

Management Considerations for Post Flooding Soils

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Farmland in Iowa, western Illinois, and eastern Nebraska is experiencing flooding issues. Planting in these areas may be delayed or may not be planted to any crop in 2019. This can have significant economic and environmental consequences if flooded fields are left barren. Long-term damage to soil needs to be considered when planning for this year's or next season's crop.

Several changes take place when soil is flooded for an extended period of time that can be carried into the next season. One potential change is the biological health of the soil, with the greatest concern with soil left unplanted to any crop or cover crop. The existence of plants in such areas will help sustain the microbial community in the root zone, which is essential to nutrient cycling, especially phosphorous (P).

Biological, chemical and physical soil health

Flooded soils may experience what is called "post flood syndrome," similar to the fallow syndrome, where the land is left unplanted to any crop for the entire season. Flooded soils will encounter problems caused by the reduction of soil arbuscular mycorrhizae (AM) fungi colonization rates the following growing season.

AM fungi colonizing the root systems of crops in a mutually beneficial (symbiotic) relationship. The fungi benefit from the host plant roots, and the crop benefits from the increased nutrient uptake zone developed by fungal hyphae (threads that make up the mycelium of fungi). Unplanted, flooded fields may be affected next season due to the absence of a root system that is essential to maintaining this microbial community that contributes to nutrient cycling.

In addition to biological changes caused by flooding and the absence of an active root system, there are some other chemical and physical changes that can occur when soil is flooded. Most of the chemical changes will be induced by temporary changes in oxidation and reduction conditions. However, physical-chemical-biological changes in soil such as aggregate stability, soil structure, pH, etc., can be significant, especially if there is no growing crop.

Measures to manage previously flooded soils

Research documents growing plants, such as cover crops, row crops and other crops, can increase the AM recolonization and ultimately the availability of phosphorous, which is the nutrient most affected by reductions in mycorrhizae population. The following are a few management options that need to be considered:

Land Leveling and Sand Cleaning – Sand removal depends on the depth of accumulation.

- Sand a few inches (i.e., 2-4 inches deep) can be incorporated in soil using normal field operations. Otherwise, minimum soil disturbance is advisable.

- If sand is up to six inches deep, then moldboard plow to a depth twice the sand depth to incorporate.
- If sand is 8-24 inches deep, it is advisable to consider spreading it to areas with less sand and incorporate with special deep tillage equipment. It is not advisable to move sand to fill lower or severally eroded areas in the field without proper top soil to cover the sand.
- For sand more than 24 inches deep, evaluate the cost of removing or stockpiling sand.
- In the case of severe erosion and deep cuts, top soil from surrounding fields should be used to fill such areas.

Soil Testing

- Soil testing should be conducted after any land leveling is done.
- Soil samples should not be collected immediately after soils dry.
- Allow time for phosphorus (P) reactions in soils after soils aerate.
- Potassium (K) deficiency can occur due to soil compaction.
- Soil test levels could increase from sediment deposition.

Cover Crops (if a crop cannot be planted in 2019)

- Use a cover crop immediately after soil dries to promote growth of microorganisms that are essential for nutrient cycling.
- Planting conditions should provide good soil to seed contact for cover crop success.
- Consider overwintering cover crops to provide additional benefits of continuous growth in the spring prior to planting.
- Cover crop establishment can help suppress weeds, preventing buildup of the weed seedbank.

Other Considerations

- When planting soybean, as a precaution, seed should be inoculated with *Bradyrhizobium japonicum* to ensure nodulation and nitrogen fixation.
- AM fungi inoculation of soil is not feasible.
- Once soils become aerobic, soil microflora will recover naturally.

Observations from Previous Research

- Corn growing on flooded soils showed purple leaves that disappeared within a week.
- Flooded fields with weeds or without tillage showed less purpling than those tilled to control weeds.
- Fields with high manure application history (i.e., feedlots) showed no adverse effect for flooded soils on crops.
- Crops planted after a fallow/flood period grew poorly.
- P deficiency symptoms in crops — for corn it is slow early growth and purple coloration.
- Flooded soils may have normal P test level and low AM population.
- To alleviate P deficiency, high banded P rates are needed — twice or more than the normal recommended rate.