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Hail Damage Assessment and Replant Decisions



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Hail Damage Assessment and Replant Decisions

Hail is one of many hazards that can damage a growing crop. Early in the growing season a producer has the option to replant a field seriously damaged by hail. The question is, how do you decide if it is worthwhile to replant, and what information do you need to make an informed decision?

Factors to consider when deciding to replant are the expected yield reduction due to hail, the cost of replanting, and the yield potential of the replanted crop. Other information needed to make a rational decision is included in this publication, and several examples are given.

Deciding whether or not to replant is one of a producer's most difficult decisions. Time is critical if replanting is to succeed.

The more quickly replanting is accomplished, the higher the probability of it succeeding. Each day of delay makes replanting a less favorable economic alternative, since potential yield is lost each day the crop is delayed in the replanting.

Unfortunately, in order to accurately determine the damage from a hailstorm, the best estimates are made a week or two after the event.

The following paragraphs outline how a replant decision is made. A worksheet for determining costs and returns related to replant decisions is included as a way to base the decision on facts and proven research, not emotion.

Anyone who has experienced a hailstorm knows that even slight damage may look like total devastation right after the hail. It is difficult to imagine crop recovery and subsequent yield levels.

Yet extensive research has been conducted and procedures established to permit accurate prediction of the effect of hail damage to crops. Given the appropriate procedures, trained personnel can make estimates of percent yield losses based on stage of crop growth and degree of damage to the plant. As a producer, you can use these procedures to estimate yield loss for yourself. Then you can examine the cost of not taking any remedial action versus the cost of replanting the same crop or an alternative crop.

Example Situations

Three examples follow. *Example 2* is analyzed in detail, with a worksheet to illustrate the data. A separate worksheet is included at the end of this publication for your figures.

Example 1. Corn was planted May 1. On May 20 the corn is in the three leaf stage. A hail storm occurs with apparent complete destruction of the crop. No corn leaves are visible.

Example 2. Another cornfield planted May 5 missed the first storm, but a second hailstorm occurred June 15 when the corn was in the nine leaf stage.

Example 3. Nearby was a field of soybeans. They were planted May 15 and also were hailed on June 15.

First, visit a Cooperative Extension Office and select the NebGuides listed at the end of this article. Second, inspect each field and observe the damaged plants using the procedures in the NebGuides. Make an estimate of plant survival and the extent of damage. If you purchased crop insurance, the insurance company should be contacted at this time.

Example 1.

When hail hits a corn plant early in the season, yield reduction is minimal. The growing point is underground until the seven leaf stage. Corn will recover unless conditions cause a crust to develop that prevents the growing point from emerging. If there is a crust developing, a light rotary hoeing will help break the crust.

Conclusion: Since yield loss is negligible, the only additional cost is a possible rotary hoeing. No replanting should be attempted, but the field should be watched for crusting problems.

Example 2.

At the nine leaf stage two factors need to be considered to determine yield loss: 1) percent leaf defoliation, and 2) reduction in population.

To properly estimate yield loss, first assess the reduction in population. The NebGuide G86-803, *Assessing Hail Damage to Corn*, has a chart that gives the effect of reduced population on yield. Research in Nebraska has shown this chart may overestimate yield reduction, so be conservative in your estimate of yield reduction due to stand loss, especially if the stand loss is minor.

For example, assume a stand reduction from 24,000 to 16,000 plants per acre. The charts show a 10 percent yield loss for this stand reduction. An 85 percent defoliation at the nine leaf stage produces a 10 percent yield reduction. Since the defoliation loss only affects the remaining 90 percent of the plants, and 10 percent of 90 percent is 9 percent, the actual yield loss due to hail is 19 percent (the sum of stand reduction, 10 percent, plus

defoliation, 9 percent). The worksheet is illustrated with this data.

In this example the best alternative would be to not replant the corn, since the expected net revenue for the existing crop is highest.

Example 3.

The hail June 15 damaged the soybeans in the V4 growth stage (five nodes). As with *Example 2*, stand reduction needs to be taken into account. The NebGuide G85-762, *Soybean Yield Loss Due to Hail Damage*, has a stand reduction table.

Assume an initial population of 125,000 plants/acre reduced to 70,000 plants/acre. The chart in the NebGuide predicts an 18 percent yield loss.

