable cause of loss (PACE ISH Exhibit 4).

### B. Determination of Final Post-Application Percent and PACE Loss Factor

If the insured's actual pre-plant nitrogen exceeds (1) the maximum nitrogen rate times (2) the difference between one and the declared post-application percent, by more than 5%, the Final Post-Application Percent should be recalculated and rounded down to the nearest 5%. The Final PACE Loss Factor should then be referenced with the Final Post-Application Percent.

**Example:** An insured has an approved yield per acre of 200 bushels. The maximum nitrogen per acre is  $200 \times 1.2 = 240$  lbs. N/acre. The declared post-application percent is 30% of 240, and the actual total nitrogen applied per acre is 180 lbs. N/acre on PACE loss acres. The Final Post-Application Percent is equal to  $(1 - [180 / 240]) = 25\%$ . Since the Final Post-Application Percent does not match the declared post-application percent, the loss factor must be adjusted downward to reflect the actual post-application percentage. The new loss factor is 17% (at 25% post-application), rather than the original 18% (at 30% post-application). Actual loss factors are found in the corresponding actuarial documents (AD).

### C. Determinations of the PACE Indemnity and PACE Offset

- (1) PACE losses are only paid on affected PACE loss acres in PACE insured units; therefore, the unit structure does not affect the total indemnity payment on insured acres. The preliminary PACE indemnity is calculated by:
  - (a) Multiplying the approved yield by the greater of the harvest price or projected price defined in the underlying insurance policy;
  - (b) Multiplying the result of (a) by the insured's PACE loss acres;



### 33 PACE Payment Calculation (Continued)

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- (c) Multiplying the result of (b) by the insured's PACE coverage level election percent;
  - (d) Multiplying the result of (c) by the insured's share; and
  - (e) Multiplying the result of (d) by the final PACE loss factor.
- (2) The amount of payment owed under this Endorsement may be reduced by a PACE offset in the event an indemnity is also owed on the underlying insurance policy and exceeds the underlying insurance policy deductible., the PACE offset is calculated by:
- (a) Subtracting the underlying insurance policy coverage level from one;
  - (b) Multiplying the result of (a) by the approved yield;
  - (c) Multiplying the result of (b) by the greater of the projected or harvest price defined in the underlying insurance policy;
  - (d) Multiplying (c) by the insured PACE acres;
  - (e) Multiplying (d) by the share to get the underlying insurance policy deductible; and
  - (f) Subtracting (e) from the PACE indemnity. If this is greater than zero, and your underlying insurance policy has paid an indemnity on those PACE loss acres, then the PACE offset is equal to the lesser of this result or the indemnity on your underlying insurance policy.

**Example:** Preliminary PACE Indemnity

The insured was prevented from post-application of nitrogen on 100 acres. The insured has an approved yield of 200 bushels/acre. The greater of the projected price and harvest price is \$4.00. The insured elects 90 percent PACE coverage level, has 100% share, and has a final PACE loss factor of 17%. The harvest price is less than the projected price.

$$200 \text{ bushels/acre} \times \$4.00/\text{bu.} = \$800 \text{ /acre}$$

$$\$800/\text{acre} \times 100 \text{ acres} = \$80,000$$

$$\$80,000 \times 90\% \text{ coverage} = \$72,000$$

$$\$72,000 \times 100\% \text{ share} = \$72,000$$

$$\$72,000 \times 17\% \text{ loss factor} = \$12,240 \text{ preliminary PACE indemnity}$$

### 33 PACE Payment Calculation (Continued)

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**Example:** Final PACE Indemnity and PACE Offset

