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John E. Watkins

University of Nebraska - Lincoln, jwatkins1@unl.edu


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Watkins, John E., "EC05-774 Recommendations for Harvesting Dry Edible Beans With the John Deere Walker Series Combine" (2005). *Historical Materials from University of Nebraska-Lincoln Extension*. 1549. <https://digitalcommons.unl.edu/extensionhist/1549>

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Recommendations for Harvesting Dry Edible Beans With the John Deere Walker Series Combine

John A. Smith, Extension Machinery Systems Engineer

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 walker 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. Other field conditions will require a different starting point. Use these recommendations as a *starting point* only and

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.

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.

These recommendations apply to 9X00, 9X10, 9X50 and 9X60 Series John Deere combines with a conventional cylinder and straw walkers. (Refer to "Recommendations for Harvesting Dry Edible Beans with a John Deere STS Series Combine," Extension Circular 05-773, for instructions specific to that combine series.)

Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by University of Nebraska-Lincoln Extension is implied.

Section 1

Initial Settings and Options

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

Combine Component	Recommended Starting Point	Comments
Cylinder speed	140 rpm	Slow speed cylinder drive kit, Part No. BH 79239, is required. Increase rpm only if threshing is incomplete and only after making other related adjustments.
Concave clearance indicator setting	15-40 on newer series, 2-4 on previous series	Set closer if material volume is low and/or threshing is difficult.
Cylinder bars	Black bar	Bars should have at least 10 hours use to smooth any rough edges. Replace bars with more than 50% wear or uneven wear. Bars must be replaced as a complete set.
Cylinder filler plates	Remove	
Concave type	Short wire with every other or all wires removed	Removing every other wire provides larger openings to move beans out of the concave as rapidly as possible.
Beater grate position	Down	
Fan speed	1000 – 1200 rpm	
Chaffer precleaner	Closed	
Chaffer clearance	5/8-3/4 in (16-19 mm)	Adjust for seed size. Avoid threshed beans in tailings.
Chaffer extension	3/4-7/8 in (19-22 mm)	
Sieve clearance	3/8-1/2 in (10-13 mm)	Adjust for seed size. Avoid threshed beans in tailings.
Feeder house conveyor chain speed	Slow speed sprocket and minimum speed on variable speed backshaft option	Try increasing speed if there are problems with material feeding or if the quantity of material is high.
Feeder house chain drum position	Down	Adjust the "Down" position so slats do not pinch beans in the lowest position of feeder house chain travel.
Chopper speed (rpm)	Slow	Use high speed for more spreading distance.
Chopper knife position	Out	Use medium setting for more straw cutting action.
Concave inserts and covers	Removed	Concaves normally need to be open to allow seed to exit quickly.
Clean grain elevator chain tightener	Keep snug	Check periodically to avoid pinching beans.

Section 2

Steps to Solve Problems and Improve Combine Performance

After initial adjustments have been made and the combine has been operated in the field, follow the steps outlined below to improve performance of the John Deere walker series combine.

Note: 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 cylinder 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 no threshed bean seed in the tailings return. The tailings system will release the bean seed over the rotating, bare cylinder, causing 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 tailings increases, decrease fan rpm because excess air flow 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 rpm.
2. Review sieve and chaffer settings.

3. Problem: Too many unthreshed pods (containing full-sized bean seeds) in grain tank.

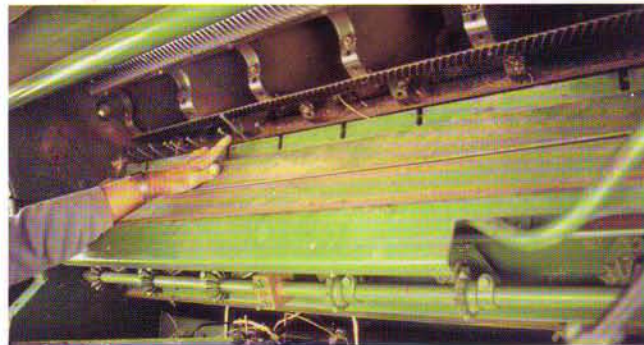
(The goal is to return these unthreshed pods with good bean seeds to the cylinder for rethreshing and/or to improve threshing.)