The varieties grown in Nebraska are mostly semi-determinates or indeterminates. Determinate soybeans cease vegetative growth when flowering begins; indeter-

minate varieties continue to grow during reproductive stages. Defoliation up to flower initiation will not consistently reduce yield. For this example we will assume another 10 percent yield reduction due to stem damage (explained in the NebGuide). This calculates to a 23.6 percent yield loss due to hail.

With an expected yield of 35 bu/acre, the yield reduction due to hail would be 8.3 bu/acre. This would leave 26.7 bu/acre to harvest (35-8.3). If soybeans were \$5/bu, additional costs were \$8.25/acre, and harvest costs were \$10.50, the estimated net revenue would be \$114.75/acre ((26.7 x 5.00) - 8.25 - 10.50).

Replanting soybeans June 20 could result in a yield reduction of 8 bu/acre due to the late planting date. This would be a harvest yield of 27 bu/acre (35-8). If additional costs were \$23.25/acre and harvest costs were the same, the estimated net revenue would be \$101.25/acre ((27 x 5.00) - 23.25 - 10.50). Therefore, it would not pay to replant the soybean field.

Worksheet for Determining Costs Related to Replant Decisions

The following worksheet will help you make replant decisions by comparing the estimated net return with hail loss to the estimated net return of replanting. Actual numbers are included from *Example 2*. Space is provided for you to work through your own example in a separate worksheet. The basic idea is to estimate the net revenue for all the alternatives. Choose the alternative with the highest expected net revenue.

The worksheet is organized into five steps. The first step provides the information needed for the replanting analysis. The second step calculates the net revenue of not replanting. The third and fourth steps do the same for replanting the same crop or an alternate crop. The fifth step compares all the alternatives.

General Information and formulas

STEP I. Information needed for the replant analysis

- A. Yield potential of the field, in bushels/acre, based on field history
- B. Value of grain at harvest, \$/bushel
- C. Percent yield loss due to the storm, percent based on field estimate and NebGuides
See previous discussion of Example 2.
- D. Yield loss due to late planting, bushels/acre
Based on replant date, the following are general guides; the dates vary each year and by location in the state. Use these or other values you feel are most suitable for your situation.

Corn: One bushel per day yield loss planting after May 10, or 5 percent loss per week after May 10 to June 1, and then 10 percent per week.

Soybeans: Three bushel yield decrease between May 20 and June 10.

Sorghum: One bushel per day yield loss planting after June 7.

- E. Additional costs, \$/acre
Consists of tillage, seed, herbicide, labor, and any other costs associated with replanting.
- F. Harvest costs, \$/acre
Consists of combining, hauling, and drying.

STEP II. Estimated net revenue from existing crop

- A. Yield reduction due to storm
Normal yield potential and predicted yield loss are used to determine bushel per acre loss due to hail.
- B. Yield to be harvested
Normal yield potential is reduced by bushels calculated in "A" above.
- C. Estimated gross revenue
Expected yield after storm is multiplied by expected value of the crop to calculate gross returns if no replanting occurs.
- D. Estimated net revenue
Gross revenue is reduced by additional costs and harvest costs calculated in Step I.

STEP III. Estimated net revenue from replanting same crop**A. Harvestable yield***Determine expected yield from replanting same crop based on information supplied or calculated in Step I.***B. Estimated gross revenue***Expected yield is multiplied by expected bushel price of replanted crop.***C. Estimated net revenue***Estimated gross revenue is reduced by additional costs and harvest costs calculated in Step I.***STEP IV. Estimated net revenue from replanting alternative crop****A. Harvestable yield***Determine expected yield from alternative crop based on information supplied or calculated in Step I.***B. Estimated gross revenue***Expected yield is multiplied by expected bushel price of alternative crop.***C. Estimated net revenue***Estimated gross revenue is reduced by additional costs and harvest costs calculated in Step I.***STEP V. Compare replanting choices**

With net revenue calculated for maintaining the existing crop, replanting same crop and replanting alternative crop, a comparison can be made to determine the choice with the highest net revenue.