Using the example above, the insured elected an 85 percent coverage level on their underlying insurance policy, and the underlying policy is YP, and the projected price is \$4. Suppose the final yield is 100. The harvest price is less than the projected price. The PACE offset and final PACE indemnity is calculated as follows:

$$100\% - 85\% = 15\% \text{ (or } 0.15) \text{ underlying deductible percent}$$

$$0.15 \times 200 \text{ bu./acre} = 30 \text{ bu./acre}$$

$$30 \text{ bu./acre} \times \$4.00/\text{bu.} = \$120/\text{acre}$$

$$\$120/\text{acre} \times 100 \text{ acres} = \$12,000$$

$$\$12,000 \times 1.00 \text{ share} = \$12,000$$

$$\$12,240 - \$12,000 = \$240 \text{ (preliminary PACE offset)}$$

$$\text{YP Indemnity} = \$28,000$$

The preliminary PACE indemnity is \$12,240, and the preliminary PACE offset is \$240. The YP indemnity is greater than zero, therefore the final PACE offset is the lesser of \$240 and the YP indemnity of \$28,000. Therefore, the indemnity for PACE will be reduced by up to \$240. The final PACE indemnity is thus  $\$12,240 - \$240 = \$12,000$ .

34-50 (Reserved)

## Acronyms and Abbreviations

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The following table provides the acronyms and abbreviations used in this handbook.

| <b>Approved<br/>Acronym/Abbreviation</b> | <b>Term</b>   |
|--|---|
| AD                                       | Actuarial Documents   |
| CIH                                      | FCIC-18010 Crop Insurance Handbook  |
| CY                                       | Crop Year   |
| DSSH                                     | Document and Supplemental Standards Handbook, FCIC-24040  |
| GFP Determination<br>Standards Handbook  | Good Farming Practice Determination Standards Handbook, FCIC-14060  |
| GSH                                      | General Standards Handbook, FCIC-18190  |
| LAM                                      | Loss Adjustment Manual, FCIC-25010  |
| PACE                                     | Post-Application Coverage Endorsement   |
| PACE ISH                                 | PACE Insurance Standards Handbook   |
| PRISM                                    | Parameter-elevation Regressions on Independent Slopes Model<br>Website: <a href="https://prism.oregonstate.edu/">https://prism.oregonstate.edu/</a> |
| SCD                                      | Sales Closing Date  |
| YP                                       | Yield Protection  |
| RP                                       | Revenue Protection  |
| RP-HPE                                   | Revenue Protection with Harvest Price Election  |

## Definitions

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**Crop Year** as defined in the applicable Coarse Grains Crop Provisions.

**Insurance Period** begins on the calendar date stated in the actuarial documents that corresponds to the start of the post-application window and ends on the calendar date in the actuarial documents for the end of the post-application window, subject to the variance window. This represents the time period in which the post-application of nitrogen would customarily be applied under the standards of good farming practice, as published in the actuarial documents. To account for warmer and colder than average years, and their impacts on growth rates of the crop climatic events, the post-application window can be shifted forward or backward up to the variance dates as published in the actuarial documents, in accordance with this document (see [Paragraph 13](#)).

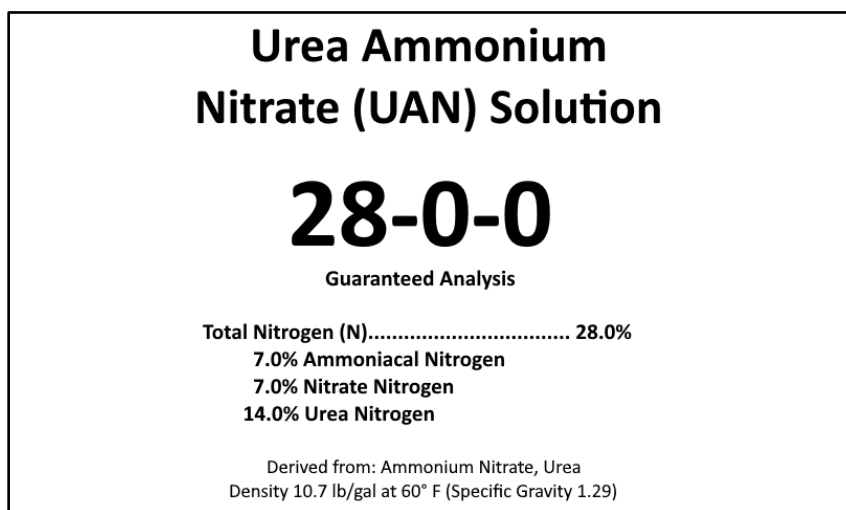
**Split application** means the recognized good farming practice whereby the producer applies a portion of the total amount of nitrogen prior to planting and the remainder of the nitrogen is applied prior to the crop reaching approximately the V10 growth stage. The timing of nitrogen applications for post-apply relies on the insurance period.

