2005

EC05-773 Recommendations for Harvesting Dry Edible Beans With the John Deere STS Series Combine

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University of Nebraska Lincoln EXTENSION
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Recommendations for Harvesting Dry Edible Beans With the John Deere STS Series Combine

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Maximum combine performance — characterized by low mechanical seed damage, low field loss, and high field capacity — requires optimization of combine equipment, combine adjustments, and field operating practices. This Extension Circular provides information to maximize performance of the John Deere STS series combine in dry edible beans in typical western Nebraska field conditions. These recommendations are presented in three sections, covering initial to more advanced assessments and adjustments.

- ***Section 1*** provides initial settings and options to be used with a new combine or in a new field.
- ***Section 2*** is a step-by-step guide to improving combine performance after the initial settings have been tried.
- ***Section 3*** includes additional recommendations and adjustments for harvesting high quality dry edible beans.

These recommendations are for pinto and great northern bean market classes grown under western Nebraska field conditions where the soil and plant material are typically dry, and seed moisture content ranges from 10 to 14 percent.

Warning: The modern combine is powerful, heavy, and a very complicated machine with many moving parts. To avoid injury or death, read and follow all safety recommendations in your Operator's Manual before operating, inspecting, adjusting, or repairing your combine.

Other field conditions will require different adjustments. Use these recommendations as a *starting point* only and fine-tune adjustments according to specific field conditions. Also refer to your Operator's Manual for additional information on the operation and performance of your combine. (For combines with a conventional cylinder, refer to "Recommendations for Harvesting Dry Edible Beans with the John Deere Walker Series Combine," Extension Circular 05-774.)

Initial Settings and Options

Recommended settings for initial setup of a John Deere STS series combine in dry edible bean in western Nebraska.

Combine Component	Recommended Starting Point	Comments
"Rotor" speed	280 rpm (range 230 - 350)	Within this range, use settings on the higher end to improve threshing and/or separation and on the lower end to reduce seed damage. In certain field conditions using lower rpm's may not provide adequate movement of material through rotor.
Concave clearance indicator	20-30	Set closer if material volume is low and/or threshing is difficult. Seed damage and threshing are very sensitive to this setting.
Concave type	Large wire concave with every other wire removed	Removal of every other wire provides larger openings to move beans out of the concave as rapidly as possible. If threshing conditions are ideal, the Round Bar concave also will be satisfactory.
Feed accelerator speed	320 rpm (slow down kit is required)	Try increasing speed if having problems with material handling or if quantity of material is high. Higher seed damage may result.
Feed accelerator wear strips	Contour serrated	Part No. BH84027. Good material handling with minimum seed damage. If material movement through the feed accelerator is not uniform or if tough plant material is expected, try the straight, nonserrated wear strip.
Fan speed	1150 - 1250 rpm	
Chaffer clearance	16-19 mm (5/8 - 3/4 in.)	Adjust for seed size. Avoid threshed beans in tailings.
Sieve clearance	10-13 mm (3/8 - 1/2 in.)	Adjust for seed size. Avoid threshed beans in tailings.
Feeder house conveyor chain speed	Slow speed sprocket (15T) and minimum speed on variable speed backshaft option	Try higher speed if problems develop with material feeding or if the quantity of material is large.
Feeder house chain drum position	Down	Adjust drum height in down position so slat does not pinch beans under chain slat when crop is light.
Chopper speed (rpm)	Slow	Use high speed if more spreading distance is needed.
Chopper knife position	Out	Set to medium if more straw cutting action is needed.
Concave inserts and covers, and separator grate covers	Removed	Concaves and separator grates normally need to be open to allow seed to exit as quickly as possible.
Clean grain elevator chain tightener	Keep snug	Check periodically to avoid "pinching" beans between sprocket and chain.

Combine accessories which can help minimize bean seed damage or reduce wear when using a John Deere STS series combine in dry edible bean in western Nebraska.

Description	Part Number	Comments
Rotor discharge flights	BH84410	This option, made available in late 2004, helps move material from the rear of the rotor, particularly in damp conditions. The rear row of tines is removed and replaced with discharge flights that aggressively move material from the rear of the rotor.
Slow speed drive for clean grain cross auger, clean grain elevator, and grain tank loading auger	BH84034 (also need to order low speed shaft monitor board AH201361)	Reduces rotational speed from 400 to 250 rpm. Will help reduce seed damage. **GREENSTAR system will require recalibration and may not be accurate**. Increase speed when returning to higher yielding crops.

