Native Grasses' Ability to Mitigate Poultry Farm Emissions

Shawn Belt[1]

[1]U.S.D.A., Natural Resources Conservation Service,
Norman A. Berg National Plant Materials Center
Building 509, B.A.R.C. - East, Beaver Dam Rd., Beltsville, MD 20705

ABSTRACT

Poultry houses emit significant amounts of ammonia (NH^3), dust (particulate matter (pm) 2.5 and 10 microns in size) and odors ultimately contributing to air and water quality degradation of the Chesapeake Bay. This study was initiated to test the survival and growth of grasses, shrubs and trees and their ability to tolerate poultry emissions and conditions. Plantings of eight different species of grasses were established on nine primarily broiler poultry farms. After two years of evaluations, 'Northwind', 'Thundercloud', 'Kanlow' and 'Timber' switchgrass, 'Atlantic' coastal switchgrass, Saltmeadow cordgrass, Florida Paspalum, 'Freedom' giant miscanthus, and Giant Cane survived, grew and filtered poultry tunnel fan emissions, showing grass buffers assist with the mitigation of poultry farm emissions.

INTRODUCTION

The Delmarva Peninsula and southern Pennsylvania are home to some of the country's highest concentrations of poultry farms. There are a limited number of plant species currently being used for poultry windbreaks. Dust is linked to respiratory effects in poultry workers[1] and odors a nuisance for neighbors. Poultry buffers are capable of reducing dust up to 67%[2], odor 67%[3], and ammonia (varies with plant species)[4]. This study was designed to test the survival and size of grasses planted closest to tunnel fans.

MATERIALS and METHODS

Table 1 lists the grasses tested for the following reasons:
- Active growth in spring and summer/ventilation needs are highest
- Upright form/stiff stems tolerating high wind speeds (40 mph)
- High dust filtering ability due to leaf structure
- Tolerance to heat and dry (xeric) conditions

Common Name	Cultivar Name	Mature Size (w x h)
Switchgrass	'Kanlow', 'Thundercloud', 'Timber'	5' x 8'
Coastal Panicgrass	'Atlantic'	3' x 6'
Eastern Gamagrass	'Meadowcrest'	4' x 5'
Big Bluestem	'Niagara'	4' x 6'
Giant Miscanthus*	'Freedom'	6' x 12'
Florida Paspalum	'Mid Atlantic'	3' x 7'
Saltmeadow Cordgrass		Spreads x 4'
Giant Cane		Spreads x 20'

Table 1. Cultivar and mature size of grasses tested at 6 different broiler farms. *Sterile non native plant, not recommended for MD/DE NRCS standards.

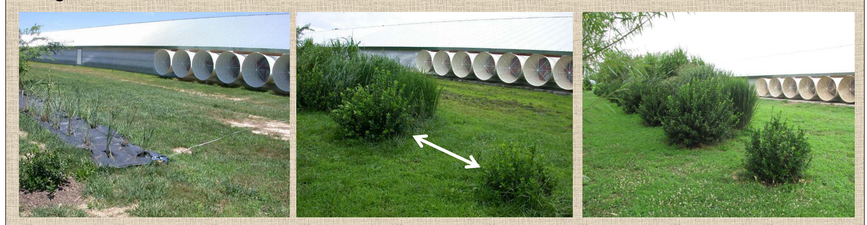
RESULTS

Over 200 grasses were planted at six different test sites, with over 90% survival over a two year period. Table 2 lists many of the variables existing at the sites. Acting as a filter of tunnel fan emissions (see Figure 1), they are capable of slowing wind speed and sheltering the subsequent rows of shrubs and trees (see Figure 2). Since grasses do not have as stiff stems as shrubs and trees, they were planted in the first row closest to the fans. At this distance (20 feet), effects on fan performance was not measured but no obvious effects were observed.

Figure 1. Producer A Test Farm (June 2009).

Photos taken while flock is at its largest size and the highest amount of dust accumulates on the grass leaves.

Figure 2. Producer S -1 Test Farm.



