# Estimating Yield and Economic Returns from Replanting Corn

Stephen Hawkins
Extension Corn and Sorghum Specialist

The corn plant, from the moment it's kernel is laid in the seed furrow and covered with soil to the time it has ripened ready for harvest, has many factors working against it's survival. The foremost factor working to the detriment of the corn plant is seed viability. Other factors, primarily environmental, include late spring frosts and freezes, hail and other storm damage, insect and disease attack, flooding, and unfavorable seedbeds.

Of these factors, one or more occasionally cause enough field damage to warrant a decision as to whether to replant corn or to switch to another crop. Such a decision, must be based on strong evidence that the returns of replanting will outweigh the costs and on the restrictions of government programs. The following fact sheet, with a step-by-step procedure for estimating the yield and dollar gain or loss from replanting it is to be used as a guide for gathering and collecting necessary decision-making information, for calculating the damaged field's current yield potential, its replant yield potential, and its economic return (if any) to replanting. With each step, an explanation and a sample situation is given. A worksheet is provided at the end of this publication for personal calculations. Please read and study the entire publication before starting to make your calculations.

## Information Needed to Make a Corn Replant Decision:

The following information is necessary to calculate the feasibility of replanting corn: (1) original target plant population, (2) after-damage plant population, (3) after-damage stand uniformity, (4) after-damage plant defoliation (leaf loss), (5) original planting date, (6) likely replanting date, (7) likely replanting costs, (8) expected "normal" yield, and (9) expected market price for corn. This data comes from production records, field observations and measurements, and/or one's best judgments.

**Step 1.** Original target plant population. Target population or intended plant stand is different from seeding rate. Normally, a seeding rate greater than the target population is used since seed germination and plant survival will be less than 100%.

If the target population goal is known, record that value in step #1d below. If not, enter values for the original seeding rate, seed germination percentage, and expected plant survival rate in steps #1a, #1b, and #1c, then calculate target population in step #1d. Remember to convert percentiles to decimal numbers in steps #1b and #1c when multiplying (e.g., .90 rather than 90%).

a. Original seeding rate (from your records): 21,000 seeds/ac.
b. Seed germination percentage (from seed tag): 95%
c. Expected plant survival rate (use 95% if unsure): 95%
d. Original target population (#1a x #1b x #1c): 18,953 plants/ac.

**Step 2.** After-damage plant population. An accurate estimate of the remaining live-plant population is essential to determine the potential yield of a damaged field. The time to make this estimation is 4 to 7 days after the damage first occurs. This allows time for the whorl leaves of plants with undamaged growing points to expand and emerge. If after 4 days a plant shows no new green leaf material, it is probably dead.

The quantity of population estimates needed depends on the uniformity of damage throughout the field. If the damage seems to be uniformly distributed, estimates recorded at three or four sites representative of the whole field should suffice. However, if damage exists only in certain areas of the field, then an estimate or two should be taken in each area of damage (Remember that only certain areas or parts of a field may have to be replanted).

For this step, first repeat instructions, steps #2b through #2d at each chosen site to estimate after-damage plant population; then determine in step #2e the live-plants-per-acre average for all sites.

**Site 1**

a. Length of row equal to 1/1000th acre (from Table 1, based on a row width of 30 in.): 17-5 ft.-in.
b. Number of live plants in three 1/1000th-acre lengths of row: (1st row) 12 + (2nd row) 13 + (3rd row) 15 = 40 total plants.
c. Average plants per 1/1000th acre (#2b/3 rows): 13.3 plants.
d. Average live plants per acre for site (#2c x 1000): (13,300 plants/ac.)

| | Site 2 | Site 3 | Site 4 |
|---|---|---|---|
| Row 1 | 11 | 9 | 14 |
| Row 2 | 9 | 10 | 12 |
| Row 3 | 14 | 12 | 12 |
| Total | 34 | 32 | 38 |
| Average | 11,300 | 10,600 | 12,600 plants/acre |

After-damage plant population for all inspected sites (sum of #2d from all sites/number of sites): 13,300 + 11,300 + 10,600 + 12,600/4 = 11,950 plants/ac.