Description	Part Number	Comments
Reduced diameter specialty crop shoe grain supply augers	BH84017	Reduced flight diameter to provide more clearance for large seed. Will help reduce seed damage.
Hard faced rotor feed flighting	AH120403	Reduces wear on front of rotor.
Expanded stone trap door	BH84029	Two piece front feed floor. Front section can be removed to provide more rock storage.
Stainless steel feed floor	BH84026	Improves feed floor wear life.
Heavy duty feed accelerator wear strip supports	BH84030	Strengthens wear strips in rocky conditions.
Clean grain elevator bucket conveyor	Amadas Industries P/N 70555 (ordered directly from Amadas Industries). Clean grain elevator slow speed bundle (BH84034) also should be installed.	This option replaces the paddle elevator with a bucket conveyor. The bucket conveyor can reduce seed mechanical damage and "mud tagging" or "staining" when harvesting in wet soil conditions or weedy fields. The Greenstar yield monitor system will not function with this option.
Belt unloading conveyor	Amadas Industries P/N 70558 (ordered directly from Amadas Industries). Also requires in-cab control panel and hydraulic drive system P/N 70557.	This belt conveyor unloading system unloads from the bottom of the grain tank and avoids the vertical and horizontal auger system. This helps reduce mechanical seed damage and seed staining such as can develop from wet soil and green weeds with the standard unloading auger system.

Section 2

Steps to Solve Problems and Improve Combine Performance

After the initial adjustments are made and the combine is operated in the field, follow the steps outlined below to improve performance of the John Deere STS series combine. Make only one adjustment at a time, in the order outlined here, and determine combine response. Adjusting one combine function may necessitate adjusting another function. For example, reducing rotor rpm to reduce seed damage may increase the number of unthreshed pods. Additional changes may then be required to reduce unthreshed pods. Monitor all combine outputs each time a change is made.

1. **Problem: Threshed bean seeds in tailings return system.**
   (The goal is to have few if any threshed bean seeds in the tailings return. The tailings system will release the bean seed back into the rotor area, increasing potential for damage to the bean seed.)
   1. Open lower sieve in 1/16 inch increments.
   2. Open chaffer (upper sieve) in 1/16 inch increments.
   3. Increase fan speed in 50 rpm increments. If the number of threshed seeds in the tailing increases, decrease fan rpm. The fan may be carrying seed into the tailings area of chaffer or sieve.

2. **Problem: Excessive chaff and foreign material in grain tank.**
   1. Increase fan speed in 50 rpm increments.
   2. Review sieve and chaffer settings.
   3. Increase concave clearance or reduce rotor speed. Plant material is being overthreshed.

3. **Problem: Too many unthreshed pods (containing full sized bean seeds) in grain tank.**
   (The goal is to return any unthreshed pods that contain good bean seeds to the threshing area for re-threshing and/or to improve threshing.)
   1. Close lower sieve in 1/16 inch increments to recirculate unthreshed pods to tailings system.
   2. Allow pods to dry further before combining.
   3. Increase rotor rpm in 30 rpm increments. *(Monitor seed quality.)*
   4. Close concave in 5/32 inch increments. *(Monitor seed quality.)*
   5. Check alignment of concave with rotor. (*Adjust concave level.*)

4. **Problem: Too many unthreshed pods (containing no seeds or very small seeds) in grain tank.**
   (The goal is to convey these unthreshed pods with no seeds or very small seeds across the chaffer and out the rear of the combine.)
   1. Close chaffer (upper sieve) in 1/16 inch increments.
   2. Increase fan speed in 50 rpm increments.

5. **Problem: Excessive field loss behind combine.**
   First, determine source of loss — previous field conditions or operations, the header, the shoe, or the rotor.
   a. Examine soil surface ahead of combine for **precombine loss.**
   b. Examine soil surface behind header but before rear of combine for **header loss.**
   c. Examine soil surface for whole or broken bean parts behind the combine. If a chopper is used, pay special attention to the area 5-10 feet from the center of the

Assessing and Minimizing Combine Loss

Precombine loss. This is caused by field conditions or operations prior to harvest. While you cannot control it at this point, you will need to subtract it from the total loss behind the header or combine to determine actual header or combine loss.

Header loss. Observe header operation for source or cause of header loss. Reduce field speed, synchronize rotational speed of bean pickup attachment with combine field speed and search for patterns of header loss that would suggest particular header problems.

Shoe loss. (Observe results of adjustments on the shoe loss display section of the grain loss monitor.) Open chaffer (upper sieve) in 1/16 inch increments. Increase or decrease fan speed in 50 rpm increments to create better floatation of grain and chaff above the chaffer, facilitating better separation of grain. If there is excessive material in the chaffer, reduce field speed. If there is excessive material on the chaffer, check to see if the material is being overthreshed. If so, increase the concave clearance or reduce rotor speed.

Rotor loss. First, determine if rotor loss is unthreshed pods or seed that was threshed but not separated from the straw as straw was released from the discharge beater. If the combine is equipped with a chopper, disengage and raise the chopper to inspect the straw windrow for unthreshed pods and threshed seed.

