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Spray Boom Set-up on Field Sprayers

Robert N. Klein, Extension Western Nebraska Crops Specialist
Greg R. Kruger, Extension Cropping Systems Specialist

Design attributes and expected costs of dry and wet field sprayer booms are compared and illustrated.

Field sprayer booms are an important part of the pesticide delivery system and can influence application accuracy and efficiency. Booms come in all shapes and sizes, depending on their use, and deliver the spray solution to the nozzles and tips at the desired pressure for the target. A small hand boom may be only a single nozzle while a large field sprayer could have a 120-foot or wider boom.

Nozzle Spacing

The most common nozzle spacings are 20 and 30 inches. Many sprayers are now being converted from 30 inch to 15 inch spacings. The 30-inch spacing is used for the lower application rates (7 to 10 gallons per acre) and the 15-inch spacing for the higher application rates (14 gallons per acre and higher). For most applications, the 30-inch spacing (adding 15-inch spacing if desired) works best since most row crops are in 30-inch rows. For those in 20- and 22-inch rows you may wish to have nozzle spacing the same as row width. Having nozzles spaced the same as the row width enables you to easily use drop nozzles, although with row spacing less than 30 inches it is usually difficult to use drop nozzles. The recommendation is to use 80-degree nozzles in 20-inch or narrower spacing, and to use 100-degree nozzles with 30-inch nozzle spacing. Many new nozzles are only available in 110 degrees. The 30-inch nozzle spacing also lets the applicator use a larger nozzle tip that permits use of 50 mesh nozzle screens. If possible, use 0.25 gallons per minute (GPM) nozzle tips or larger. A 0.20 GPM nozzle tip may be used with a 50 mesh nozzle screen but is just on the border of what is recommended to prevent plugging. The particle size of a 110 degree nozzle tip that is 50 percent larger (used in 30-inch spacing) and an 80-degree nozzle used in 20-inch spacing (0.3 GPM vs 0.2 GPM) is almost the same size as you do not increase the potential spray drift problem going to 30-inch nozzle spacing and 110-degree nozzles.

Stability and Strength — Boom Features

Two attributes to look for when selecting a boom are stability and strength. Stability, the most important factor, ensures that the boom maintains a constant orientation to the target. Field conditions may vary widely, but if a spray boom is expected to provide a uniform application, stability must be maintained. Also important is a boom's strength or its ability to withstand operating conditions without becoming damaged.

Two systems are used to control boom stability. Passive systems, which include trapeze suspensions, center pivots, and dampening suspensions, all use balance. They minimize the amount

Figure 1. Sections of two booms — dry boom on top, wet boom on bottom.

of deflection transferred from the sprayer to the boom through various linkage designs. Active systems, on the other hand, use sensors and actuators in stabilizing the boom. An active system will usually have a sensor on the boom which is set to distinguish any fluctuation in distance between the target and the boom. If a difference in height is observed, the sensor signals the actuator on the boom linkage and it makes the appropriate adjustment. This usually means raising or lowering the boom in relation to the original setting.

Figure 2. Angle of boom can be changed by rotating the boom within the clamps.

Wet and Dry Booms

There are two types of booms: wet and dry. A boom is considered a wet boom *(Figure 1, bottom)* if the pipe span is not only used as a support mechanism for the spray nozzles but delivers spray solution to them as well, hence the name "wet boom." A boom that is used merely as a span along which to space the nozzles, but which does not deliver the spray solution, is considered a dry boom *(Figure 1, top)*. The solution is delivered to the nozzles via a separate hose line that runs along the boom span using it as a support mechanism to mount each nozzle.

The advantages of a wet boom are less plugging of nozzle tips since there is less area where particles could build up and the ease of flushing the boom. On the dry boom, hose and nozzle assemblies are much more subject to being contaminated with residues than stainless steel tubing or pipe. Some adjuvants used with pesticides provide excellent cleaning of the tank, hose, etc., and may cause the spray solution to become contaminated. Even though the tank has been cleaned, the spray booms often have not been cleaned.

As more glyphosate-resistant weeds appear, use of products with greater residual activity or different modes of action will increase. As this occurs, greater attention is going to need to be given to flushing the system before moving on to other crops or on to crops without the appropriate resistance traits. Because of this, wet booms are going to become more practical because of the ease of cleaning.

Unless the boom is really long or a small size pipe is used, the spray boom on a wet boom needs only to be fed with the spray solution on the end. Since the nozzle assemblies on a dry boom greatly restrict the flow rate, the boom must be fed every few nozzles to prevent a pressure drop.

Another advantage of a wet boom is that the angle of the boom can be changed *(Figure 2)* and in most situations it is easier to change the height of a wet boom than a dry boom. Additional nozzle assemblies to accommodate various row spacings on a wet boom do not restrict the flow rate *(Figure 3)* nearly as much as additional nozzle assemblies on a dry boom.

The two main disadvantages of a wet boom are initial cost and its potential for damage. If the boom contacts a non-moveable object, it may break or bend, destroying part of the boom.

Table I. Comparison of wet and dry boom costs.

20-foot wet boom:		
20 feet of 1-inch OD 16-gauge stainless steel tubing - $6.75/foot	= $135.00	
2 nipples - $6 each	= $ 12.00	
Welding 2 nipples - $4 each	= $ 8.00	
Total	$155.00	
20-foot dry boom:		
20 feet of 3/4-inch braided hose - $0.95/foot		= $19.00
If 30-inch nozzle spacing, 16 stainless steel clamps - $0.80 each		= $12.80
To keep from losing pressure, each 10-foot section of hose is fed in the middle		
Extra hose is 7 feet + 17 feet = 24 x $0.95 =		$22.80
4 more clamps at $0.80 each		= $ 3.20
Two fittings at approximately $7 each		= $14.00
		$71.80

Cost Comparison

The costs of a modern wet boom design versus a dry boom are summarized in *Table I*. The cost of 1-inch outside diameter 16-gauge stainless steel tubing is approximately $6.75 per foot. The ends of the tubing are compressed and 1-inch stainless steel pipe nipples are welded to each end of the stainless steel tubing. The nipples cost approximately

Figure 3. **Nozzle assemblies for dry *(left)* and wet *(right)* booms.**

Figure 4. **The bracket to hold the wet boom. The rubber hose protects the boom and the stainless steel hose clamps hold the wet boom in place.**

Figure 5. **How dry boom is fed — note restriction to flow rate.**

Figure 6. **How wet boom is fed.**

Figure 7. **End cap on wet boom to drain and flush boom.**

Figure 8. **Wet boom nozzle body on and off boom.**

Figure 9. Multiple nozzle body on wet boom.

Figure 10. Gauge to check spray pressure on a wet boom.

$6.00 and welding each one costs about $4. The hose that feeds the boom and the plug can be attached to these nipples. Both are quick attach couplers. Holes on the boom need to be precisely drilled at the nozzle spacing being used.

This example assumes the connectors and nozzle assemblies for the hose and stainless steel tubing will be about equal to the additional hose and fittings needed on the dry boom.

If the dry boom is left outside and unprotected, the hose may need to be replaced every two or three years. The stainless steel tubing should last for many years if not damaged.

Figures 3-10 help illustrate differences between wet and dry booms.

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