**Table 1. Length of Row Equal to 1/1000th Acre at Different Row Widths.**

| Row width | Length of row equal to 1/1000th acre |
|---|---|
| inches | Feet-inches |
| 15 | 34-10 |
| 20 | 26-2 |
| 30 | 17-5 |
| 36 | 14-6 |
| 38 | 13-9 |
| 40 | 13-1 |

Oklahoma Cooperative Extension Fact Sheets are also available on our website at: **http://osufacts.okstate.edu**

**Step 3.** After-damage stand uniformity. Yield loss due to stand reduction results not only from the outright loss of plants, but also from uneven distribution of the remaining plants. The more numerous and longer the between plant gaps within rows, the greater the yield reduction.

While in the field determining after-damage plant population, note the gaps between live plants in each row inspected, and record any observations.

Number of evident gaps within rows counted in step 2 with an average length of more than 3 feet 4; less than 3 feet 1?

**Step 4.** After-damage plant defoliation. Defoliation (loss of leaves) reduces the size of the plant's photosynthetic factory, which, in turn, cuts potential yield. How much loss of yield depends on the amount of defoliation (percent leaf area lost or destroyed), and when the damage occurred (growth stage).

To estimate percent leaf area lost or destroyed consider both the leaf area removed and the area still attached but no longer green. Live green tissue remaining on the plant, even though mutilated, should not be considered as leaf area destroyed.

To determine the corn growth stage, count the number of exposed leaves (i.e., 7-leaf stage, 13-leaf stage, etc.) beginning with the lowermost leaf with a rounded tip. If this lowest leaf or others have been lost or damaged, the leaf number can still be determined by splitting open the corn stalk and locating the leaf attached to the top of the first noticeably elongated internode. This is the fifth leaf. Continue counting upward to the "indicator leaf" which is the uppermost leaf being 40-50% exposed from the whorl and whose tip point is below an imaginary horizontal line at the height of the whorl.

a. Average plant leaf area lost or destroyed: 20%
b. Growth stage of corn: 4 exposed leaves

**Step 5.** Original planting date. This is the original planting date of the field.

Date that planting began: April 1. (For this example assume April 1 is the average date of the last killing frost)

**Step 6.** Likely replanting date. This is the earliest date that, to the best of one's judgement, replanting could be accomplished. Consider factors that might affect the date of replanting such as the availability of labor and machinery, the securing of production inputs, and the preparation of the field for replanting.

Date that replanting could begin: April 20

**Step 7.** Likely replanting costs. Even if the yield from replanting would be greater than that from the damaged field, the cost of replanting may still be more than the income from the additional replant bushels. Thus it is important to estimate as accurately as possible the following costs associated with replanting:

a. Seed cost: $8.00/ac. This may vary from zero to full cost, depending on the seed corn company's replant policy. The example given assumes 1/2-price seed ($30 vs. $60/75,000-kernel unit) replanted at a rate of 20,000 seeds/ac. (step #14a)
b. Fuel cost: S6.00/ac. Include fuel cost for any field work performed before and/or after replanting as well as for the replant operation itself. If possible, however, avoid tillage prior to replanting so as to retain original herbicide effectiveness. The example assumes fuel for planting, cultivations for weed control, and subsequent chemical application.
c. Herbicide cost: $10.00/ac. A preplant or preemergence herbicide may be needed if deep tillage is performed prior to replanting. Again, however, try to avoid such tillage, depending instead on postemergence chemicals (e.g., dicamba, 2,4-D, or atrazine/crop oil) or cultivation for weed control. The example assumes that the original herbicide application plus one cultivation will give adequate control, thus eliminating the herbicide cost. Switching over to grain sorghum may be feasible where compatible herbicides have been applied or post emergence herbicide use was planned.
d. Insecticide cost: $0/ac. Reapplication of soil insecticide is not necessary if you replant directly into the original rows. Preplant soil insecticide.
e. Other replant costs: $0/ac. The main cost is interest on loans for replant production inputs.
f. Total replant costs (sum steps #7a through #7e): $24.00/ac

**Step 8.** Expected "normal" yield. This is the expected yield of the field under normal conditions had it not been damaged.

