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Assessing Flood Damage to Soybean

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Severe flooding has many low-lying soybean fields underwater. As the water dissipates yield potential and replant questions will arise. Flooding can be divided into either water-logging, where only the roots are flooded, or complete submergence where the entire plants are under water (VanToai et al., 2001). Water-logging is more common than complete submergence and is also less damaging. Soybeans can generally survive for 48 to 96 hours when completely submersed (Image 1). The actual time frame depends on air temperature, humidity, cloud cover, soil moisture conditions prior to flooding, and rate of soil drainage. Soybeans will survive longer when flooded under cool and cloudy conditions. Higher temperatures and sunshine will speed up plant respiration which depletes oxygen and increases carbon dioxide levels. If the soil was already saturated prior to flooding, soybean death will occur more quickly as slow soil drainage after flooding will prevent gas exchange between the rhizosphere and the air above the soil surface. Soybeans often do not fully recover from flooding injury.

Image 1. Flooded soybean field located at Arlington WI, June 8th 2008.



Crop injury from water logging is difficult to assess. Water-logging can reduce soybean yield 17 to 43% at the vegetative growth stage and 50 to 56% at the reproductive stage (Oosterhuis et al., 1990). Yield losses are the result of reduced root growth, shoot growth, nodulation, nitrogen fixation, photosynthesis, biomass accumulation, stomatal conductance, and plant death due to diseases and physiological stress (Oosterhuis et al., 1990; VanToai et al., 1994 and 2003). A significant amount of genetic variability for flooding tolerance among soybean varieties occurs in maturity groups II and III (VanToai et al., 1994) and likely exists for maturity group I soybeans as well.

Increased disease incidence in the surviving plants may also occur and limit yield potential. The main culprit will likely be [phythophthora](#) given the warm wet weather; however phythium, rhizoctonia, or fusarium may also occur. Differential response among varieties will be tied to the sources of genetic resistance to these diseases.

Once we can get back into the fields the decision to replant will be based on the yield potential of the current stand relative to the cost and yield potential of the replanted soybean field (Table 1). Before any decision to tear up a field is made make sure you contact your crop insurance agent to discuss coverage and you have the replant seed on your farm or at least en route. As we all know seed supplies are tight and replant acres will be high. Also remember to check herbicide labels for plant back restrictions if you are planning to plant soybean into a flooded corn field.

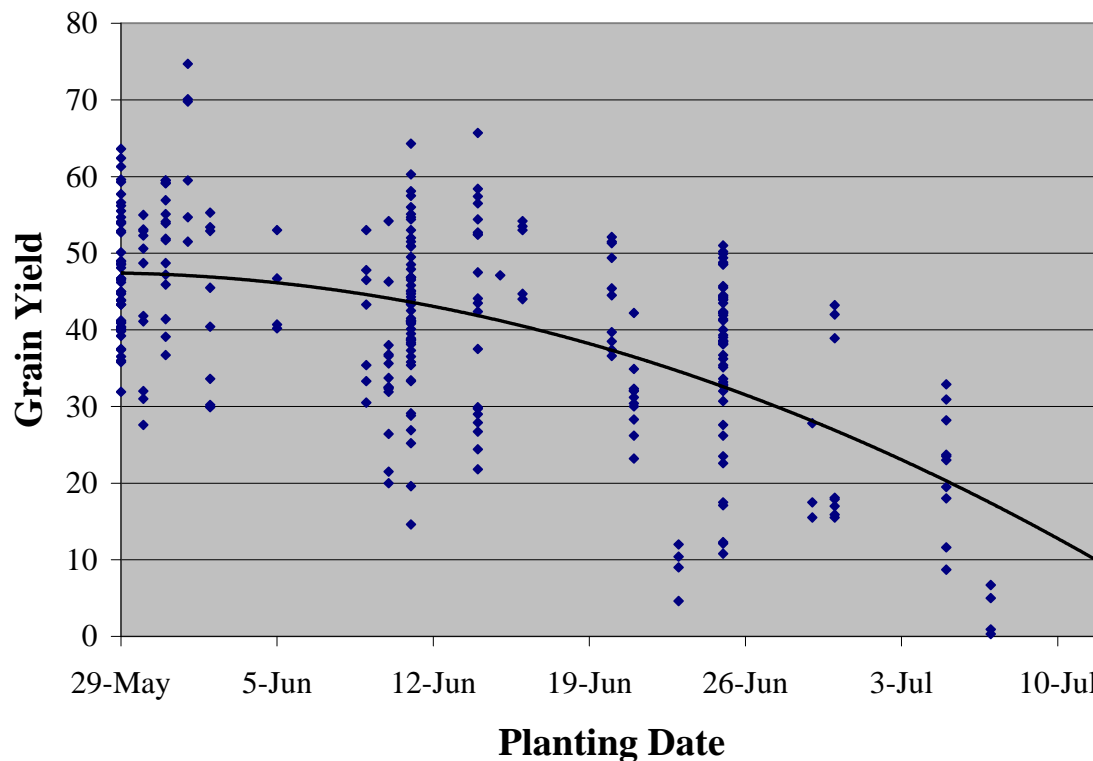
Table 1. Expected relative soybean yield at four replanting dates compared to predicted yields for a range of plant populations resulting from an optimum planting date of May 1-20 for full season maturity or short season maturity varieties.

Early plant population	Replanting date									
	May 1-20		June1		June 10		June 20		July 1	
Ppa x 1000	-----% of maximum yield-----									
200	100¹	86	89	90	75	75	68	67	61	60
180	98	85	88	87	75	72	66	64	63	60
160	97	84	87	84	70	70	64	61	63	58
140	95	83	85	81	67	67	62	57	62	56
120	93	81	82	78	65	65	59	53	60	52
100	91	80	80	76	63	63	57	49	56	47
80	88	79	77	73	61	61	54	44	51	40
60	86	78	73	70	60	60	51	39	44	33
40	83	77	69	67	59	59	47	34	35	25

¹Yield potential of full season varieties are in bold while yield potential of earlier maturity group soybeans are given in normal text.

Since full season maturity group soybeans are unrealistic for planting this late only early and mid-group soybean cultivars should be considered. The average yield potential for soybean planted in late June in southern WI is in the 30 to 35 bu yield range (Figure 1). For yield potential and harvestability, (a combine may not be able to pick up the lower pods) a grower should plant if possible a mid maturity group soybean instead of an early maturity group for their geographic area.

Figure 1. Planting date effect on grain yield of early to mid maturity group soybeans (0.4 to 1.8 RM) in southern WI (Data from early 1990s planting date study).



To maximize yield potential in late planted soybean, a minimum of 180,000 plants per acre is required in a drilled system as yield potential in rowed beans would be significantly reduced due to decreased canopy development. To achieve 180,000 plants per acre a grower may have to seed as many as 225,000 seeds per acre.

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