Equipping and Operating Sprayers to Control Insects and Diseases in Soybeans

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Controlling insects and diseases in soybeans can be challenging because they commonly start in lower, hard-to-reach parts of the canopy. For example, soybean flower petals are the primary colonization sites for *Sclerotinia Stem Rot* (white mold) spores. To effectively manage this disease, fungicides must be directed at soybean flower petals, especially in the lower parts of the crop canopy. Flower petals are very close to the stem of the plant and at about two-thirds of the height of the plant from the ground up. This article will help you maximize insect and disease control in soybeans by equipping and operating your sprayer properly.

Spray volume has the greatest impact on canopy penetration and leaf and stem coverage. Spray volumes of 15 gallons per acre are required when applying insecticide and fungicides to soybeans through growth stage R3 (pod development). After R3, 20 gallons per acre will improve coverage.

Droplet size is the second most important factor affecting canopy penetration and coverage. Research has shown that medium droplets provide better leaf and stem coverage and canopy penetration under thick and tall canopy conditions. All nozzle manufacturers, following a Standard developed by ASABE (American Society of Biological and Agricultural Engineers), use a common spray quality classification system shown in Table 1. Each droplet size class is also identified with a unique and internationally accepted color. For example, yellow is the color for droplets falling in the medium (M) category. **The colors listed in table 1 should not be confused with the color of the nozzle itself.** The colors listed in Table 1 refer to the droplet size range and the color of the nozzle refers to the flow rate, commonly referred to as capacity.

Table 1. ANSI/ASAE S572.3 FEB2020, Spray Nozzle Classification by Droplet Spectra.

Droplet Category	Symbol	Color
Extremely Fine	XF	Purple
Very Fine	VF	Red
Fine	F	Orange
Medium	M	Yellow
Coarse	C	Green
Very Coarse	VC	Blue
Extremely Coarse	XC	White
Ultra Coarse	UC	Black

Ground speed is an important consideration as it affects the spray application rate (gallons per acre or GPA) significantly. There is a direct but inverse relationship between the travel speed and the application rate. For example, if the travel speed is doubled, the application rate will be halved and vice/versa. In addition, higher travel speeds generally increase the drift potential, and reduce canopy penetration. Ground speeds of less than 10 mph are recommended.

Nozzle pressure must be considered when equipping and operating sprayers. Higher spray pressures increase GPA and droplet velocity, but decrease droplet size, increasing the risk of spray drift and droplet evaporation. These concepts are shown in Table 2. In general, spray pressures of 40 psi are recommended for conventional flat-fan nozzles. Higher pressures are okay if the optimum droplet size spectra is produced.

Nozzle type and spray pattern are important factors. Research conducted at the Ohio State University showed that nozzles producing a single flat-fan pattern provided better canopy penetration than nozzles or combinations of nozzles producing a twin-fan pattern or cone nozzles when used in large and dense soybean canopies. Because they produce relatively larger droplets, venturi or air-induction nozzles are not generally recommended for insecticide and fungicide applications.

Consider spray volume, droplet size, ground speed and operating pressure when selecting spray nozzles. Select nozzles that produce droplet sizes in the medium (yellow) category and deliver 15 gallons per acre at your desired ground speed and operating pressure. The information in Table 2 shows that a sprayer, equipped with XR11005 nozzles, operated at 40 psi, and traveling at 10 mph will deliver 14.9 GPA while producing droplets in the medium category.

Table 2. Relationship between spray volume, ground speed, pressure, and droplet size for Teejet XR8004, XR11004, XR8005, and XR11005 nozzles (nozzle spacing is 20 inches).

		*Droplet Size		MPH		
				6	8	10
Tip	PSI	80º	110º	GPA		
XR8004 & XR11004	15	M	M	11.9	8.9	7.1
	20	M	M	13.9	10.4	8.3
	30	M	M	17.3	13.0	10.4
	40	**M**	**M**	19.8	**14.9**	11.9
	50	F	F	22.0	16.7	13.4
	60	F	F	24.0	18.2	14.6
XR8005 & XR11005	15	C	M	15.3	11.5	9.2
	20	M	M	17.3	13.0	10.4
	30	M	M	21.0	16.0	12.8
	40	M	**M**	25.0	18.6	**14.9**
	50	M	F	28.0	21.0	16.6
	60	F	F	30.0	23.0	18.1

Source: Catalog 52, Spraying Systems Co. *C = coarse, M = medium and F = fine

Note that the color of the XR11005 nozzle is brown and it produces droplets in the medium (yellow) to fine (orange) categories depending on the operating pressure. Table 2 also shows that XR8004 and XR11004 nozzles are viable options if the ground speed is reduced to 8 mph. All nozzle manufacturers provide similar information for each of their nozzles.

Boom height has a significant influence on spray pattern uniformity. The boom height recommended by nozzle manufacturers is the distance between the target and the nozzles on the boom that achieves the most uniform spray pattern at the target area. When spraying soybeans for white mold, the target area should be where the flower petals are (top 1/3 of the canopy).

Therefore, the boom height should be measured from this area up, not from the top of the canopy or from the ground. For example, a boom equipped with 110 degree flat-fan nozzles spaced 20 inches apart should be operated 16 to 18 inches above the target area. When setting the boom height for treating white mold, the boom would be 10 to 12 inches above the top of the canopy in 24-inch-tall soybeans. However, if the soybean canopy is extremely tall and dense, the target area should be about 5 inches below the top of the canopy and the boom would be 11 to 13 inches above the top of the canopy to avoid streaks of totally untreated areas.

The recommendations discussed above will improve insect and disease control in large, dense soybean canopies.

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