Normal yield: 110 bu./ac.

**Step 9.** Expected market price for corn. This is the expected price return when marketing this grain.

Market price: $2.10/bu.

## Yield Potential if Damaged Field is Not Replanted

Estimating after-damage yield potential is a difficult task since various factors, whether individually or in combination, can affect final grain yield. The main factors considered here are plant population, stand distribution, and defoliation. However, keep in mind that, under favorable growing conditions, increased ears per plant, kernel rows per ear, kernels per row, and kernel weight will offset some of the yield loss caused by these factors.

**Step 10.** Estimated yield of after-damage plant population. This is determined from Table 2a or 2b and is expressed as percent of optimum yield. Read down the table's far left column to the date closest to the original planting date (step #5), then read to the right on that line to the column that most nearly represents that field's after-damage plant population (step #2e). Plant populations of less than 10,000 plants per acre should be replanted or if possible put into another crop.

78% of optimum yield

**Step 11.** Additional yield loss due to uneven plant stands. Referring to the answer in Step #3, if common gap size was more than 3 feet, enter 5% here; if less than 3 feet, enter 2%.

5% yield loss

**Step 12.** Additional yield loss due to defoliation. This is determined from Table 3. Read down the table's far left column to the corn's growth stage when damaged (step #4b), then look right on that line to the column representing percent of leaf area lost or destroyed on the field of damage (step #4a).

0% yield loss

**Step 13.** Yield potential of damaged field. This is the estimated after-damage yield (step #10) minus the additional yield loss due to uneven stands (step #11) and to defoliation (step #12).

(#10)78% - (#11)5% - (#12)0% = 73% of optimum yield

**Table 2a. Grain Yields for Various Planting Dates and Population Rates; Expressed as a Percent of Optimum* Planting Date and Population Yield (Uniformly Spaced Within Row).****

| Planting | Plants per acre at harvest | | | | | |
|---|---|---|---|---|---|---|
| date | 12,000 | 14,000 | 16,000 | 18,000 | 20,000 | 22,500 |
| | % of optimum yield | | | | | |
| 10 days before | 78 | 83 | 87 | 90 | 93 | 95 |
| 5 days before | 81 | 86 | 90 | 93 | 96 | 98 |
| Average date of last killing frost | | | | | | |
| 5 days after | 83 | 88 | 92 | 95 | 98 | 100 |
| 10 days after | 83 | 88 | 92 | 95 | 98 | 99 |
| 15 days after | 81 | 86 | 90 | 93 | 96 | 98 |
| 20 days after | 78 | 83 | 87 | 91 | 94 | 95 |
| 25 days after | 75 | 80 | 84 | 87 | 90 | 92 |
| 30 days after | 70 | 75 | 79 | 82 | 85 | 87 |
| 35 days after | 64 | 69 | 73 | 77 | 80 | 81 |
| 40 days after | 58 | 63 | 67 | 70 | 73 | 75 |

*See fact sheet - "Corn Planting Dates" for recommended dates for your area.