## Calculating Nitrogen Pounds Per Acre

PACE ISH Exhibit 5 (Post-Application Coverage Endorsement Nitrogen Report) provides the producer nitrogen fertilizer reporting requirements. These requirements include submitting fertilizer labels, the rate of fertilizer application, and the overall pounds of nitrogen per acre applied. This exhibit provides examples to the adjuster for methods of double-checking the reported pounds of nitrogen per acre, using the rates of product applied and product labels. To calculate pounds of nitrogen per acre, fertilizer products must be linked to their underlying nitrogen content, as well as their density (for liquid fertilizer applications).

### A. Utilizing Fertilizer Labels

Labels provide all the necessary data for a given fertilizer, including nitrogen content and product density. All fertilizer labels provide nitrogen content as the percentage of elemental nitrogen.



*Figure 1: Recreated example of a Urea Ammonium Nitrate (UAN) label, showing nitrogen content and density*

### B. Utilizing Fertilizer Safety Data Sheets

Any data missing from a given fertilizer label can most likely be found in the associated safety data sheet. Safety data sheets include exhaustive information on hazard identification, company contact information, ingredients, safety and handling instructions, physical properties, and chemical properties. Statistics such as density and specific gravity are often included in the “Physical and chemical properties” section of a safety data sheet.

## Calculating Nitrogen Pounds Per Acre (Continued)

### B. Utilizing Fertilizer Safety Data Sheets (continued)

| Section 9: Physical and Chemical Properties |   |  |
|---|---|--|
| Physical State                              | : | Liquid                                     |
| Color                                       | : | Clear to slightly hazy                     |
| Odor  | : | Ammoniacal [Slight]                        |
| pH  | : | 6 to 7                                     |
| Melting Point                               | : | -18° C (-0.4°F)                            |
| Boiling Point                               | : | 121° C (249.8°F)                           |
| Vapor Pressure                              | : | Not available                              |
| Vapor Density                               | : | Not available                              |
| Density                                     | : | 10.7 lb/gal @ 60°F                         |
| Relative Density                            | : | 1.28                                       |
| Solubility                                  | : | Easily soluble in cold water and hot water |
| Solubility in Water                         | : | Water-soluble liquid                       |
| Viscosity                                   | : | Not available                              |

Figure 2: Recreated safety data sheet “physical and chemical properties” section for UAN-28 product. Data Source<sup>1</sup>

### C. Nitrogen Calculation Examples

(0) Example 1 – a fertilizer tank mix consisting of:

Smart Trio @ 15 gallons per acre  
 28% UAN @ 5 gallons per acre  
 Water @ 10 gallons per acre

The overall tank mix application operation is applied at **30 gallons per acre**. To find the amount of nitrogen per acre, first determine how much nitrogen is in each fertilizer product. 28% UAN is 28% nitrogen and can quickly look up the density (~10.7 lbs./gal). We can find the label for Smart Trio through a Google search. The label reveals that Smart Trio contains 4% N and has a density of 10.5 lbs./gal. If density is missing from the label for a given product, it can usually be located in the product’s safety data sheet; otherwise, call the retailer or manufacturer or other means (e.g., consult university or agency extension agent, online research, etc.).

<sup>1</sup> “UAN 28-0-0 (Bulk) US-GHS Safety Data Sheet,” [Nutrien](#), 2021  
 December 2021 [FCIC-20660L](#)