1. Close lower sieve in 1/16 inch increments to recirculate unthreshed pods in tailings system.
2. Decrease concave clearance.
3. Inspect cylinder bars and concave surface for excessive or uneven wear. Replace if necessary.
4. Check alignment of concave with cylinder according to Operator's Manual and correct if only slightly out of alignment. Misalignment of only 1/16 inch can cause unthreshed pods similar to what occurs with uneven wear on cylinder bars.
5. Increase cylinder speed in 20 rpm increments.
6. Allow pods to further dry before combining.

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 rear section of chaffer (upper sieve) in 1/16 inch increments.
2. Close main section of chaffer (upper sieve) in 1/16 inch increments.
3. Increase fan speed in 50 rpm increments.



Removing every other wire from the concave will allow bean seed to exit the concave quickly and minimize seed damage.

5. Problem: Excessive field loss behind combine.

First, determine the source of loss — previous field conditions or operations, the header, the shoe section of the combine, or the walker. (*see below*)

- Examine soil surface ahead of combine for **precombine loss**.
- Examine soil surface behind header but before rear of combine for **header loss**.
- Examine material on rear axle or on soil surface before material is spread by the chopper (if a chopper is used) for **shoe loss**.
- 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 combine on either side. This would represent **walker loss** — unthreshed pods through the chopper. It may be necessary to move the chopper to the windrow position to separate shoe loss from chopper loss.

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 of the grain loss monitor.) First, open rear section of chaffer (upper

sieve) in small increments to allow seed to fall through, then open main section of chaffer (upper sieve) in small increments to allow seed to fall through. Increase or decrease fan speed to create better floatation of grain and chaff above chaffer, facilitating better separation of grain. If excessive material is found on the chaffer, reduce field speed.

Walker loss. (*Results of adjustments can be observed on the separator loss display of the grain loss monitor.*) It may be necessary to disengage the chopper and move it to the forward position to distinguish beans that are in unthreshed pods from beans that have been threshed but not separated from the straw.

If walker loss is from *unthreshed* pods:

1. Close concave in small increments. (Observe grain loss monitor and seed damage.)
2. Increase cylinder speed in 30 rpm increments. (Observe grain loss monitor and seed damage.)
3. Inspect cylinder bars and concave surface for excessive or uneven wear. Either will contribute to unthreshed pods. Replace if necessary. Check alignment of concave with cylinder.

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

1. Move beater grate to "up" position.
2. If there is excessive bean straw material on the straw walkers, reduce field speed.

6. Problem: Excessive seed damage in grain tank.

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

Decrease cylinder speed in 30 rpm increments. (Observe grain loss monitor for any changes.)

Increase concave clearance in small increments. (Observe grain loss monitor for any changes.)

Increase field speed to increase amount of threshed seed and non-seed material within the combine to provide more “cushion” for the bean seed. The goal is to have material against material or seed against seed. Seed against metal increases the potential for seed damage.

Check clean grain elevator chain tension on bottom sprocket. Check clearance between clean grain cross auger flighting and mating auger trough. It should be at least 5/8 inch to avoid crushing the seed. Material build-up in auger trough will reduce effective clearance and can contribute to seed damage.

Inspect cylinder bars and concave surface for excessive or uneven wear. Check for misalignment, even minor misalignment, of concave with cylinder. Any of these problems can impair good threshing and necessitate more aggressive adjustments to obtain acceptable threshing, in turn resulting in higher seed damage.

Check condition of flighting on augers below cylinder and clearance between flighting and mating auger troughs. Clearance should be 5/8 inch or more to avoid crushing seed. If clearance is less than 5/8 inch, examine flighting edge and seed for evidence of seed damage.

Check seed moisture content. Seed with very low moisture content (less than 10 percent) is “brittle” and difficult to thresh without causing substantial seed dam-



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



Build-up of soil and other material on auger trough under the clean grain cross auger will minimize clearance and can cause bean breakage.

age. If seed moisture is high, the seed will be crushed, especially when seeds are swollen. Review alternatives for harvesting at a more optimum seed moisture content.

Section 3

Additional Considerations for Harvesting High Quality Edible Beans

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.

To minimize seed damage, keep machine near full capacity to provide a cushion for the bean seed and to keep conveying systems relatively full.

Cylinder speed should be 130-150 rpm to minimize seed damage unless threshing conditions are very difficult. With this combine, most seed damage occurs in the cylinder-concave area. This is primarily impact damage from the moving cylinder bars impacting the bean seed. Reducing the cylinder’s rotational speed will reduce the

energy of the impact, reducing seed damage.