** Adapted from NCH-30, "Guidelines for Making Corn Replanting Decisions."

**Table 2b. Grain Yields for Various Planting Dates and Population Rates; Expressed as a Percent of Optimum. Planting Date and Population Yield (Uniformly Spaced Within Row); Use in Areas Under Intense Irrigation.****

| Planting date | Plants per acre at harvest | | | | | | |
|---|---|---|---|---|---|---|---|
| | 14,000 | 16,000 | 18,000 | 20,000 | 22,500 | 25,000 | 27,500 |
| | % of optimum yield | | | | | | |
| 10 days before | 72 | 78 | 83 | 87 | 90 | 93 | 95 |
| 5 days before | 75 | 81 | 86 | 90 | 93 | 96 | 98 |
| Average date of last killing frost | | | | | | | |
| 5 days after | 78 | 83 | 88 | 92 | 95 | 98 | 100 |
| 10 days after | 77 | 83 | 88 | 92 | 95 | 98 | 99 |
| 15 days after | 75 | 81 | 86 | 90 | 93 | 96 | 98 |
| 20 days after | 73 | 78 | 83 | 87 | 91 | 94 | 95 |
| 25 days after | 69 | 75 | 80 | 84 | 87 | 90 | 92 |
| 30 days after | 64 | 70 | 75 | 79 | 82 | 85 | 87 |
| 35 days after | 59 | 64 | 69 | 73 | 77 | 80 | 81 |
| 40 days after | 52 | 58 | 63 | 67 | 70 | 73 | 75 |

*See fact sheet - "Corn Planting Dates" for recommended dates for your area.

** Adapted from NCH-30, "Guidelines for Making Corn Replanting Decisions."

**Table 3. Estimated Percent Corn Grain Yield Loss Due to Defoliation at Various Stages of Growth.***

| Stage of growth | Percent leaf area destroyed | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 |
| | % yield loss | | | | | | | | | | | | | | | | | | | |
| 7-leaf | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 5 | 6 | 7 | 8 | 9 | 9 |
| 8-leaf | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 3 | 4 | 5 | 5 | 6 | 6 | 7 | 8 | 9 | 10 | 11 |
| 9-leaf | 0 | 0 | 0 | 1 | 1 | 2 | 2 | 3 | 4 | 5 | 6 | 6 | 7 | 7 | 9 | 10 | 11 | 12 | 13 |
| 10-leaf | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 8 | 9 | 9 | 11 | 13 | 14 | 15 | 16 |
| 11-leaf | 0 | 0 | 1 | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 13 | 14 | 16 | 18 | 20 | 22 |
| 12-leaf | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 7 | 9 | 10 | 11 | 13 | 15 | 16 | 18 | 20 | 23 | 26 | 28 |
| 13-leaf | 0 | 1 | 1 | 2 | 3 | 4 | 6 | 8 | 10 | 11 | 13 | 15 | 17 | 19 | 22 | 25 | 28 | 31 | 34 |
| 14-leaf | 0 | 1 | 2 | 3 | 4 | 6 | 8 | 10 | 13 | 15 | 17 | 20 | 22 | 25 | 28 | 32 | 36 | 40 | 44 |
| 15-leaf | 1 | 1 | 2 | 3 | 5 | 7 | 9 | 12 | 15 | 17 | 20 | 23 | 26 | 30 | 34 | 38 | 42 | 46 | 51 |
| 16-leaf | 1 | 2 | 3 | 4 | 6 | 8 | 11 | 14 | 18 | 20 | 23 | 27 | 31 | 36 | 40 | 44 | 49 | 55 | 61 |
| 17-leaf | 2 | 3 | 4 | 5 | 7 | 9 | 13 | 17 | 21 | 24 | 28 | 32 | 37 | 43 | 48 | 53 | 59 | 65 | 72 |
| 18-leaf | 2 | 3 | 5 | 7 | 9 | 11 | 15 | 19 | 24 | 28 | 33 | 38 | 44 | 50 | 56 | 62 | 69 | 76 | 84 |

* Adapted, with permission, from the National Crop Insurance Association's "MPCI Corn Handbook M-201" (Rev. 5/85).

** As determined by counting the exposed leaves (i.e., those with 40-50% of leaf exposed from whorl and whose tip points below the horizontal).