## Calculating Nitrogen Pounds Per Acre (Continued)

### C. Nitrogen Calculation Examples (continued)

| Micro Fertilizer Example 4-0-0   |       |
|--|-------|
| Nutrient Solution  | 4-0-0 |
| <b>Guaranteed Analysis</b>   |       |
| Total Nitrogen (N) .....   | 4.00% |
| 4.00% Urea nitrogen  |       |
| Sulfur (S) .....   | 3.00% |
| 3.00% Combined sulfur  |       |
| Boron (B) .....  | 0.25% |
| 0.25% Water soluble boron  |       |
| Manganese (Mn) .....   | 3.00% |
| 3.00% Water soluble manganese  |       |
| Zinc (Zn) .....  | 3.00% |
| 3.00% Water soluble zinc   |       |
| Derived from urea, boric acid, manganese sulfate and zinc sulfate. F76   |       |
| <b>Net Contents: 2.5 gallons (9.46 liters)</b><br>Density: 10.5 lb/gal @ 68°F<br>Net Weight: 26.0 lb (11.7 kg)<br><b>Packaged: 2 x 2.5 gallons (9.46 liters)</b> |       |

Figure 3: Example label for a micronutrient fertilizer product containing nitrogen – Data Source

We can now use the rates, densities, and nitrogen contents of each component of the tank mix to calculate the pounds per acre of nitrogen in each component:

- (a) 28% UAN @ 5 gallons per acre:

Given the per acre rate of 28% UAN, we can translate that rate into pounds of 28% UAN per acre by multiplying it by the product density. Since this product is 28% nitrogen, we can translate our per acre 28% UAN to per acre nitrogen by multiplying it by 28/100.

$$5 \frac{\text{gal}}{\text{acre}} \times 10.70 \frac{\text{lbs}}{\text{gal}} \times \frac{28}{100} \% \text{ nitrogen} = 14.98 \frac{\text{lbs. nitrogen}}{\text{acre}}$$

- (b) Micro Fertilizer @ 15 gallons per acre:

The same process used above can be done for Smart Trio.

$$15 \frac{\text{gal}}{\text{acre}} \times 10.50 \frac{\text{lbs}}{\text{gal}} \times \frac{4}{100} \% \text{ nitrogen} = 6.30 \frac{\text{lbs. nitrogen}}{\text{acre}}$$

- (c) Total Results:

Adding together our per acre nitrogen results, we end up with a total nitrogen per acre content of 21.28 lbs./acre. In some cases, it can be useful to calculate pounds of N per gallon of the tank mix applied. We can add the results in (a) and (b) then by total gallons in the application operation to arrive at average lbs. per gallon applied as below (e.g., if provided with spray maps in gallons per acre):

## Calculating Nitrogen Pounds Per Acre (Continued)

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### C. Nitrogen Calculation Examples (continued)

$$21.28 \frac{\text{lbs nitrogen}}{\text{acre}} \div 30 \frac{\text{gal}}{\text{acre}} = 0.7093 \frac{\text{lbs nitrogen}}{\text{gal}}$$

(2) Example 2 - a dry application consisting of:

- DAP 18-46-0 @ 197.53 pounds per acre

This dry application is of a single common fertilizer product (diammonium phosphate). This product contains 18% nitrogen. Since we already have the pounds per acre of the product, we only need to multiply the pounds per acre by the nitrogen percentage to get the pounds of nitrogen per acre.

(a) DAP 18-46-0 @ 197.53 pounds per acre:

DAP is being applied here at 197.53 lbs./acre. Since we have the pounds of product and we know what percentage of this product nitrogen (18%) is, we can translate to pounds of nitrogen by multiplying the application rate by the nitrogen percentage.

$$197.53 \frac{\text{lb}}{\text{acre}} \times \frac{18}{100} \% \text{ nitrogen} = 35.56 \frac{\text{lbs. nitrogen}}{\text{acre}}$$

(b) Total Results:

We end up with a total nitrogen per acre content of 35.56 lbs./acre. We can likewise divide lbs. of nitrogen/acre by lbs. of operation/acre to reach the to find the lbs. of nitrogen per lbs. of applied operation.

$$35.56 \frac{\text{lbs nitrogen}}{\text{acre}} \div 197.53 \frac{\text{lbs operation}}{\text{acre}} = 0.18 \frac{\text{lbs nitrogen}}{\text{lbs operation}}$$



## Calculating Nitrogen Pounds Per Acre (Continued)

### C. Nitrogen Calculation Examples (continued)

- (3) Example 3 - a liquid manure application consisting of:

Hog manure @ 5,629 gallons per acre

Aside from a chemical test, there is no way to know the exact nitrogen content for a given manure application. To estimate nitrogen content, the adjuster may reference this table from the Ontario Ministry of Agriculture and Food, producers test, or other applicable credible source<sup>2</sup>:

*Table 1: Manure types and nitrogen percentage. Solid and liquid manure nitrogen content listed as provided by the Ontario Ministry of Agriculture and Food.*

| Manure Type | %N (Liquid) | %N (Solid) |
|-------------|-------------|------------|
| Hog         | 0.39        | 0.93       |
| Dairy       | 0.39        | 0.72       |
| Beef        | 0.37        | 0.92       |

From the table above, liquid hog manure has a nitrogen content of 0.39%. Since liquid manure has an extremely low solids content, its density is close to that of water. Some sources estimate a density of around 8.4 pounds per gallon.<sup>3</sup> With the nitrogen content and density, calculate the nitrogen content of the manure application:

- (a) Liquid Hog Manure @ 5,629 gallons per acre:

The per acre rate of 5,629 gallons per acre of liquid hog manure can be translated to pounds per acre by multiplying by the density. We can then multiply by the nitrogen content (0.39%) to obtain the per acre nitrogen content of the application.

$$5,629 \frac{\text{gal}}{\text{acre}} \times 8.4 \frac{\text{lbs.}}{\text{gal}} \times \frac{0.39}{100} \% \text{ nitrogen} = 184.41 \frac{\text{lbs. nitrogen}}{\text{acre}}$$

- (b) Total Results: Total nitrogen per acre content of 184.41 lbs./acre. We can then divide lbs. nitrogen/acre by gallons of operation/acre to reach the lbs. of nitrogen per gallon of applied operation.

$$\begin{aligned} 184.41 \frac{\text{lbs. nitrogen}}{\text{acre}} \div 5629 \frac{\text{gallons operation}}{\text{acre}} \\ = 0.0328 \frac{\text{lbs nitrogen}}{\text{gallon operation}} \end{aligned}$$

<sup>2</sup> C. Brown, "Available Nutrients and Value for Manure from Various Livestock Types," [Ontario Ministry of Agriculture and Food](#), 2013

<sup>3</sup> "Common Manure Test Results Conversions," [LPELC](#), 2019

## Calculating Nitrogen Pounds Per Acre (Continued)

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### D. Manure Nitrogen Content

Aside from a chemical test, there is no way to know the exact nitrogen content for a given manure application. To estimate nitrogen content, we can reference this table from the Ontario Ministry of Agriculture and Food.<sup>4</sup>

*Table 2: Reference for Estimating Nitrogen Content*

| Manure Type         | %N (Liquid) | %N (Solid) |
|---------------------|-------------|------------|
| Hog                 | 0.39        | 0.93       |
| Dairy               | 0.39        | 0.72       |
| Beef                | 0.37        | 0.92       |
| Poultry             | 0.81        | 2.71       |
| Mink                | 0.45        | -          |
| Runoff              | 0.05        | -          |
| Milk-fed veal       | 0.08        | -          |
| Aerobic Biosolids   | 0.12        | -          |
| Anaerobic Biosolids | 0.28        | -          |
| Dewatered Biosolids | -           | 3.76       |
| Sheep               | -           | 0.87       |
| Dairy Goats         | -           | 1.04       |
| Composted Cattle    | -           | 0.86       |
| Compost: all types  | -           | 1.09       |
| Grain-fed veal      | -           | 0.79       |
| Horses              | -           | 0.5        |
| Turkeys             | -           | 2.53       |

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<sup>4</sup> C. Brown, "Available Nutrients and Value for Manure from Various Livestock Types," [Ontario Ministry of Agriculture and Food](#), 2013

Photograph of Nitrogen Stress

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Source: <https://extension.psu.edu/causes-of-yellowing-in-corn-plants>



**Photograph of Nitrogen Stress (Continued)**

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Source: <https://extension.tennessee.edu/publications/Documents/W976.pdf>



Source: <https://extension.sdstate.edu/sites/default/files/2019-09/S-0003-23-Corn.pdf>