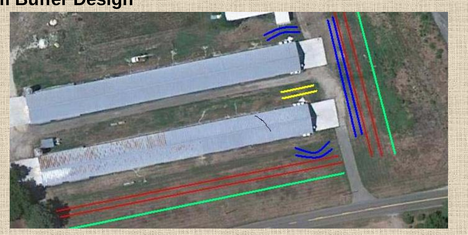
2008 (June) 2009 (June) 2010 (July)

Note the larger size of the 'Manhattan' Euonymus behind the grass buffer compared to the smaller plant just outside the buffer. Both plants were planted at the same time and were similar sizes.

Producer	Planting Length (ft)	Fan Distance (ft)	Irrigation	#/ Fan width (ft)	Flock size/# per year	Soil classification
A	28', 20'	20, 40	no	6/ 28	31,800/4-5	Matapeake Silt Loam
S-1	40'	37	yes	7/ 42	30,000/4-5	Fallsington Loam
G	30'	24	yes	5/ 29	24,500/5	Hambrook Sandy Loam
S-2	25', 15	30, 17	yes	3/15	22,000/6	Hambrook Sandy Loam
M	42	55	no	7/42	40,800/5	Hambrook Sandy Loam
R	40	32	no	7/40	45,000/5	Fallsington Sandy Loam

Table 2. Poultry Farms Test Site Variables.

Figure #3. Broiler Farm Buffer Design



Yellow Lines 1° Filter (grasses and shrubs), Blue Lines 1° Filter (grasses) , Red Lines 1°and 2° Filter (shrubs and trees), Green Lines 3° Filter (evergreens for year round visual screens).

CONCLUSIONS

Northwind', 'Thundercloud', 'Timber' and 'Kanlow' switchgrasses; 'Atlantic' coastal panicgrass; Eastern gama grass; Big Bluestem, Florida paspalum, Saltmeadow Cordgrass, Giant Cane and 'Freedom' giant miscanthus can be established and will survive in distances as close as 20 feet from the harsh environment associated with poultry house tunnel fans.

Continuing studies (with Agricultural Research Service and various universities) will quantify the benefits of these selected grasses, which are used in a multi-row planting with shrubs and trees, are also effective for filtering dust, odors and absorbing ammonia in these dry, heavily polluted environments.

References

[1]Donham, K.J.; Cumro, D; Reynolds, S.; Synergistic effects of dust and ammonia on the occupational health effects of poultry production workers. 2002 J. Agromed, 2: 57-76.

[2]Parker, D.B., W. Malone and D. Walter. Vegetative environmental buffers for reducing downwind odor and VOCs from tunnel-ventilated swine barns. 2011. In Proceedings 2011 American Society of Agricultural and Biological Engineers, ASABE Paper No. 11-10791. August 7-10, 2011. Louisville, Kentucky.

[3]Adrizal, A.; Patterson, P.H.; Hulet, R.M.; Bates, R.M.; Myers, C.A. ; Martin, G.P.; Shockey, R.; Van Der Grinten, M.; Anderson, D.A.; Thompson, J.R.; Vegetative Buffers for Fan Emissions from Poultry Farms; 2 Ammonia, Dust, and Foliar Nitrogen. 2008 Journal of Environmental Science and Health Part B 43 96-103.

[4] Adrizal, A.; Patterson, P.H.; Hulet, R.M.; Bates, R.M.; Myers, C.A. ; Martin, G.P.; Shockey, R.; Van Der Grinten, M.; Anderson, D.A.; Thompson, J.R.; Vegetative Buffers for Fan Emissions from Poultry Farms; 2 Ammonia, Dust, and Foliar Nitrogen. 2008 Journal of Environmental Science and Health Part B 43 96-103.

Acknowledgments

The author would like to acknowledge the assistance of the Caroline and Queen Anne's Counties Soil Conservation Districts, and Pennsylvania State University Extension, University of Delaware Extension, and Delmarva Poultry Institute, Georgetown Delaware.

For further information, contact:
Shawn Belt
Phone: (301) 504-8516
Email: Shawn.Belt@md.usda.gov