If the loss is from *unthreshed* pods:

1) increase rotor speed in 30 rpm increments (observe grain loss monitor for improvement);

2) close concave in 5/32 inch increments (observe grain loss monitor for improvement); and

3) determine if the seed damage is acceptable.

If the loss is from *threshed* seed not separated from the straw:

1) increase rotor rpm in 30 rpm increments (observe grain loss monitor for improvement);

2) verify that separator grate covers are not being used; and

3) determine whether the level of seed damage is acceptable.

combine on either side. This would represent **rotor loss** — unthreshed pods and/or threshed seeds not separated from the straw and discharged through the chopper — **and shoe loss** — loss from the chaffer. *(See above.)*

6. **Problem: Excessive seed damage in grain tank.** Assess the possible cause and make the following adjustments, as needed, to reduce seed damage:

Check tailings system for threshed bean seed. There should be few, if any, threshed seeds in the tailings. *(See previous section to reduce threshed bean seed in the tailings.)*

Increase field speed to increase amount of threshed seed and non-seed material in the combine to provide more cushion for individual bean seeds.

Reduce rotor speed in 30 rpm increments (observe grain loss monitor for changes).

Open concave clearance in 1/16 inch increments (observe grain loss monitor for changes).

Check clean grain elevator chain tension and clearance between clean grain cross auger flighting and mating auger trough. The clearance should be at least 5/8 inch. Accumulated material in auger trough will reduce effective clearance and can contribute to seed damage.

Check condition of flighting on shoe grain supply augers and clearance between flighting and mating auger troughs. The clearance should be 5/8 inch or greater. If clearance is less than 5/8 inch, examine flighting edge and seed for evidence of seed damage.

Wet soil and nightshade berries can cause a build-up on the clean grain cross auger flighting and the mating auger trough. This can create pinch points for seed and increase seed damage.

Check seed moisture content. Seed with very low moisture content (less than 10 percent) is difficult to thresh without causing substantial seed damage. If seed moisture is very high, particularly causing swollen seeds, crushed seeds will occur. Review alternatives for harvesting at a more optimum seed moisture content.

Verify that rotor threshing elements and concaves are not damaged or excessively worn.

Section 3

Additional Recommendations for Harvesting Dry Edible Beans with the STS Combine

When bean plant material is dry, threshing and separation will be relatively easy. Settings and accessories should minimize aggressive threshing, separation, and handling of the bean seed.

When bean plant material is tough, threshing and separation will be relatively difficult. Settings and accessories should provide more aggressive threshing and separation.

Keeping the machine near full capacity will minimize seed damage by "cushioning" the bean seed and keeping the conveyor systems relatively full.

Tailings return should not include *threshed* bean seed. Adjust fan speed, chaffer, and sieve to eliminate threshed bean seed in the tailings system. Any threshed seed in the tailings will likely be damaged when returned to the threshing system.

Response of rotor speed in the STS combine. The rotor must turn with sufficient rpm to accomplish threshing, separation and movement ("indexing") of material through the rotor area. If the rotor rpm is too slow for conditions, seed will not be threshed from the pods, and material will not move fast enough through the rotor, reducing capacity and potentially increasing seed damage. Also, if the rotor rpm is too slow, threshed seed will not be released from the straw as it moves through the separator section and excess field loss may occur. However, as with a conventional threshing cylinder, if rotor rpm is too high, excessive seed damage can occur. Each crop and harvesting situation requires sufficient rotor rpm to enable good threshing, separation, and indexing of material through the rotor, while keeping rotor rpm low enough to minimize seed damage.

Response of concave clearance in STS combine. Changing concave clearance can influence threshing performance, seed quality, and speed of material flow through the rotor. Typically, decreasing concave clearance will improve threshing, increase seed damage, and increase the speed that material flows through the rotor.

Keep concave clearance as wide as good threshing and separation will allow. Operating with the concave closer than necessary to the rotor will consume excessive engine power and fuel, reduce straw length, and may contribute to premature wear of threshing components. Generally, operate the STS combine with the concave as open as possible while still providing adequate threshing and material flow.

If the rotor "rumbles," it probably means material is not feeding uniformly into and through the rotor. Crop material may be too damp, flow of incoming material may be uneven and bunched, or rotor rpm may be too slow to move material through the rotor. Try increasing rotor rpm or the speed of feed accelerator, adjust concave clearance, or use more aggressive feed accelerator wear strips. If the problem is that material will not exit from the rear of the rotor, install the optional rotor discharge flights.

A consistent volume of material flowing into the rotor is necessary to optimize threshing and separation and minimize seed damage. This requires uniform crop windrows and a properly configured header, feederhouse, and feed accelerator, each operating at the correct rpm.