## Yield Potential if Damaged Field is Replanted

**Step 14.** Replant target population. Determine the replant target population in the same way as the original target population.

a. Planned seeding rate: 20,000 seeds/ac.
b. Seed germination percentage (from seed tag): 95%
c. Expected plant survival rate (use 95 % if you're not sure) 95%
d. Replant target population (#14a x #14b x #14c): 18,050 plants/ac.

**Step 15.** Expected yield from replanting. Using Table 2a or 2b, read down the far left column to the date closest to the likely replanting date (step #6), then right on that line to the column that most nearly represents the replant target population (step #14d).

70% of optimum yield

**Step 16.** Yield gain or loss from replanting. This is the difference between expected yield of the replanted stand (step #15) and that of the damaged original stand (step #13), expressed as a percent of optimum yield. If the answer shows a yield loss (a minus percentage), replanting is definitely not feasible. If, on the other hand, there is a yield gain go on to Steps #17 and #18 to determine if that gain is an economical one.

(#15) 70% - (#13) 73% = -3% of optimum yield

**Step 17.** Gross income from a replant yield gain. First multiply the percent of yield gain (step #16) by the field's expected "normal" yield (step #8) to determine the amount of yield gain in bushels per acre. Then multiply that figure by the expected corn market price (#9) to determine the dollar value of the replant yield gain.

a. (#16) -3% x (#8)110 bu./ac. = -3.3 bu./ac.
b. (#17a) -3.3 bu./ac. x (#9) $2.10/bu. = $ - 6.93/ac.

**Step 18.** Dollar gain or loss from replanting. This is the difference between the potential gross income from the replant yield gain (step #17b) and the likely cost of replanting (step #7f). A monetary gain indicates that replanting may be a viable option for this damaged field. However, dollar returns should still be weighed against both the alternative uses of available time and money, and the added risks associated with delayed planting before making a final decision.

(#17b)$-6.93/ac. - (#7f)$24.00/ac. = $-30.93/ac.

Completely replanting a field may not be necessary where small localized areas can be spot planted. In this case, small equipment would be more desirable to avoid disturbing any rows with acceptable stands.

## A Word about Replanting and Hybrid Maturity

Table 2a assumes that pollination and grain filling takes place before the hot dry period that normally occurs in late July and August. In Table 2b the percent-of-optimum yield figures shown indicate yield from harvest before a killing frost for the Panhandle areas. If replanting is delayed, switching to another crop or to a shorter season could guarantee some return in that growing season. When switching crops, fertility and herbicide programs should first be reviewed. If corn has been fertilized, then soil nutrient levels should be adequate for the replanting of most crops. Consult herbicide labels for replanting or uses with other crops. Some herbicidal restrictions may limit the choices to a shorter season corn only.

# Worksheet For Estimating Yield and Economic Returns from Corn Replanting

This worksheet is for assistance in making that important corn replant decision. It allows for determination of a damaged field's current yield potential, its replant potential, and its dollar returns (if any) to replanting.

The 18 procedural steps of the worksheet are explained in detail in the accompanying publication. Review it carefully so as to be sure to understand exactly what information is needed or how to do the calculations.

## Information Needed to Make a Replant Decision

**Step 1. Original target plant population**

a. Original seeding rate (from your records): _____ seeds/ac.
b. Seed germination percentage (from seed tag): _____ %
c. Expected plant survival rate (use 95 % if you're not sure): _____ %
d. Original target population (#1a x #1b **x** #1c): _____ plants/ac.