If threshing conditions are very difficult, the concave should be set close, sometimes nearly “ticking” the cylinder bars. If threshing conditions are good and threshing is easy, the concave should be opened to avoid seed damage. If the mat of material between the cylinder and concave is too tight, it will be difficult for the threshed pods to exit the concave, increasing the likelihood of being impacted or crushed by a cylinder bar.

To improve seed quality, remove every other wire or all wires from the concave. A concave with more open area will allow threshed seed to exit the concave more quickly, limiting impact from the cylinder bars.

Check the tailings return to ensure it does not include threshed bean seeds. Threshed seed will be released by the tailings system directly to the cylinder and will have a high probability of being damaged. Adjust fan speed, chaffer, or

sieve to eliminate *threshed* bean seed in the tailings system.

Accurately align concave with cylinder. Misalignment will cause unthreshed pods, which will lead the operator to increase cylinder speed and/or decrease concave clearance, which in turn will needlessly increase seed damage. See Operator's Manual for alignment instructions. Clearance variation at all four inspection points should be within 1/32 inch.

Use power shutdown to determine the source of seed damage or other performance problems. When easy, straight forward combine adjustments and changes in operating practices do not satisfactorily solve a combining problem, a *power shutdown* often will be an effective diagnostic tool. For example, if seed damage remains excessively high after making the usual adjustments, a power shutdown can help determine where in the combine the damage is occurring. Perhaps the seed damage is occurring in an area of the combine that you do not suspect, or, if you find too much seed on the ground behind the combine, this can help 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 was when the machine was running. After the engine is cooled down and shut off, panels and observation doors can be opened to view 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 on the walker or see if material is only being threshed near the center of the cylinder and not across its full width. Refer to your Operator's Manual for complete directions on how to do 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.

Grain tank unloading auger covers, if adjustable, should be raised high enough (usually mid position) to keep unloading auger full at low to medium unloading auger speed. If the tank contains significant amounts of soil or high moisture seed (more than 15 percent), lower the covers to prevent breaking a shear bolt or damaging the auger system.

Check position of header auger. Auger should be spaced 5/8 to 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. 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 clean-out door of the clean grain elevator and for the unloading auger. These may eliminate some fine, dry soil; however, 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 unloading augers

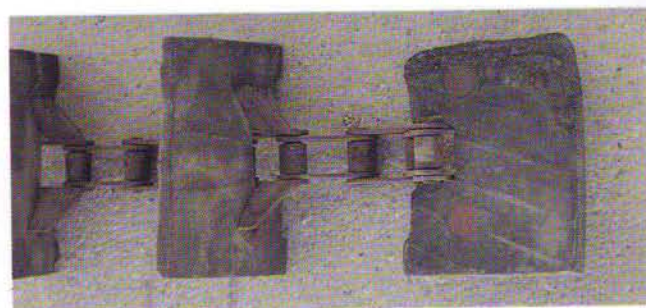


Sharp, edges, notches, or excessive auger wear can increase seed damage.

are operated at high speeds or when augers are nearly empty. Operate engine at low idle when beginning to unload the grain tank and when unloading is nearly complete. 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 seed in a full grain tank.

Never use auger-type 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



Worn and bent paddles on the clean grain elevator allow bean seed to slide by, increasing the opportunity for seed damage.

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 only move the combine far enough that beans continue to fall on the side of the bean pile already in place. This minimizes the drop distance and limits the number of beans that drop directly to the truck floor.

Clean out combine. Because dry edible beans are used for human consumption, contamination with other market classes of beans, other crops, or other material can result in an entire truckload being rejected. Make sure the combine, header, and truck are completely clean before entering the field. See the combine Operator's Manual for clean out techniques, and visit with your bean buyer to define acceptable cleanliness.

Check seed quality frequently. Use a relatively tall container that will hold approximately 100 seeds from the field being harvested. Use this container to take several random samples from the combine tank or truck. Each sample should include approximately 100 seeds. Place the beans on a flat, well lighted surface and look for damaged seeds. Place the seed in room temperature water for five 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 accurate and quick method to sample and inspect for seed damage in the combine.



Bean seed should not be dropped more than 4 feet to a hard surface. Allow a pile of beans to build up in the truck before moving the combine to minimize the the drop distance when unloading.