Example 2 Worksheet**STEP I. Information needed for the replant analysis**

	Existing Crop (Corn)	Replant Original Crop	Replant Alternate Crop (Sorghum)
a. Yield potential (field history)	a.1) <u>100</u> bu	a.2) <u>100</u> bu	a.3) <u>80</u> bu
b. Value of grain (at harvest)	b.1) <u>\$2.50</u> /bu	b.1) <u>\$2.50</u> /bu	b.2) <u>\$2.15</u> /bu
c. Yield loss due to storm	c.1) <u>19</u> %		
d. Yield loss due to late planting		d.2) <u>50</u> bu	d.3) <u>13</u> bu
e. Additional cost (see Table I)			
		\$/acre	
Tillage	<u>1.50</u>	<u>8.00</u>	<u>8.00</u>
Seed	<u> </u>	<u>20.00</u>	<u>5.00</u>
Herbicide	<u> </u>	<u> </u>	<u> </u>
Labor	<u>1.25</u>	<u>3.50</u>	<u>3.50</u>
Other	<u> </u>	<u> </u>	<u> </u>
Total	e.1) <u>\$2.75</u>	e.2) <u>\$31.50</u>	e.3) <u>\$16.50</u>

f. Harvesting costs (see Table I)

Combine (inc. labor)	<u>9.25</u>	<u>7.75</u>	<u>7.00</u>
Truck	<u>8.10</u>	<u>5.00</u>	<u>6.70</u>
Auger	<u>.81</u>	<u>.50</u>	<u>.67</u>
Dry	<u>12.51</u>	<u>7.50</u>	<u>10.05</u>
Total	f.1) <u>\$30.31</u>	f.2) <u>\$20.75</u>	f.3) <u>\$24.42</u>

STEP II. Estimated net revenue from existing crop

A. Yield reduction due to storm

$$\frac{100}{a.1} \text{ bu/a} \times \frac{19}{c.1} \% \text{ loss} = \frac{19}{c.1} \text{ bu/a loss}$$

B. Yield to be harvested

$$\frac{100}{a.1} \text{ bu/a} - \frac{19}{c.1} \text{ bu/a loss} = \frac{81}{a.1} \text{ bu/a harvested}$$

C. Estimated gross revenue

$$\frac{81}{b.1} \text{ bu/a harvested} \times \frac{\$2.50}{b.1} \text{ /bu} = \frac{\$202.50}{b.1} \text{ /a}$$

D. Estimated net revenue

$$\frac{\$202.50}{e.1} \text{ /a} - \frac{\$2.75}{\text{cost}} \text{ /a additional} - \frac{\$30.31}{f.1} \text{ /a harvest} = \frac{\$169.44}{\text{cost}} \text{ /a}$$

STEP III. Estimated net revenue from replanting same crop

A. Yield to be harvested

$$\frac{100}{a.2} \text{ bu/a} - \frac{50}{d.2} \text{ bu/a loss} = \frac{50}{d.2} \text{ bu/a harvested}$$

B. Estimated gross revenue

$$\frac{50}{b.2} \text{ bu/a harvested} \times \frac{\$2.50}{b.2} \text{ bu} = \frac{\$125.00}{b.2} \text{ /a}$$

C. Estimated net revenue

$$\frac{\$125.00}{e.2} \text{ /a} - \frac{\$31.50}{\text{cost}} \text{ /a additional} - \frac{\$20.75}{f.2} \text{ /a harvest} = \frac{\$72.75}{\text{cost}} \text{ /a}$$

STEP IV. Estimated net revenue from replanting alternative crop

A. Yield to be harvested

$$\frac{80}{a.3} \text{ bu/a} - \frac{13}{d.3} \text{ bu/a loss} = \frac{67}{d.3} \text{ bu/a harvested}$$

B. Estimated gross revenue

$$\frac{67}{b.3} \text{ bu/a harvested} \times \frac{\$2.15}{b.3} \text{ /bu} = \frac{\$144.05}{b.3} \text{ /a}$$

C. Estimated net revenue

$$\frac{\$144.05}{e.3} \text{ /a} - \frac{\$16.50}{\text{cost}} \text{ /a additional} - \frac{\$24.42}{f.3} \text{ /a harvest} = \frac{\$103.13}{\text{cost}} \text{ /a}$$

STEP V. Compare replanting choices

	Existing Crop	Replant Original Crop	Replant Alternate Crop
Net Revenue	<u>\$169.44/a</u>	<u>\$72.75 a</u>	<u>\$103.13/a</u>

Choose the choice with the highest net revenue.