**Step 2. After-damage plant population (Repeat steps #2b thru #2d at each site inspected.)**

a. Length of row equal to 1/1000th acre (from Table 1, based on a row width of _____in.): _____ft. -in.
b. Number of live plants in three 1/1000th-acre lengths of row: Site 1 (1st row) _____ + (2nd row) _____ + (3rd row) _____ = _____
c. Average plants per 1/1000th acre (#2b/3 rows):_____
d. Average live plants per acre for site (#2c x 1000):_____

| | Site 2 | Site 3 | Site 4 |
|---|---|---|---|
| Row 1 | _____ | _____ | _____ |
| Row 2 | _____ | _____ | _____ |
| Row 3 | _____ | _____ | _____ |
| Total | _____ | _____ | _____ |
| Average | _____ | _____ | _____ |

e. After-damage plant population for all sites inspected (sum of #2d at each site/number of sites): _____ plants/ac.

**Step 3. After-damage stand uniformity**

Average length of evident gaps within rows (more) (less) than 3 feet?:_____

**Step 4. After-damage plant defoliation**

a. Average plant leaf area lost or destroyed: _____%
b. Growth stage of corn: _____exposed leaves

**Step 5. Original planting date**

Month and day that planting began (from your records):_____

**Step 6. Likely replanting date, if justified**

Month and day that replanting could begin: _____

**Step 7. Likely replanting costs**

a. Seed cost: $ _____ /ac.
b. Fuel cost: $ _____ /ac.
c. Herbicide cost: $ _____ /ac.
d. Insecticide cost: $ _____ /ac.
e. Other replant costs (e.g., dryer fuel, interest): $ _____ /ac.
f. Total replant costs (sum of #7a through #7e): $ _____ /ac.

**Step 8. Expected "normal" yield**

What the field would likely have yielded under normal conditions: _____bu/ac.

**Step 9. Expecced market price for corn**

Price expected when the grain from this field is marketed: $ _____ /bu.

## Yield Potential If Damaged Field Is Not Replanted

**Step 10. Estimated yield of the after-damage plant population**

From Table 2a or b, based on the field's after-damage plant population (#2e) and the original planting date (#5): _____% of optimum yield

**Step 11. Additional yield loss due to uneven plant stands**

If common gap size (#3) is more than 3 feet, enter 5 %; if it is less than 3 feet, enter 2%: _____% yield loss

**Step 12. Additional yield loss due to defoliation**

From Table 3, based on percent of leaf area lost or destroyed (#4a) and the corn's growth stage when damaged (#4b) _____ % yield loss

**Step 13. Yield potential of the damaged field**

(#10)_____48% - (#11) _____% - (#12) _____ % = _____% of optimum yield

## Yield Potential If Damaged Field is Replanted

**Step 14. Replant target population**

a. Planned seeding rate: _____ seeds/ac.
b. Seed germination percentage (from seed tag): _____ %
c. Expected plant survival rate (use 95 % if you're not (sure): _____ %
d. Replant target population (#14a x #14b x #14c): ____ plants/ac.

**Step 15. Expected yield from replanting**

From Table 2a or b, based on the likely replanting date (#6) and the replant target population (#14d): _____% of optimum yield

## Feasibility of Replanting

**Step 16. Yield gain or loss from replanting**

(#15) _____% - (#13) _____% = _____% of optimum yield If there is a yield loss, replanting is not warranted and should not be done. If there is a yield gain, go on to Steps #17 and #18.

**Step 17. Gross income from a replant yield gain**

a. (#16) _____% x (#8) _____bu./ac. = _____bu. /ac.
b. (#17a) _____bu./ac. x (#9) $ _____/bu. = $ _____ /ac.

**Step 18. Dollar gain or loss from replanting**

(#17b) $ _____/ac. - (#7f) $ _____/ac. = $ _____/ac.

If there is a monetary loss, replanting is not justified and should not be done. If there is a monetary gain, replanting may be a viable option for this field.



Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Robert E. Whitson, Director of Cooperative Extension Service, Oklahoma State University, Stillwater, Oklahoma. This publication is printed and issued by Oklahoma State University as authorized by the Vice President, Dean, and Director of the Division of Agricultural Sciences and Natural Resources and has been prepared and distributed at a cost of 20 cents per copy. 1202