Deficiency Symptom Locations for Different Nutrients

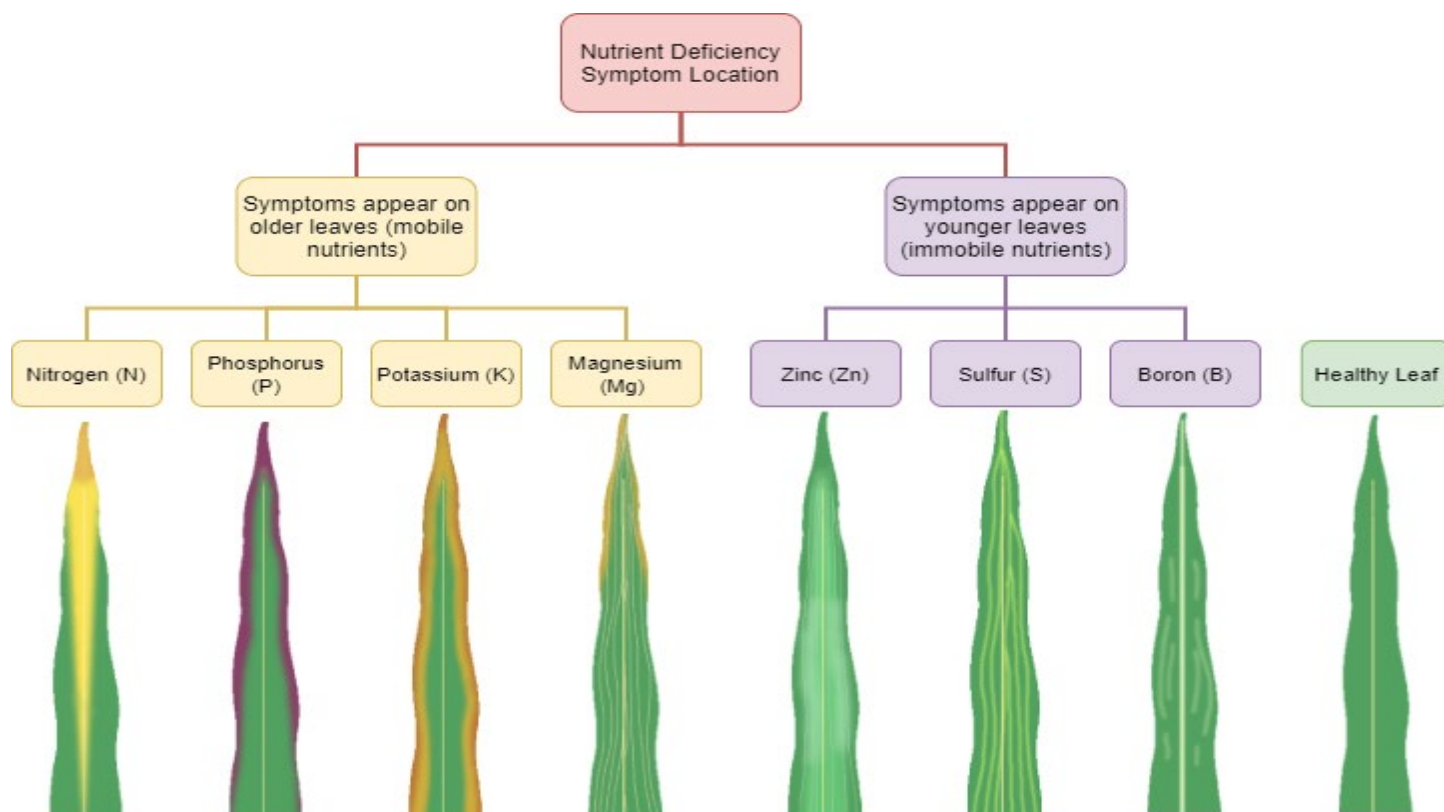


Figure 4: Common types of nutrient stress, and general corn leaf appearance when deficient<sup>5</sup>

<sup>5</sup> Adotey et al, “Visual Symptoms: A Handy Tool in Identifying Nutrient Deficiency in Corn, Cotton and Soybean,” [University of Tennessee Institute of Agriculture](#), 2020  
 December 2021