Since the existing crop has the highest net revenue, don't replant.

Summary

Take into consideration non-economic factors such as time available, herbicide compatibility, seed availability, soil moisture, and risk of early fall frosts. Fertilizer needs will vary. Some data indicate starter fertilizer applied with late planted sorghum may hasten maturity. If there is an early frost this would be beneficial.

Consider alternate uses of the land such as seed to hay crop, or taking the replant crop as silage. There also may be other factors to consider, such as crop insurance, loan payments, government program and landlord/tenant agreements.

Generally, early season hail defoliation needs to be extremely severe to justify replanting. Loss due to early season hail damage is not usually detrimental to yield. Late planting limits maximum yield potential and entails additional costs.

Usually it does not pay to replant corn with corn due to the late date at which hail damage begins to hurt yield. Severe damage to young soybean plants occurs due to stripping cotyledons from the plant. Replanting with soybeans or sorghum may be more profitable under these conditions. By following the procedures outlined in this article and the information in the NebGuides listed at the end, you should be able to make a better informed replant decision.

Table I. Selected costs for field operations connected with replanting. (Source: Estimated Crop and Livestock Production Costs, 1989)

Item	Hours/operation	Fuel	Repair	Total@ Variable	Fixed	Total
				\$ /acre		
Disk	0.104	\$0.42	\$0.93	\$1.35	\$3.23	\$ 4.58
Field Cult.	0.112	0.45	1.40	1.85	3.82	5.67
Planter	0.204	0.83	3.06	3.89	7.27	11.15
Row Cult.	0.189	0.49	1.09	1.58	2.68	4.28
Combine corn (130 bu/a)	.47	1.56	4.72	6.28	21.01	27.28
Combine corn (80 bu/a)	.31	1.04	4.72	5.76	21.01	26.76
Combine sorghum	.22	.73	4.72	5.45	21.01	26.46
Combine soybeans	.29	.96	4.66	5.62	23.55	29.17
Truck grain						.10/bu
Dry grain						.15/bu
Auger						.01/bu
Seed						
Corn					15.00-25.00	
Soybeans					15.00	
Sorghum					5.00	
Herbicide	-----variable and optional-----					
Fertilizer	-----only if going from soybeans to sorghum-----					

@Note: Only variable costs need to be considered if equipment is owned

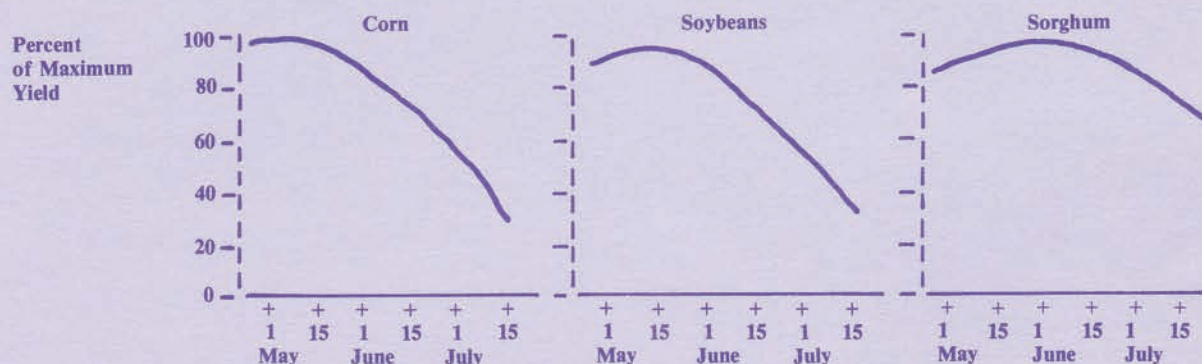


Figure 1. Effect of planting date on yield of corn, soybeans and sorghum

For More Information

These NebGuides are available at your Extension office:

G84-687, *Soybean Planting Date: When and Why*

G75-252, *Replanting After Flood or Hail*

+ G85-762, *Soybean Yield Loss Due to Hail Damage*

+ G86-812, *Sorghum Yield Loss Due to Hail Damage*

+ G86-803, *Assessing Hail Damage to Corn*

G86-796, *Growing Degree Day Requirements and Freeze Risk as a Guide to Selecting and Planting Corn Hybrids*

+ Data in these NebGuides are based on procedures developed by the National Crop Insurance Association.