Material velocity should be similar as it transitions from one section of the combine to another. Sudden changes in material velocity may disrupt uniform material flow and cause seed damage. Transitions in material flow from windrow through header auger, feederhouse, feed accelerator, and rotor should be as gentle as possible. For example, use slow feederhouse chain speed if the header is operating at slow speed and the feed accelerator slow down kit is installed.

Large, uniform windrows, centered with the feederhouse improve feeding into the combine.

To optimize threshing and separation performance without excessive seed damage, the concave must be leveled relative to the rotor, and the concave sensor zero position must be properly calibrated. See the operator's manual for adjustment and calibration procedure.

Use power shutdown to determine the source of seed damage or other performance problems. When easy, straight-forward combine adjustments or changes in operating practices do not satisfactorily solve a combining problem, often a *power shutdown* can help diagnose the problem. For example, if seed damage remains excessively high after making the usual adjustments, a power shutdown can help determine where within the combine the damage is occurring. Perhaps the damage is occurring in an area you do not suspect, or, if you find too much seed on the ground behind the combine that went through the chopper, this is an effective way to determine the source of the loss. The power shutdown stops the combine operation as quickly as possible without damaging the machine. It allows seed and plant material to remain where it would be while the machine is running. After the engine is cooled down and shut off, open panels and observation doors to see where material is within the machine. For example, if

you have excessive loss from the rear of the machine, look for unthreshed pods or threshed seed at the end of the rotor and check to see if the crop is uniformly distributed within the rotor and behind the concave, leading to uneven distribution on the chaffer. Refer to your Operator's Manual for complete directions on how to perform a power shutdown. **Warning: Always turn off the engine, set the brake, and either position the header on the ground or put the header cylinder stop in place before leaving the combine cab and working on the combine.**

Finger width clearance between clean grain cross auger flighting and mating auger trough will minimize seed breakage

Grain tank unloading auger covers should be raised high enough to keep unloading auger full at low to medium unloading speed. Start with mid-position. If tank contains significant amounts of soil or high moisture seed (greater than 15 percent), the covers must be lowered to prevent breaking a shear bolt or damaging the auger system.

Check position of header auger. Auger should be spaced 5/8-3/4 inch from the auger trough at the closest position to avoid pinching bean seed. A larger clearance may cause uneven or bunch feeding into the combine, decreasing capacity and seed quality.

Clean rock trap daily or more often if rocks are numerous. A rock trap full of rocks or hard-packed soil and plant material will not effectively collect rocks and protect the combine. Also, accumulated rocks protruding from the rock trap will impair feeding and may increase seed damage.

Optional perforated screens are available below the clean grain cross auger, for the lower door of the clean grain elevator, and for the unloading auger. These may eliminate some fine dry soil. If the screens plug with soil, small stones, broken seeds, or nightshade berries, they may contribute to higher bean seed damage and should not be used.

Bean seed can be damaged when augers are operated at high rpm or when augers are nearly empty. Operate the engine at low idle to begin unloading grain tank and again when the tank is nearly unloaded. Do not unload tank completely.

Do not fill grain tank above the exposed flighting of the grain tank loading auger. Bean seed may be damaged by the grain tank loading auger pushing against bean seed in a full grain tank.

Never use grain carts for dry edible beans. Grain carts with auger-type unloading systems are designed for high capacity and can cause high seed damage. Unload directly into the truck that will haul the crop from the field to avoid additional handling damage.

Do not drop bean seed more than 4 feet. Seed damage can be expected when seed is dropped more than 4 feet to a hard, flat surface. Start filling the truck at one point and move the combine only far enough that beans continue to fall on the side of the bean pile already in place. This minimizes the distance beans drop from the unloading auger as well as the number of beans that drop directly to the truck floor.

Combine clean out. Because dry edible beans are used for human consumption, contamination with other market classes of beans, crops, or materials can be cause for rejection of an entire truckload. Make sure the combine, header, and truck are completely clean before entering the field. See the combine Operator's Manual for combine clean out procedure.

Check seed quality frequently. Locate or make a relatively tall container that will hold as close as possible to 100 bean seeds from the field being harvested. Use this container to take several random samples (of approximately 100 seeds) from the combine tank or truck. Place the beans on a flat, well lighted surface and look for damaged seeds. Place the seed in room temperature water for 5 minutes for a soak test. Seed with damaged seedcoats will have noticeable wrinkling and separation of the seedcoat. Each damaged seed will represent one percent damage. This technique will provide a relatively quick method to sample, inspect, and estimate seed damage in the tank.

Extension is a Division of the Institute of Agriculture and Natural Resources at the University of Nebraska–Lincoln cooperating with the Counties and the U.S. Department of Agriculture.

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