Hail Damage Assessment and Replant Decision Worksheet

STEP I. Information needed for the replant analysis

	<i>Existing Crop</i>	<i>Replant Original Crop</i>	<i>Replant Alternate Crop</i>
A. Yield potential (field history)	a.1) _____ bu	a.2) _____ bu	a.3) _____ bu
B. Value of grain (at harvest)	b.1) \$_____/bu	b.1) \$_____/bu	b.2) \$_____/bu
C. Yield loss due to storm	c.1) _____ %		
D. Yield loss due to late planting		d.2) _____ bu	d.3) _____ bu

E. Additional Costs (see *Table I*)

		\$/acre	
Tillage	_____	_____	_____
Seed	_____	_____	_____
Herbicide	_____	_____	_____
Labor	_____	_____	_____
Other	_____	_____	_____
Total	e.1) \$ _____	e.2) \$ _____	e.3) \$ _____

F. Harvesting costs (see *Table I*)

Combine (inc. labor)	_____	_____	_____
Truck	_____	_____	_____
Auger	_____	_____	_____
Dry	_____	_____	_____
Total	f.1) _____	f.2) _____	f.3) _____

STEP II. Estimated net revenue from existing crop**A. Yield reduction due to storm**

$$\frac{\text{_____}}{\text{a.1}} \text{ bu/a} \times \frac{\text{_____}}{\text{c.1}} \% \text{ loss} = \text{_____} \text{ bu/a loss}$$

B. Yield to be harvested

$$\frac{\text{_____}}{\text{a.1}} \text{ bu/a} - \text{_____} \text{ bu/a loss} = \text{_____} \text{ bu/a harvested}$$

C. Estimated gross revenue

$$\text{_____} \text{ bu/a harvested} \times \$ \frac{\text{_____}}{\text{b.1}} / \text{bu} = \$ \text{_____} / \text{a}$$

D. Estimated net revenue

$$\$ \frac{\text{_____}}{\text{a}} - \$ \frac{\text{_____}}{\text{e.1}} / \text{a additional} - \$ \frac{\text{_____}}{\text{f.1}} / \text{a harvest} = \text{_____} / \text{a}$$

STEP III. Estimated net revenue from replanting same crop**A. Yield to be harvested**

$$\frac{\text{_____}}{\text{a.2}} \text{ bu/a} - \frac{\text{_____}}{\text{d.2}} \text{ bu/a loss} = \text{_____} \text{ bu/a harvested}$$

B. Estimated gross revenue

$$\text{_____} \text{ bu/a harvested} \times \$ \frac{\text{_____}}{\text{b.2}} \text{ bu} = \$ \text{_____} / \text{a}$$

C. Estimated net revenue

$$\$ \frac{\text{_____}}{\text{a}} - \$ \frac{\text{_____}}{\text{e.2}} / \text{a additional} - \$ \frac{\text{_____}}{\text{f.2}} / \text{a harvest} = \$ \text{_____} / \text{a}$$

STEP IV. Estimated net revenue from replanting alternative crop**A. Yield to be harvested**

$$\frac{\text{_____}}{\text{a.3}} \text{ bu/a} - \frac{\text{_____}}{\text{d.3}} \text{ bu/a loss} = \text{_____} \text{ bu/a harvested}$$

B. Estimated gross revenue

$$\text{_____} \text{ bu/a harvested} \times \$ \frac{\text{_____}}{\text{b.3}} / \text{bu} = \$ \text{_____} / \text{a}$$

C. Estimated net revenue

$$\$ \frac{\text{_____}}{\text{a}} - \$ \frac{\text{_____}}{\text{e.3}} \text{ additional} - \$ \frac{\text{_____}}{\text{f.3}} \text{ harvest} = \$ \text{_____} / \text{a}$$

STEP V. Compare replanting choices

	<i>Existing Crop</i>	<i>Replant Original Crop</i>	<i>Replant Alternate Crop</i>
Net Revenue	\$ _____ / a	\$ _____ / a	\$ _____ / a

Choose the choice with the highest net revenue.